PROJECT MANUAL

KENSINGTON FIRE PROTECTION DISTRICT PUBLIC SAFETY BUILDING RENOVATION

KENSINGTON, CA

100% CONSTRUCTION DOCUMENTS

September 19, 2022

MARJANG Architecture

930 Cole Street, Suite 101
SAN FRANCISCO CA 94117
415-522-0600

DOCUMENT 00 0110

TABLE OF CONTENTS

Initial Issue	Current Revision		
03/31/22	--	26 0531	Conduit
03/31/22	--	26 0533	Boxes
03/31/22	--	26 0553	Electrical Identification
03/31/22	--	26 0942	Digital Lighting Control
03/31/22	--	26 2416	Panelboards
03/31/22	--	26 2716	Cabinets and Enclosures
03/31/22	--	26 2719	Surface Raceways
03/31/22	--	26 2726	Wiring Devices
03/31/22	--	26 2816	Overcurrent Protective Devices
03/31/22	--	26 2819	Disconnect Switches
03/31/22	--	26 2900	Motor Controls
03/31/22	--	26 4313	Surge Protective Devices (SPD)
03/31/22	--	26 5000	Lighting
03/31/22	--	26 6113	Fire Alarm System

DIVISION 27 – COMMUNICATIONS

03/31/22	--	27 0500	Common Work Results for Communications
03/31/22	--	27 0526	Grounding and Bonding for Communications Systems
03/31/22	--	27 0529	Hangers and Supports for Communications Systems
03/31/22	--	27 0533	Conduits and Backboxes for Communications Systems
03/31/22	--	27 0536	Cable Trays
03/31/22	--	27 0543	Underground Ducts and Raceways for Communications Systems
03/31/22	--	27 0548	Noise and Vibration Controls for Communications Systems
03/31/22	--	27 0553	Identification for Communications Systems
03/31/22	--	27 1000	Structured Cabling, Basic Materials and Methods
03/31/22	--	27 1116	Communications Cabinets, Racks, Frames and Enclosures
03/31/22	--	27 1119	Communications Termination Blocks and Patch Panels
03/31/22	--	27 1123	Communications Cable Management
03/31/22	--	27 1300	Communications Indoor Backbone Cabling
03/31/22	--	27 1400	Communications Outside Plant Backbone Cabling
03/31/22	--	27 1500	Communications Horizontal Cabling
03/31/22	--	27 4116	Integrated Audio-Video Systems and Equipment
03/31/22	--	27 4123	Communications Broadband Systems
03/31/22	--	27 5116	Public Address and Mass Notification Systems

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

03/31/22	--	28 0500	Common Work Results for Electronic Safety and Security
03/31/22	--	28 0513	Conductors and Cables for Electronic Safety and Security
03/31/22	--	28 0528	Pathways for Electronic Safety and Security
03/31/22	--	28 1300	Access Control and Alarm Systems
03/31/22	--	28 1619	Intrusion Detection
03/31/22	--	28 2300	Video Surveillance

DIVISION 31 – EARTHWORK

03/31/22	--	31 2100	Utility Trenching and Backfill
03/31/22	--	31 2319	Dewatering

END OF DOCUMENT

DOCUMENT 00 0120

PROJECT DIRECTORY

OWNER

Kensington Fire Protection District T: 415-378-9064
217 Arlington Avenue
Kensington, CA 94707
Contact: Bill Hansell E: bhansell@kensingtonfire.org

ARCHITECT

MARJANG Architecture T: 415-522-0600
930 Cole Street, #101
San Francisco, CA 94117
Contact: Karen Mar Ext. 1001
E: karen@marjang.com

CIVIL ENGINEER

BKF Engineers T: 925-940-2200
1646 N. California Boulevard, Suite 400
Walnut Creek, CA 94596
Contact: Keith Palmer T: 925-940-2232
E: kplamer@bkf.com

STRUCTURAL ENGINEER

ZFA Structural Engineers T: 650-394-8869
558 Brewster Avenue, Suite 200
Redwood City, CA 94063
Contact: Matt Frantz Ext. 205
D: 805-748-9803
E: mattf@zfa.com

MECHANICAL, PLUMBING and FIRE PROTECTION

List Engineering Company T: 831-373-4390
2 Harris Court, Suite A7
Monterey, CA 93940
Contact: Lettie Tang Ext. 6
E: lettie@listengineering.com

ELECTRICAL CONSULTANT

The Engineering Enterprise T: 510-769-7600
1305 Marina Village Pkwy.
Alameda, CA 94501
Contact: Paul Miller D: 510-263-1522
E: paul@engent.com

GEOTECHNICAL ENGINEER

Haley Aldrich T: 510-879-4544
1956 Webster Street, #300
Oakland, CA 94612
Contact: Catherine H. Ellis D: 925-949-4407

E: cellis@haleyaldrich.com

AV CONSULTANT

Smith, Frause & McDonald Inc. (SFMI) T: 415-255-9140
351 8th Street
San Francisco, CA 94103
Contact: Peter A. McDonald E: peter@sfmi.com

SPECIFICATIONS

Topflight Specs, Inc. T: 415-546-6033
49 Geary Street, Suite 230
San Francisco, CA 94108
Contact: Philippe Erville E: erville@topflightspecs.com

END OF DOCUMENT

DOCUMENT 00 1000
BID PACKAGE

KENSINGTON FIRE PROTECTION DISTRICT

Notice to Contractors, Instructions to Bidders,
Special Provisions, Proposal, and Contract for:

Public Safety Building Seismic Renovation
217 Arlington Avenue
Kensington, CA 94707

REVISED: June 14, 2022

Kensington Fire Protection District

KENSINGTON FIRE PROTECTION DISTRICT

BID PACKAGE FOR

Public Safety Building Seismic Renovation

TABLE OF CONTENTS

CONTRACT

Checklist for Execution of Construction Contract

APPENDIX I

Contract Drawings

APPENDIX II

Specifications

NOTICE INVITING SEALED BIDS

KENSINGTON FIRE PROTECTION DISTRICT

BIDS MUST BE RECEIVED BY:	**7/1/2022, 2:00PM**
BIDS TO BE OPENED AT:	**7/1/2022, 2:05PM on Zoom at the following link:** https://us06web.zoom.us/j/89170132713?pwd=cC9wVTlCN092M2x6Wk5obk8wMUE5QT09 Webinar ID = 891 7013 2713 Webinar Passcode = 112233
PLACE OF BID RECEIPT:	Electronic copy of the bid document to be emailed to; Bill Hansell – bhansell@kensingtonfire.org With a copy to karen@marjang.com by **2:00PM on 7/1/2022**

Request for Information (RFI) on the bid documents are to be emailed to: bhansell@kensingtonfire.org with a copy to karen@marjang.com .

NON-MANDATORY SITE VISIT:	**6/14/2022, 11:00AM** at the project site, 217 Arlington Ave, Kensington, CA
LAST DATE FOR BID RFI:	**6/17/2022, 4:00PM**
LAST DATE FOR ADDENDUMS:	**6/22/2022, 4:00PM**

Bidder agrees to receive addendum(s) by e-mail.

NOTICE IS HEREBY GIVEN that the Kensington Fire Protection District (which shall be known throughout these documents and attachments as "District" or "Owner"), County of Contra Costa, California, will receive up to, but not later than the time set forth above, sealed contract bids for the award of a contract for the project described in this document. All bids shall be made on the form furnished by the District and shall be opened and publicly read aloud at the above-stated time at the place of bid identified above; the opening and public reading of the bids will be through a virtual platform, such as Zoom or another similar platform.

PROJECT IDENTIFICATION NAME: Public Safety Building Seismic Renovation

DESCRIPTION OF WORK:
The Kensington Public Safety Building is approximately 5,800sf and was constructed in 1971. It is owned by the Kensington Fire Protection District (KFPD). The renovation work includes but is not limited to: seismic retrofitting of the structure, the interior remodel of the work and living quarters for fire personnel (dormitories, bathrooms, restrooms, kitchen, dining, day room, offices and a multi-purpose room); upgrades to apparatus garage areas and support spaces; new mechanical, electrical, plumbing, fire protection and lighting systems; new foundation systems, new partial roof, site improvements; exterior envelope siding replacement, new windows and doors, and accessibility compliance upgrades such as an elevator and wheelchair lift, as defined by the project documents.

COMPLETION OF WORK: All work shall be completed within the contract period of 365 working days following the written Notice to Proceed.

OBTAINING BID DOCUMENTS: Bid documents for the project may be obtained at **BPXpress Reprographics**, 4903 Central Avenue, Richmond, CA 94804, phone - 510 559 8299, weblink below, and on the District's website.
https://www.bpxplanroom.com/jobs/816/details/kensington-fire-protection-district-public-safety-building-seismic-renovation

Each bid response shall be accompanied by the bid securities required as part of this Request for Bid.

Each bid must include an accurate bidder's questionnaire properly completed on behalf of the bidder and signed by a representative authorized to bind the bidder. Failure to provide accurate and verifiable information in the bidder's questionnaire or the omission of relevant information may, in itself, be sufficient to support a determination that a bidder is non-responsive.

Pursuant to the Labor Code of the State of California (California Labor Code Section 1770 *et seq.*) the Director of Industrial Relations has determined the general prevailing rate of wages and employer payments for health and welfare, vacation, pension and similar purposes applicable to the work to be done. This rate and scale are on file with the District and copies will be made available to any interested party on request. The information is also available on the state's Department of Industrial Relations Division of Labor Statistics and Research Website www.dir.ca.gov/dlsr. The Contractor to whom the contract is awarded and the subcontractors under him must pay not less than these rates for this area to all workers employed in the execution of this contract.

Each bidder must submit a bid to the District, on the standard forms provided by the District. The bid must be accompanied by a cash deposit, a certified or cashier's check or a bidder's bond issued by a California admitted surety, made payable to the Owner, in an amount not less than 10 percent of the total bid submitted. Bids shall remain valid and shall not be subject to withdrawal for ninety (90) calendar days after the bid opening date.

In accordance with California Public Contract Code Section 3300, the bidder must possess a valid **Class A or B contractor's license**. No contract will be awarded to any bidder who at bid opening is not a properly licensed California contractor in possession of one of the aforementioned licenses as required by the California Business and Professions Code.

The Contractor may, at Contractor's sole cost and expense, substitute securities equivalent to any monies withheld by the Owner as provided in California Public Contract Code Section 22300. No such substitution shall be accepted until all documents related to such substitution are reviewed and found acceptable by the Owner's attorney.

Bidders are hereby on notice that $500.00 per day liquidated damages will be charged for each calendar day that work remains incomplete beyond the time specified for the completion of the work. Refer to the bid specifications and contract documents for further details.

The District reserves the right to reject any or all bids or any parts thereof and waive any irregularities, omissions, or informalities in any bid or in the bidding and to make awards in all or part in the best interest of the District in accordance with applicable law.

A non-mandatory pre-bid meeting will be held on 6/14/2022 at 11:00AM at the project site, 217 Arlington Avenue, Kensington, CA.

Bids must remain valid for a period of ninety (90) days after the date set for the opening of bids.

KENSINGTON FIRE PROTECTION DISTRICT

By:  **06/14/2022**

Bill Hansell — Date
General Manager

INSTRUCTIONS TO BIDDERS

FORM OF PROPOSAL: The proposal shall be made on the bidding schedule ("proposal") herein. The proposal shall be enclosed in a sealed envelope bearing the name of the bidder and the name of the project as described under Notice Inviting Sealed Bids.

DELIVERY OF PROPOSALS: The proposal shall be delivered by the time and to the place stipulated in the Notice Inviting Sealed Bids. It is the bidder's sole responsibility to see that their proposal is received in proper time. Any proposal received after the scheduled closing time for receipt of proposals will be returned to the bidder unopened unless the District has granted an extension. Bidders or their authorized agents are invited to be present. A Zoom meeting invite will be provided.

MODIFICATIONS AND ALTERNATIVE PROPOSALS: Unauthorized conditions, limitations or provisos attached to a proposal will render it non-responsive and will be rejected. The complete proposal forms shall be without interlineations, alterations or erasures, unless each such correction is suitably authenticated by affixing in the margin immediately opposite the correction the surname or surnames of the person or persons signing the bid. No oral, telegraphic or telephonic proposals or modifications to proposals will be considered.

WITHDRAWAL OF PROPOSAL: The proposal may be withdrawn upon request by the bidder without prejudice prior to, but not after, the time fixed for opening of bids, provided that the request is in writing, has been executed by the bidder or his duly authorized representative, and is filed with the District.

BIDDER'S SECURITY: Each bid shall be accompanied by a certified or cashier's check payable to the District, or a satisfactory bid bond in favor of the District executed by the bidder as principal and a California admitted surety as surety, in an amount not less than ten percent (10%) of the amount set forth in the bid. The check or bid bond shall be given as a guarantee that the bidder shall execute the contract if it is awarded to them in conformity with the contract documents and shall provide the evidence of insurance and furnish the necessary bonds as specified in the contract documents, within fifteen (15) calendar days after written notice of the award. In case of the bidder's refusal or failure to do so, the cash, check, or bond, as the case may be, shall be forfeited to the District. No bidder's bond will be accepted unless it conforms substantially to the form set forth as required.

ADDENDA: The District may, from time to time, issue addenda to the contract documents during the period of advertising for bids. Securers of contract documents shall be notified of, and furnished with, copies of such addenda, by email during the period of advertising at no additional cost.

DISCREPANCIES IN PROPOSALS: The bidder shall set forth each item of work, in clearly legible figures, a unit or line-item bid for the item in the respective spaces provided for this purpose.

In case of discrepancy between the unit price and the total set forth for the item, the unit price shall prevail, provided, however, if the amount set forth as a unit price is ambiguous, unintelligible or uncertain for any cause, or is omitted, or in the case where the unit price is the same amount as the entry in the "Total" column, then the amount set forth in the "Total" column for the item shall prevail in accordance with the following:

(1) As to lump sum items, the amount set forth in the "Total" column shall be the unit price.
(2) As to unit price items, the amount set forth in the "Total" column shall be divided by the estimated quantity for the item and the price thus obtained shall be the unit price.

In case of discrepancy between words and figures, the words shall prevail.

Contractors must sign the "Statement Acknowledging Penal & Civil Penalties Concerning the Contractor's Licensing Laws."

BIDDER'S EXAMINATION OF SITE AND CONTRACT DOCUMENTS: Bidders must satisfy themselves by personal examination of the location of the proposed work and by such other means as they may prefer as to the proposal, plans, specifications, contract form and actual conditions and requirements of the work, and shall not at any time after submission of the bid, dispute, complain, or assert that there was any misunderstanding in regard to the conditions to be encountered, the character, quality, and quantities of work to be performed and materials to be furnished, and the requirements of the proposal, plans, specifications, and the contract form. The submission of a proposal shall be considered conclusive evidence that the bidder has made such examination.

DISQUALIFICATION OF BIDDERS: No person, firm, or corporation shall be allowed to make, file or be interested in more than one bid for the same work, unless alternate bids are specifically called for. A person, firm or corporation that has submitted a subproposal to a bidder, or that has quoted prices of materials to a bidder is not hereby disqualified from submitting a subproposal or quoting prices to other bidders or making a prime proposal. If there is a reason to believe that collusion exists among the bidders, all bids will be rejected.

RETURN OF BID SECURITY: The successful bidder's proposal guarantee shall be held until the contract is executed. Bid security shall be returned to unsuccessful bidders within twenty (20) calendar days after the successful bidder has signed the contract.

AWARD OF CONTRACT: The District reserves the right to reject any or all bids or any parts thereof or to waive any irregularities, omissions, or informalities in any bid or in the bidding. The award of the contract, if made by the District, will be to the lowest responsible bidder. The award, if made, will be within ninety (90) calendar days after the opening of the proposals; provided that the award may be made after said period if the successful bidder has not given the District written notice of the withdrawal of their bid. Bidder agrees that this bid shall be good for a period of ninety (90) calendar days after the scheduled closing time for receiving bids.

ALTERNATES: If alternate bids are called for, the contract shall be awarded to the lowest responsible bidder on the total of base bid and the chosen alternate(s).

LISTING SUBCONTRACTORS: Each bidder shall submit a list of the proposed subcontractors on this project, as required by the Subletting and Subcontracting Fair Practices Act (Public Contract Code Sections 4100, et seq.). Forms for this purpose are furnished with the contract documents.

EXECUTION OF AGREEMENT: The bidder to whom award is made shall execute a written contract with the District in the form included in these contract documents and shall secure and provide to District all insurance and bonds as herein specified within fifteen (15) calendar days from the date of mailing of written notice of the award. Failure or refusal to enter into the agreement or to conform to any of the stipulated requirements shall be just cause for the annulment of the award and forfeiture of the bidder's security. In the event the bidder to whom an award is made fails or refuses to execute the Agreement within said time, the District may declare the bidder's security forfeited, and it may award the work to the next lowest bidder, or may call for new bids.

If the successful bidder refuses or fails to execute the contract, the District may award the contract to the second lowest responsible bidder. If the second lowest responsible bidder refuses to execute the contract, the District may award the contract to the third lowest responsible bidder to execute the contract; such bidder's securities shall be likewise forfeited to the District.

INSURANCE AND BONDS: The Contractor shall not begin work under the Agreement until it has given the District evidence of comprehensive public liability insurance and Workers' Compensation Insurance coverage. The successful Contractor shall also furnish two (2) bonds required by the State Contract Act. Each of the said bonds shall be executed in a sum equal to the contract price. One of the said bonds shall guarantee the faithful performance of the said contract by the Contractor (performance bond), and the other said bond shall secure the payment of claims for labor and material (payment bond).

INTERPRETATION OF PLANS AND DOCUMENTS: If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the drawings, specifications or other contract documents, or finds discrepancies in or omissions from the drawings and specifications, he or she may submit to the District a written request for an interpretation or correction. The person submitting the request will be responsible for its prompt delivery. Any interpretation or correction of the contract document will be made only by an Addendum duly issued, and a copy of such Addendum will be mailed or delivered to each person receiving a set of the contract documents. No oral interpretation of any provision in the contract documents shall be binding.

SALES AND/OR USE TAXES: Except as may be otherwise specifically provided herein, all sales and/or use taxes assessed by federal, state or local authorities on materials used or furnished by the Contractor in performing the work hereunder shall be paid by the Contractor.

GENERAL PROVISIONS (SECTION I)

A. PROJECT PROVISIONS

The project provisions applicable to this contract shall be those set forth in the latest edition of the Caltrans Standard Specifications (hereinafter referred to as "Standard Specifications"). The Standard Specifications are referred to and by this reference are made a part hereof as though set forth at length. The Contractor is required to comply with the Standard Specifications in addition to the conditions set forth in these General Provisions and Special Provisions. To the extent that the Project's Notice Inviting Sealed Bids, Instructions to Bidders, General Provisions, Special Provisions, Proposal, Contract, and Appendices conflict with the Standard Specifications, the terms of the Notice Inviting Sealed Bids, Instructions to Bidders, General Provisions, Special Provisions, Proposal, Contract, and Appendices that conflict with the Standard Specifications shall prevail over the Standard Specifications.

B. AWARD OF BID AND EXECUTION OF CONTRACT

1. DECISION AS TO WHICH CONTRACTOR IS THE LOWEST RESPONSIBLE BIDDER

All bidders must submit with their proposals satisfactory evidence that they are capable of performing the work in accordance with the plans and specifications. The District may require any bidder bidding on any public improvement to submit experience records covering a three-year period. In accordance with applicable law including principles of due process, the District may reject the bid of any bidder who has been delinquent or unfaithful in the performance of any previous contract work. The decision of the District as to which bidder is considered the "lowest responsible bidder" will be based not only on the actual amount of the bid, but also on the relative competence and experience of the bidders, with particular regard to the quality and performance of any work done by them for the District or other entity in the past, and such decisions shall be final and binding upon all parties.

2. NON-COLLUSION AFFIDAVIT

The Contractor shall execute and return a "Non-collusion Affidavit" with its bid in the form attached herein.

3. EXECUTION OF THE CONTRACT

The contract, in the form set forth in the Contract Section shall be executed by the successful bidder in accordance with the Instructions for Execution of Documents, and returned to the District for execution by the District, and shall be accompanied by bonds as described in paragraph GP-1-B-4 and the evidence of insurance required by paragraph GP-2-B-5, all within fifteen (15) calendar days from the date written notice of the award is mailed to bidder. No bidder proposal shall be considered binding upon the District until such time as the District has executed it. Failure or refusal to enter a Contract as herein provided or to conform to any of the stipulated requirements in connection therewith shall be just cause for annulment of the award and forfeiture of the Bid Security. If the lowest responsible bidder refuses or fails to execute the Agreement, the District may award the contract to the second lowest responsible bidder. If the second lowest responsible bidder refuses or fails to execute the Agreement, the District may award the contract to the third lowest responsible bidder. On the failure or refusal of such second or third lowest bidder to execute the Contract, each such bidder's bid securities shall be likewise forfeited to the District.

4. CONTRACT BONDS

The successful bidder shall furnish to the District at their own expense two-surety bonds. One bond shall be in the amount of 100 percent of the contract price in the form set forth in the Contract Section to guarantee faithful performance of the contract work. The other bond, in an amount not less than 100 percent of the contract price in the form set forth in the Contract Section shall be furnished to secure payment of those supplying labor and materials as required by California Civil Code section 9554. Each bond shall be executed in accordance with the instructions set forth in the Proposal Section and each bond shall be executed by a California admitted surety insurer acceptable to, and approved by the District.

5. INSURANCE

The Contractor shall at all times, during the term of this contract, as referenced in the Insurance Requirements for Kensington Fire Protection District attachment to the Agreement, carry, maintain and keep in full force and effect, a policy or policies of (1) comprehensive public liability insurance with a California admitted insurance company with a Best's rating of no less than A:VII, within minimum limits of Two Million Dollars ($2,000,000.00) combined single limit coverage against any injury, death, loss or damage as a result of wrongful or negligent acts or omissions by the Contractor, together with an endorsement in substantially the form set forth in the Contract Section attached hereto (2) property damage insurance with a minimum limit of $2,000,000.00, (3) automotive liability insurance with a minimum combined single limit coverage of $2,000,000.00. The Contractor shall also at all times during the term of this contract carry, maintain and keep in full force and effect a policy or policies of Workers' Compensation insurance as required by applicable laws and regulations and shall provide to the District evidence of such coverage in the form set forth herein.

6. COMPLIANCE WITH PROVISIONS OF THE PUBLIC CONTRACT

All Contracts shall conform with the provisions of Sections 4100 through 4114 (the "Subletting and Subcontracting Fair Practices Act"), inclusive, of the Public Contract Code, as amended, concerning subcontractors and subcontracts.

7. REJECTION OF BIDS

The District reserves the right to reject any or all bids and to waive any irregularity, omission, or informality in any bid to the extent permitted by law.

C. LEGAL RELATIONS AND RESPONSIBILITY TO THE DISTRICT

1. LAWS TO BE OBSERVED

The Contractor shall keep itself fully informed on all existing and pending State and federal laws and all municipal ordinances and regulations of and applicable to the District, which in any manner affect those employed in the work, or the material used in the work, or which in any way affect the conduct of the work, and of all such orders and decrees of bodies or tribunals having jurisdiction or authority over the same. The Contractor shall observe all ordinances of the District in relation to the obstruction of streets or conduct of the work, keeping open passageways and protecting the same where they are exposed or dangerous to traffic.

2. SOCIAL SECURITY & CERTIFIED PAYROLL REQUIREMENTS

The Contractor shall furnish to the District satisfactory evidence that their and all subcontractors working for them are complying with all requirements of the Federal and State Social Security legislation. The Contractor, at any time on request, shall satisfy to the District that the Social Security and Withholding taxes are properly reported and paid. Contractor and subcontractors shall also submit to the DIR certified payrolls as required by applicable laws and regulations.

3. PREVAILING WAGES

In accordance with California Labor Code Section 1771, not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is to be performed, and not less than the general prevailing rate of per diem wages for holiday and overtime work fixed as provided in the California Labor Code must be paid to all workers engaged in performing the work. In accordance with California Labor Code Section 1770 and following, the Director of Industrial Relations has determined the general prevailing wage per diem rates for the locality in which the Work is to be performed. In accordance with California Labor Code Section 1773.2, copies of the prevailing rate of per diem wages are on file at the District and will be made available on request. The information is also available on the DIR website www.dir.ca.gov/dlsr. Throughout the performance of the work the Contractor must comply with all provisions of the Contract Documents and all applicable laws and regulations that apply to wages earned in performance of the work.

4. PENALTIES

The Contractor shall comply with the provisions of California Labor Code Sections 1774 and 1775 concerning the payment of prevailing rates of wages to workers and the penalties for failure to pay prevailing wages. The Contractor and any subcontractor under the Contractor shall, as a penalty to the District, forfeit not more than two hundred dollars ($200) for each calendar day, or portion thereof, for each worker paid less than the prevailing rates as determined by the Director of Industrial Relations for the work or craft in which the worker is employed for any public work done under the contract by Contractor or by any subcontractor.

5. WORKING HOURS

The Contractor shall forfeit, as penalty to the District, the sum of twenty-five ($25.00) dollars for each worker employed in the execution of the contract by Contractor or by any subcontractor under him for each calendar day during which such worker is required or permitted to work more than forty (40) hours in any one calendar week, in violation of the provisions of Article 3, Chapter 1, Part 7, Division 1 of the Labor Code (Section 1810 et. seq.). Working hours shall be limited to 8:00 AM – 5:00 PM.

6. APPRENTICES

Attention is directed to the provisions of Sections 1777.5 and 1777.6 of the Labor Code concerning the employment of apprentices by the Contractor or any subcontractor under Contractor. It shall be Contractor's responsibility to ensure that all persons shall comply with the requirements of said sections in the employment of apprentices.

Information relative to apprenticeship standards and administration of the apprenticeship program may be obtained from the Department of Industrial Relations, San Francisco, California, or from the Division of Apprenticeship Standards and its branch offices.

7. REGISTRATION AND LICENSING OF CONTRACTORS

Only a Contractor licensed in accordance with the provisions of Chapter 9, Division 3, of the Business and Professions Code shall be permitted to enter into a contract with the District for any public improvements.

8. PERMITS AND LICENSES

The Contractor shall be responsible for procuring all permits and licenses, pay all charges and fees and give all notices necessary and incidental to the due and lawful prosecution of the work. District will pay for building permit and utility connection fees.

9. PATENTS

The Contractor shall assume all responsibility arising from the use of any patented, or allegedly patented materials, equipment, devices or processes used on or incorporated in the work, and shall defend, indemnify, and hold harmless the District, and each of its officers, agents, and employees from and against any and all liabilities, demands, claims, damages, losses, costs, and expenses, of whatsoever kind or nature, arising from such use.

10. INDEMNITY

The Contractor agrees to indemnify and hold harmless the District and others and to waive subrogation as set forth in the Indemnification and Hold Harmless Agreement and Waiver of Subrogation and Contribution executed concurrently herewith, a copy of which is attached hereto and incorporated herein by this reference.

11. NOTICE

The address given in the Contractor's proposal is the place to which all notices to the Contractor shall be mailed or delivered. The mailing to or delivering at the above-named place of any notice shall be deemed sufficient service thereof upon the Contractor, and the date of that service shall be the date of such mailing or delivery. Such address may be changed at any time by written notice signed by the Contractor and delivered to the District.

12. CONTRACTOR'S RESPONSIBILITY FOR WORK

Until the final acceptance of the work by the District, the Contractor shall have the charge and care thereof and shall bear the risk of injury or damage to any part of the work by the action of the elements or any other cause. The Contractor shall rebuild, repair, restore and make good all injuries or damages to any portion of the work occasioned by any cause before its completion and acceptance and shall bear the expense thereof, except for such injuries or damages arising from the sole negligence or willful misconduct of the District, its officers, agents or employees. In the case of suspension of work from any cause whatever, the Contractor shall be responsible for all materials and the protection of work already completed and shall properly store and protect them if necessary and shall provide suitable drainage and erect temporary structures where necessary.

13. MAINTENANCE AND GUARANTEE

(a) The Contractor hereby guarantees that the entire work constructed by Contractor under the contract will meet fully all requirements as to quality of workmanship and materials. The Contractor hereby agrees to make at Contractor's own expense any repairs or replacements made

necessary by defects in materials or workmanship that become evident within one (1) year after the date of the final completion, and to restore to full compliance with the requirements of these specifications, including any test requirements set forth herein for any part of the project or work constructed hereunder, which during said one (1) year period is found to be deficient with respect to any provisions of the specifications. The Contractor shall make all repairs and replacements promptly upon receipt of written orders for the same from the District. The Contractor and Contractor's sureties shall be liable to the District for the cost thereof.

(b) The guarantees and agreements set forth in subsection (a) shall be secured by a surety bond which shall be delivered by the Contractor to the District before the Notice of Completion and acceptance of the work, by the District, as provided in Subsection 6-8 of the Standard Specifications. Said bond shall be in the form approved by the District and executed by a surety company or companies admitted in the State of California and satisfactory to the District, in the amount of 100 percent of the contract. Said bond shall remain in force for a period of one (1) year after the date of Notice of Completion and acceptance. Alternatively, the Contractor may provide for the Faithful Performance Bond furnished under the contract to remain in force and effect for said amount until the expiration of said one (1) year period.

14. COOPERATION

The Contractor is hereby notified that additional work within the work site may be scheduled during the course of this contract.

The Contractor shall cooperate with these and other projects in accordance with Sections 5-6 and 7-7 of the Standard Specifications. Contractor acknowledges that the District's Fire Station must remain operational during construction, and expressly agrees to cooperate and coordinate with the District and other necessary individuals and entities, including its subcontractors, to facilitate this requirement.

Compensation for compliance shall be included in the various items of work, and no additional compensation shall be allowed therefore.

D. PROSECUTION AND PROGRESS OF THE WORK

1. WORK SCHEDULE

Prior to the Notice to Proceed, the Contractor shall submit a work schedule to the District for approval. Said schedule must show the dates of the expected start and completion of the various items of the contract work. The final schedule will be used as a controlling document throughout the construction period.

2. SUBLETTING AND ASSIGNMENT

The Contractor shall give Contractor's personal attention to the fulfillment of the contract and shall keep the work under Contractor's control. The Contractor shall not assign, transfer nor sublet any part of the work without the prior written consent of the District and of the surety of the Contractor's bond, and such consent of Surety, together with a copy of the subcontract, shall be filed with the District. No assignment, transfer or subletting, even though consented to, shall relieve the Contractor of Contractor's liabilities under the contract. Subcontractors shall not be recognized as such, and all persons engaged in the project will be considered as employees of the Contractor, their work being subject to the provisions of the contract and the specifications. Should any subcontractor fail to perform the work undertaken by him to the satisfaction of the District, said subcontractor shall be removed immediately from the project upon request by the

District, shall not again be employed on the work, and the Contractor shall be held liable for the deficient work.

The Contractor shall submit to the District a list with the names, addresses and telephone numbers of all subcontractors who will work under Contractor.

3. CHARACTER OF WORKERS

The Contractor shall employ none but competent foremen, laborers and mechanics. Any overseer, superintendent, laborer or other person employed on the work by the Contractor who is intemperate, incompetent, troublesome or otherwise undesirable, or who fails or refuses to perform the work in the manner specified herein, shall be removed from the jobsite immediately and such person shall not again be employed on the work.

4. AGENTS OR FOREMAN

In the absence of the Contractor from the site of the project, even if such is only of a temporary duration, Contractor must provide and leave at the site a competent and reliable English-speaking agent or foreman in charge. All notices, communications, orders or instructions given, sent to, or served upon, such agent or foreman by the District shall be considered as having been served upon the Contractor.

5. TEMPORARY STOPPAGE OF CONSTRUCTION ACTIVITIES

The District and it's designated representative(s) shall have the authority to suspend the contract work, wholly or in part, for such a period of time as the District may deem necessary, due to unsuitable weather, or to such other conditions as the District considers unfavorable for the proper prosecution of the work, or for such time as the District may deem necessary due to failure on the part of the Contractor or Contractor's workers to carry out orders or to perform any of the requirements of the contract. The Contractor shall immediately comply with such an order from the District and shall not resume operations until so ordered in writing.

6. TIME OF COMPLETION AND LIQUIDATED DAMAGES

If all the contract work is not completed in all parts and requirements within the time specified in the contract documents, the District shall have the right to grant or deny an extension of time for completion, as may seem best to serve the interest of the District. The Contractor shall not be assessed with liquidated damages during any delay in the completion of the work caused by acts of God or of the Public Enemy, acts of the State, fire not due to acts of contractors, of subcontractors, floods, epidemics, quarantine, restrictions, strikes, freight embargo or unusually severe weather, delays of subcontractors due to such causes, or work suspensions directed by the District provided that the Contractor shall, within ten (10) days from the beginning of such delay, notify the District, in writing, of the cause of the delay. The District will ascertain the facts and the extent of the delay, if any, and the finding thereon shall be final and conclusive. If the District deems it appropriate to assess the contractor liquidated damages, such damages shall be in the amount of $500 per day.

7. SUSPENSION OF CONTRACT

If at any time, in the opinion of the District, the Contractor fails to supply an adequate working force, manufactured articles, or material of proper quality, or has failed in any other respect to prosecute the work with the diligence and force specified and intended by the terms of the contract, notice thereof in writing will be served upon Contractor, and should Contractor neglect or refuse to provide means for a satisfactory compliance with the contract within the time

specified in said notice and as directed by the District, the District shall have the power to suspend the operation of the contract and discontinue all work or any part thereof. Thereupon the Contractor shall discontinue such work, or such part thereof as the District may designate, and the District may thereupon, by contract or otherwise, as it may determine, complete the work or such part thereof, and charge the entire expense of so completing the work or any part thereof to the Contractor, and for such completion the District itself or its Contractors may take possession of and use, or cause to be used in the completion of the work, or any part thereof, any such materials, implements and tools of every description as may be found at the place of such work. All expenses charged under this paragraph shall be deducted and paid for by the District out of any moneys then due or to become due the Contractor under the contract, or any part thereof, and in such accounting the District shall not be held to obtain the lowest figure for the work for completing the contract, or any part thereof, or for ensuring its proper completion, but all sums paid therefore shall be charged to the Contractor. In case the expenses so charged are less than the sum which would have been payable under the contract, if the same had been completed by the Contractor, the Contractor shall be entitled to receive the difference, and in case such expense shall exceed the amount payable under the contract, then the Contractor shall pay the amount of the excess to the District, upon completion of the work, without further demand being made therefore. In the determination of the question as to whether or not there has been any such noncompliance with the contract as to warrant the suspension or annulment thereof, the decision of the District shall be binding on all parties to the contract.

E. MEASUREMENT AND PAYMENT

1. MEASUREMENT AND PAYMENT

Measure of the quantities of work and payments therefore shall be in accordance with Section 9 of the Standard Specifications. In accordance with Subsection 9-3.2 of the Standard Specifications, the monthly payment date shall be the last calendar day of each month. A measurement of work performed and a progress estimate of the value thereof based on the contract and of the monthly payment shall be prepared by the Contractor and submitted to the District before the tenth day of the following month for verification and payment consideration. Each payment application will include all necessary supporting documents including but not limited to project status reports, updated construction schedules and conditional and unconditional lien releases.

2. FINAL INVOICE AND PAYMENT

Whenever in the opinion of the District, the Contractor shall have completely performed the contract, the District shall notify the Contractor that the contract has been completed in its entirety. The Contractor shall then submit to the District for approval the final invoice. The District shall then cause to be filed in the office of the County Recorder, a Notice of Completion of the work herein agreed to be done by the Contractor.

On the expiration of thirty-five (35) days after the date of recording the Notice of Completion, the District shall pay to the Contractor the amount remaining after deducting from the amount of value stated in the invoice all prior payments to the Contractor and all amounts to be kept and retained under the provisions of the contract, and shall release the Faithful Performance Bond and Labor and Material Bond.

The Contractor may, at Contractor's sole cost and expense, substitute securities equivalent to any monies withheld by the Owner as provided in California Public Contract Code Section 22300. No such substitution shall be accepted until all documents related to such substitution are reviewed and found acceptable by the District.

3. EXTRA WORK

Extra work, when ordered in writing by the District or its authorized representative and accepted by the Contractor, shall be paid for under a written change order in accordance with the terms therein provided. Payment for extra work will be made at the unit price or lump sum previously agreed upon between the Contractor and the District.

Contractor will be allowed a cumulative maximum of 15% as mark up on labor and material costs. Contractor will be allowed a maximum of 5% mark up on work performed by lower tier contractors. This will override labor surcharge, mark ups and material mark ups stated in the Standard Specifications.

4. UNPAID CLAIMS

If upon or before the completion of the work herein agreed to be performed or at any time prior to the expiration of the period within which claims of lien may be filed for record as prescribed by the Code of Civil Procedure of the State of California, any person or persons claiming to have performed any labor or furnished any materials, supplies or services towards the performance of completion of this contract or if they have agreed to do so, shall file with the District a verified statement of such claim, or if any person shall bring against the District or any of its agents any action to enforce such claim, the District shall until the discharge thereof, withhold from the moneys that are under its control, as much as shall be sufficient to satisfy and discharge the amount in such notice or under such action claimed to be due, together with the cost thereof; provided, that if the District shall in its discretion permit the Contractor to file such additional bond as is authorized by the Code of Civil Procedure in a penal sum equal to one and one-quarter times the amount of said claim, said money shall not thereafter be withheld on account of such claim.

5. ACCEPTANCE

The parties agree that no certificate given shall be conclusive evidence of the faithful performance of the contract, either in whole or in part, and that no payment shall be construed to be in acceptance of any defective work or improper materials. Further, the certificate or final payment shall not terminate the Contractor's obligations under the warranty here in above. The Contractor agrees that payment of the amount due under the contract and the adjustments and payments due for any work done in accordance with any alterations of the same, shall release the District, the District’s Board of Directors, its officers and employees from any and all claims or liability on account of work performed under the contract or any alteration thereof.

F. CONTROL OF WORK

1. AUTHORITY OF THE DISTRICT'S AUTHORIZED REPRESENTATIVE

The District's Authorized Representative shall decide any and all questions that may arise as to the quality and acceptability of materials furnished and work performed as to the manner of performance and rate of progress of the work, and any and all questions, which may arise as to the interpretation of the plans and specifications. The District's Authorized Representative shall likewise decide any and all questions as to the acceptable fulfillment of the contract on the part of the Contractor, and all questions as to claims and compensation. The decision of the District's Authorized Representative shall be final, and he shall have relative authority to enforce and make effective such decisions and an action as the Contractor fails to carry out the work promptly.

For the purposes of routine and normal supervision and coordination of work, KFPD General Manager Bill Hansell is the District's Authorized Representative for all work within the scope of this agreement.

2. CONFORMITY WITH PLANS AND ALLOWABLE VARIATION

Finished surfaces shall in all cases conform with the lines, grades, cross-sections and dimensions shown on the plans. Minor deviations from approved plans, whenever required by the exigencies of construction, shall be determined in all cases by the District and authorized in writing.

3. PROGRESS OF THE WORK

The Contractor's working days shall begin on the date stated in the Notice To Proceed which will be issued following the scheduling conference. The Contractor shall diligently prosecute the work to completion before the expiration of the time limit appearing in the specifications.

4. SAMPLES

The Contractor shall furnish all products and materials required to complete the work. All materials and products must be of the specified quality and fully equal to samples, when samples are required. Whenever required, the Contractor shall submit to the District for test, and free of charge, samples of any one of the materials or products proposed to be used in the work. Said samples shall be delivered by the Contractor to the place within the District designated by the District. Rejected materials must be immediately removed from the work by the Contractor and shall not again be brought back to the site.

5. TRADE NAMES AND ALTERNATIVES

For convenience in designation on the plans or in the specifications, certain equipment or articles or materials to be incorporated in the work may be designated under a trade name of manufacturer and the catalog information. The use of an alternative equipment or an article or equipment which is of equal quality and of the required characteristics for the purpose intended will be permitted, subject to the approval of the District, in accordance with the following required by Section 3400 of the Public Contract Code of the State of California:

The burden of proof as to the comparative quality and suitability of alternative equipment or articles or materials shall be upon the Contractor, and Contractor shall furnish, at Contractor's own expense, all information necessary or related thereto as required by the District. The District shall be the sole judge as to the comparative quality and suitability of alternative equipment or articles or materials and the District's decision shall be final. All requests for substitution shall be submitted, together with all documentation necessary for the District to determine equality, within 20 days following the award of the contract.

6. PROTECTION OF WORK

The Contractor shall continuously maintain adequate protection of all Contractor's work from damage, and the District will not be held responsible for the care or protection of any material, equipment or parts of work, except as expressly provided for in the specifications.

7. CONFLICT OF TERMS

The notice to bidders, proposal, plans, specifications and General Provisions are essential parts of the contract for a given project. These documents, together with the necessary bonds and bidder's guarantee, constitute the contract as defined herein, and a requirement included in one document shall be as binding as though included in all, as they are intended to be cooperative and to provide a description of the work to be done. Should there be any conflict or discrepancy between terms used, then the specifications shall govern over plans, and change orders and supplemental agreements shall govern over any other contract document.

8. INTERPRETATION OF PLANS AND SPECIFICATIONS

Should it appear that the work to be done, or any matter relative thereto, is not sufficiently detailed or explained on the plans or in the specifications, the Contractor shall request the District for such further explanation as may be necessary, and shall conform to such explanation or interpretation as part of the contract, so far as may be consistent with the intent of the original specifications. In the event or doubt of questions relative to the true meaning of the specifications, reference shall be made to the District’s Board of Directors, whose decision thereon shall be final.

9. INCREASES AND DECREASES OF THE WORK TO BE DONE

The District reserves the right to increase or decrease the quantity of any item or portion of the work described on the plans, the specifications or the proposal form or to omit portions of the work so described, as may be deemed necessary or expedient by the District and the Contractor shall agree not to claim or bring suit for damages, whether for loss of profits or otherwise, on account of any decrease or omission of any kind of work to be done.

10. ALTERATIONS OF THE WORK TO BE DONE

By mutual consent of the parties signatory to the contract, alterations, modifications or deviations from the type of work may be described on the plans, specifications or on the proposal form may be made without in any way making the contract void. The price to be paid by the District to the Contractor for such altered or modified work shall be agreed upon in writing, endorsed upon the original contract and signed by the proper parties to said contract.

Whenever, during the progress of the work, such changes or modifications are deemed necessary by the District and agreed upon, as aforesaid, said deviations shall be considered and treated as though originally contracted for, and shall be subject to all the terms, conditions and provisions of the original contract.

11. EXTRA WORK

New and unforeseen work will be classed as extra work only when said work is not covered and cannot be paid for under any of the various items or combination of items for which a bid price appears on the proposal form. The Contractor shall not do any extra work except upon written order from the District. Compensation for such extra work shall be previously agreed upon in writing between the Contractor and the District.

12. PUBLIC UTILITIES

All of the existing utility facilities except those to be relocated as shown on the plans will remain in place and the contractor will be required to work around said facilities. In case it should be necessary to remove the property of a public utility or franchise, such owner will, upon proper application by the Contractor, be notified by the District to move such property within a reasonable time, and the Contractor shall not interfere with said property until after the expiration of the time specified. The right is reserved to the owners of public utilities or franchises to enter upon the project site for the purpose of making repairs or changes in their property, which may be necessary as a result of the work. The Contractor shall also schedule and allow adequate time for those relocations or modifications necessary for the project by the respective utility owners. Employees and agents of the District shall likewise have the privilege of entering upon the street for the purpose of making any necessary repairs or replacements.

The Contractor shall employ and use only qualified persons, as hereinafter defined, to work in proximity to P.G.&E secondary, primary and transition facilities. The term "qualified person" shall mean one, who by reason of experience or instruction, is familiar with the operation to be performed and the hazards involved, as more specifically defined in Section 2700 of Title 8 of the California Administrative Code. The Contractor shall take such steps as are necessary to assure compliance by any subcontractors.

13. PROCEDURE IN CASE OF DAMAGE TO PUBLIC PROPERTY

Any portions of curb, gutter, sidewalk or any other District improvement damaged by the Contractor during the course of construction shall be replaced by the Contractor at Contractor's own cost, free of charge to the District. The cost of additional replacement of curb, gutter or sidewalk in excess of the estimated quantities shown in the proposal form and specifications, and found necessary during the process of construction, (but not due to damage resulting from carelessness on the part of the Contractor during Contractor's operation), shall be paid to the Contractor at the unit prices submitted in its bid. For the purposes of this contract, all curb termination stub-outs for traffic signal detectors are considered existing improvements. The Contractor at no cost to the District shall replace existing curb termination stub-outs damaged as a result of work required by the Plans and Specifications.

14. REMOVAL OF INTERFERING OBSTRUCTIONS

The Contractor shall remove and dispose of all debris, abandoned structures, tree roots and obstructions of any character met during the process of excavation, it being understood that the cost of said removals are made a part of the base bid by the Contractor.

15. QUALITY OF MATERIAL

Materials shall be new, and of specified kind and quality, and fully equal to samples when samples are required. When the quality or kind of material or articles shown required under the contract is not particularly specified, the Contractor shall estimate that the District will require articles and materials representing the best of their class or kind or at least equal to the class or quality of similar articles or materials when specified. Materials shall be furnished in such quantities and kinds and at such times as to ensure uninterrupted progress for the work. They shall be stored properly and protected as required. The Contractor shall be entirely responsible for damage or loss by weather or any other cause.

16. REMOVAL OF DEFECTIVE OR UNAUTHORIZED WORK

It is the intent of the specifications that only first-class work, materials and workmanship will be acceptable. All work which is defective in its construction or deficient in any of the requirements of the specifications shall be remedied, or removed and replaced by the Contractor in an acceptable manner, and no compensation will be allowed for such correction. Any work done beyond the lines shown on the plans or established by the District, or any extra work done without written authority will be considered as unauthorized and will not be paid for. Upon failure on the part of the Contractor to comply forthwith with any order of the District made under the provisions of this paragraph, the District shall have authority to cause defective work to be remedied or removed and replaced, and unauthorized work to be removed, and to deduct the costs thereof from any moneys due or to become due the Contractor. If the work is found to be in compliance with these specifications, the District will furnish the Contractor with a certificate to that effect.

17. SUPERVISION

All manufactured products, materials and appliances used and installed and all details of the work shall at all times be subject to the supervision, test and approval of the District or its authorized representatives. The District or its authorized representatives shall have access to the work at all times during construction, and shall be furnished with every reasonable facility for securing full knowledge with regard to the progress, workmanship and character of the materials used or employed in the work.

Whenever the Contractor varies the period during which work is carried on each day, he shall give adequate notice to the District so that proper inspection may be provided. The inspection of the work shall not relieve the Contractor of any of his obligations to fulfill the contract as prescribed. Defective work shall be made good, and unsuitable materials may be rejected, notwithstanding the fact that such defective work and unsuitable materials have previously been accepted or estimated for payment.

18. SOIL COMPACTION TESTING

Any soil compaction testing and certification shall be certified by a Geotechnical Engineer and provided and paid for by the District.

19. PRESERVATION OF PROPERTY

Existing improvements in areas adjoining the property whereon demolition and removal is being performed shall be protected from injury or damage resulting from operations of the Contractor and the Contractor shall be responsible for such damage. In like manner any building, structure, tree, shrub, or other item designated for preservation on the property where demolition and removal is being performed shall be similarly protected and preserved.

20. DUST CONTROL

The Contractor shall provide such dust laying equipment and methods as may be required to protect District's property and adjacent property from annoyance or damage from dust caused by its operations, and failure to control such dust shall be cause for the District or its authorized representative to stop the work until said dust is controlled, and the Contractor shall have no recourse to collect from the District for any loss of time or expense sustained by him due to such suspension of work.

21. SELECTED MATERIALS

Existing materials excavated within the project limits that meet the specifications for trench backfill, topsoil, or other selected materials may be used to fulfill all or a portion of the requirements for such materials. No additional compensation will be allowed for excavation, stockpiling, overhaul, or placing selected materials encountered in the excavation.

22. SURPLUS MATERIALS

The Contractor shall furnish written consent from the owner of the property where it is intended to dispose of the surplus material. Surplus excavation shall become the property of the Contractor.

23. CLEAN UP

During all phases of construction, the Contractor shall maintain a clean work site; the Contractor shall be responsible for the removal and disposal of all concrete, asphalt, tree roots, and any other debris resulting from the work performed on a daily basis. Full compensation for clean up shall be considered as included in the prices for the various contract items.

24. EQUIPMENT REQUIREMENTS

The Contractor shall provide a lead car with a "Wide Load" warning sign to lead the movement of any equipment exceeding 7 feet in maximum horizontal dimension over any street to the location of the scheduled work site. Equipment will be subject to a fine of one hundred dollars for each violation as determined by the District or its authorized representative. Any other violations shall be subject to the Vehicle Code of the State of California. Full compensation for the cost of furnishing the lead vehicles and adhering to the requirements of this section shall be considered as included in the prices for the various contract items of work, and no additional compensation will be allowed therefore.

25. PROTECTION OF WORK AND PUBLIC

The Contractor shall take all necessary measures to protect work and prevent accidents during any and all phases of the work. The Contractor shall repair all damaged parts of the project as a result of vandalism (i.e., vehicle tracks, footprints, writing, etc.) and will respond to alleged damage to private property and/or vehicles within twenty-four (24) hours of notification. If deemed necessary by the District, the Contractor shall repair the defective area in accordance with the Special Provisions.

26. CONTRACTOR'S SUPERINTENDENT AND PROJECT MANAGER

The Contractor shall designate in writing and keep on the work at all times during its process a competent, technically qualified superintendent, who shall not be replaced without written notice to the District or its authorized representative except under extraordinary circumstances. The Contractor's superintendent shall be present at the site of the work at all times while work is in progress. Failure to observe this requirement shall be considered as suspension of the work by the Contractor until such time as such superintendent is again present at the site. The District or its authorized representative shall have the right, at any time, to direct a change in the Contractor's superintendent, if the performance is unsatisfactory, as determined by the District or its authorized representative, in its sole discretion.

The Contractor shall designate in writing and keep on the work at all times during its process a competent, technically qualified project manager or a Project Engineer, who shall not be replaced without written notice to the District or its authorized representative except under extraordinary circumstances. The Contractor's project manager or Project Engineer shall be responsible for overall administration and coordination of the work. The District or its authorized representative shall have the right, at any time, to direct a change in the Contractor's project manager or project engineer, if the performance is unsatisfactory, as determined by the District or its authorized representative, in its sole discretion.

27. WORK AFTER REGULAR HOURS

Contractor must have District's approval to perform any work after regular working hours, or work in excess of 8 hours a day, or on Saturday, Sunday, or any District recognized legal holiday.

28. CONTRACTOR'S DAILY REPORTS

Contractor shall complete consecutively numbered legible daily reports indicating the number of people working, their names, a narrative description of work performed, the individual locations of the work, serviceable major equipment in use, serviceable major equipment idled, serviceable major equipment down for repairs, sub-contractors working at site, weather conditions, temperature, start time, finish time, and the date. The Contractor's Superintendent shall sign each report. The daily report shall be completed on forms prepared by the Contractor and acceptable to the District or its authorized representative. The Contractor shall distribute copies to the District or its authorized representative at either the conclusion of each workday or prior to the start of work the next day. No progress payments will be processed or made to the Contractor unless all daily reports are completed to the date of submittal of application for payment.

REQUEST FOR WORKING DAYS

The Contractor shall notify the District or its authorized representative separately in writing within 7 calendar days after the occurrence of a delay, when the Contractor believes that it is entitled to an additional working day per any day the Contractor is prevented from working at the beginning of the workday, for cause defined in Section 6-6.1 of the Standard Specifications, or any day the Contractor is prevented from working during the first 5 hours with at least 60 percent of the normal work force for cause as defined in Section 6-6.1 of the Standard Specifications. The Contractor's failure to give written notice in the time period specified above shall constitute a waiver of all claims for an additional work day, whether direct or consequential in nature and that day will be counted as a working day. Upon receipt of the Contractor's written request, the District or its authorized representative will then make a determination of whether the day or days the Contractor is requesting shall be counted as working days.

29. DEFECTIVE MATERIALS

All materials not conforming to the requirements of these specifications shall be considered as defective, and all such materials shall be removed immediately from the site of the work unless otherwise permitted by the District. Upon failure on the part of the Contractor to comply with any order by the District made under the provisions of this article, the District shall have the authority to remove and replace defective material and to deduct the cost of removal and replacement from any moneys due or to become due to the Contractor.

30. SOUND AND VIBRATION CONTROL REQUIREMENTS

The Contractor shall comply with all local sound control and noise level rules, regulations and ordinances. No internal combustion engine shall operate on the project without a muffler of the type recommended by the manufacturer. Should any muffler or other control device sustain damage, the Contractor shall promptly remove the equipment and shall not return said equipment to the jobsite until the device is repaired or replaced. Said noise and vibration level requirements shall apply to all equipment on the job or related to the job, including, but not limited to truck, transit mixers or transit equipment that may or may not be owned by the Contractor.

31. AIR POLLUTION CONTROL

Contractor shall comply with all applicable air pollution control rules, regulations, ordinances and statutes. All containers of paint, thinner, curing compound, solvent or liquid asphalt shall be labeled to indicate the contents, fully complying with the applicable material requirements.

32. FINAL CLEANING UP

Upon completion of the project and before making application to the District for acceptance of the work, the Contractor shall clean all the streets and ground occupied by Contractor in connection with the project, of all rubbish, debris, excess material, temporary structures and equipment, leaving the entire site of the work in a neat and presentable condition.

33. CONTRACTOR'S REQUEST FOR FINAL INSPECTION

When the Contractor believes all the contract work is complete in all parts and requirements, the Contractor will notify the District or its authorized representative in writing.

After the District receives the Contractor's notice, the District or its authorized representative will review the Contractor's work for substantial performance with the contract documents. If the District or its authorized representative deems the work substantially performed, the District will prepare a list of any minor remaining items of work to be completed. The Contractor shall complete all work on the list to the satisfaction of the District or its authorized representative within 30 calendar days after the date of the list or the Contractor waives any and all claims to all monies withheld by the District under the Contract to cover the value of all such uncompleted or uncorrected items, including any additional engineering, administration, or inspection costs. If the work was not substantially performed, working days will continue to accrue against the Contractor.

34. RESOLUTION OF PUBLIC WORKS CLAIMS

This contract is subject to the provisions of Article 1.5 (commencing at Section 20104) of Division 2, Part 3 of the California Public Contract Code regarding the resolution of public works claims of less than $375,000. Article 1.5 mandates certain procedures for the filing of claims and supporting documentation by the contractor, for the response to such claims by the contracting public agency, for a mandatory meet and confer conference upon the request of the contractor, for mandatory judicial arbitration upon the failure to resolve the dispute through mediation. This contract hereby incorporates the provisions of Article 1.5 as through fully set forth herein.

35. TRENCHES AND EXCAVATIONS

In accordance with Public Contract Code Section 7104, whenever the digging of trenches or other excavations extend deeper than 4 feet below the surface, the Contractor shall promptly, and before the following conditions are disturbed, notify the District in writing of any: 1) Material that the Contractor believed may be material that is hazardous waste, as defined in Health and Safety Code Section 25117, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law: 2) Subsurface or latent physical conditions at the site differing from those indicated; or 3) Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract. The District shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste and cause a decrease or increase in the Contractor's cost of, or the time required for, performance of any part of the work, the District shall issue a change order under the procedures described in the General Provisions and Standard Specifications. In the unlikely event that a dispute arises between the District and the Contractor regarding whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the work, the Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all work to be performed under the Contract. The Contractor shall retain any and all rights provided either by contract or by law, which pertain to the resolution of disputes and protests between the contracting parties. Where applicable, Contractor shall comply with the trench or excavation permit requirement found in Labor Code Section 6500 and the excavation safety requirements found in Labor Code Section 6705.

END OF SECTION

SPECIAL PROVISIONS (SECTION II)

A. GENERAL PROJECT INFORMATION

1. REQUIREMENTS

All work required herein shall be accomplished in accordance with the applicable portions of the Caltrans Standard Specifications latest edition, herein referred to as "Standard Specifications", except as modified by these Special Provisions and the Project Plans.

In addition to the above, the Contractor shall comply with the requirements of the following:

(a) Notice Inviting Sealed Bids
(b) Instructions to Bidders
(c) Proposal
(d) Bid Bond
(e) Information Required of Bidders
(f) Contract Agreement
(g) Faithful Performance Bond
(h) Labor and Material Bond
(i) Statement Acknowledging Penal and Civil Penalties Concerning the Contractor's Licensing Laws.
(j) Insurance

2. DEFINITION OF TERMS

Wherever in the "Standard Specifications" terms are used, they shall be understood to mean and refer to the following:

District & Owner – Kensington Fire Protection District

Board – Board of Directors, Kensington Fire Protection District

District Representative – Bill Hansell

Notice to Contractors - Notice Inviting Sealed Bids

Contractor – Bidder who signs the Contractual Agreement for the project

Contract – Both the project Contract Documents and the Contractual Agreement signed by the Contractor

Architect – The person holding a valid state Architect's license, whose firm has been designated within the Contract Documents as the Architect of Record to provide architectural services on this project

3. PROJECT PLANS

The location of the work, its general nature, extent, form and detail of the various features are listed as a part of these Specifications and Plans.

4. SCOPE OF WORK

The renovation work includes but is not limited to: seismic retrofitting of the structure, the interior remodel of the work and living quarters for fire personnel (dormitories, bathrooms, restrooms, kitchen, dining, day room, offices and a multi-purpose room); upgrades to apparatus garage areas and support spaces; new mechanical, electrical, plumbing, fire protection and lighting systems; new foundation systems, new partial roof, site improvements; exterior envelope siding replacement, new windows and doors, and accessibility compliance upgrades such as an elevator and wheelchair lift, as defined by the project documents.

5. NOTICE TO PROCEED

Upon award of this contract and signing the contract documents, the District shall issue the Contractor a Notice to Proceed. Contract period shall commence on the date in the Notice to Proceed. Contractor to start work within 10 working days of receipt of Notice to Proceed. Working days are defined as Monday through Friday with the exception of District recognized legal holidays.

The District will not authorize any work to be done before the contract agreement has been fully executed; and any work that is done by the contractor in advance of such time shall be considered as being done at Contractor's own risk and responsibility.

In the event that the District shall be of the opinion that the work is being inadequately or improperly executed in any respect, District may demand that Contractor improve or change the execution of the work in such manner as to assure proper and timely completion.

6. UTILITIES

Contractor shall exercise due care to ensure that utility facilities are not damaged during its operations. Contractor shall notify all necessary utility companies prior to the beginning of any work.

7. STREET/PATHWAY CLOSURES

Contractor shall be responsible for securing closure of all streets, roadways and pathways necessary for completion of the work.

8. CONFERENCE

Contractor shall attend a preconstruction meeting with the District, which shall be held a minimum of **five (5) working days** prior to commencement of any work. Contractor shall submit a preliminary schedule, schedule of values, site specific safety plan, project staff information and submittal schedule to the District for approval a minimum of **two (2) working days** prior to the pre-construction conference.

9. PUBLIC CONVENIENCE AND SAFETY

Attention is directed to Section 7-10 of the Standard Specifications and the Manual on Uniform Traffic Control Devices – Latest Edition (MUTCD), published by the Federal Highway Administration (FHWA) and current California Department of Transportation (Caltrans) Supplement(s).

Traffic Control

General: Traffic control shall conform to the MUTCD and current Caltrans Supplement(s). Minor deviations from the traffic requirements of this section, which do not significantly change the cost of the work, may be permitted upon the written request of the Contractor, if in the opinion of the Engineer public traffic will be better served as the work is expedited. Such deviations shall not be adopted until the Engineer has indicated his written approval. All other modifications will be made by contract change order.

The Contractor shall provide all markers, signs, delineators and crash cushions necessary to ensure the safe passage of traffic through the work zone.

Lane Closure Restriction: The Contractor shall maintain a minimum of one lane of traffic open at all times. The minimum width of a traffic lane shall not be less than 10 feet. Flashing Arrow Boards shall be required.

Flagging: The Contractor shall furnish at his expense and with no extra cost to the District such flagmen and guards as are necessary to give adequate warning to the public that roadway work is underway and of any dangerous conditions. Flagmen shall perform their duties and be provided with equipment in accordance with current applicable provisions of the MUTCD and current Caltrans supplement(s). The equipment shall be furnished, kept clean and in good repair by the Contractor at his own expense. The Contractor shall furnish, erect, maintain and regularly inspect barricades, lights, signs and other devices as are necessary to prevent accidents and avoid damage or injury to the public. These devices shall conform to the requirements set forth in the current MUTCD and current Caltrans Supplement(s). Any painted graffiti, vandalized, or otherwise damaged signs or equipment shall be immediately replaced.

All street closures, flagging arrangements, detours and traffic signing, including special signs, must be approved by the District at least ten (10) working days prior to such closures. Public notification signs shall be approved by the District and installed at that time.

Pathway: If work it to be conducted in the vicinity of a pathway the Contractor to provide pedestrians with a safe walkway around the construction zone.

Access: The District shall provide the Contractor access to private property when the work requires such access.

Traffic Control Plans: **10 working days** prior to commencement of any work, the Contractor shall submit to the District a Traffic Control Plan for all of the various phases of construction. Said plan shall follow the requirements of Section 7-10 of the Standard Specifications and the MUTCD and current Caltrans Supplement(s).

Full compensation for conforming to the requirements of Section 7-10 of the Standard Specifications, the MUTCD and current Caltrans Supplement(s) and these Special Provisions not otherwise provided for, shall be considered as included in the prices paid for the various contract items of work, and no additional compensation will be allowed thereof.

10. SANITARY CONVENIENCE

Necessary sanitary facilities for the use of workers on the job shall be provided and maintained in an approved manner by the Contractor, properly secluded from public observation and in compliance with health ordinances, laws and regulations, and their use shall be strictly enforced by the Contractor. Any workman, who fails to use the sanitary facilities as intended, shall be removed from the project site permanently at the sole discretion of the Engineer.

11. CONSTRUCTION YARD

It shall be the Contractor's responsibility to locate any storage sites for materials and equipment needed and such sites either located on public or private property must be approved in advance by the District or its authorized representative. If permission is given to use a District site, the Contractor shall repair any damage as a result of his operations and any repairs will restore the site to **new** and not pre-existing conditions.

When storage sites are to be on located upon private property, the Contractor shall submit to the District or its authorized representative, written approval from the record owner authorizing the use of the property by the Contractor. The Contractor shall contact the District to determine if using the site as a stockpile area is allowed. After the project is complete, the Contractor shall supply a written release signed by the owner of record that said property has been satisfactorily restored in order to provide assurance to the District that no later property owner claims will be filed by residents whose property has allegedly damaged by the Contractor and not repaired to their satisfaction.

12. EQUIPMENT REQUIREMENTS

Contractor shall furnish all equipment required to safely complete the work and avoid, if possible, conducting any on-site maintenance or repair of said equipment. Necessary minor maintenance may be conducted on site; however, all maintenance and/or repairs shall be completed Monday through Friday during regular work hours. Fueling and minor maintenance shall be in compliance with the National Pollutant Discharge Elimination System ("NPDES") requirements.

All equipment shall be in good repair. Equipment from which leaks of oil, hydraulic fluids, coolant, etc., are observed shall be removed from service until the necessary repairs have been completed.

13. PRESERVATION OF PROPERTY

Existing improvements in areas adjoining the locations whereon construction activities are being performed shall be protected from injury or damage resulting from operations of the Contractor. In like manner any building, structure, tree, shrub, or other item in the vicinity of the Contractor's operation, shall be similarly protected and preserved. Vegetation cleared during site preparation shall become the property of the Contractor and shall be removed from the area unless otherwise directed by the District.

14. NPDES COMPLIANCE/WATER POLLUTION CONTROL

Water pollution control shall consist of constructing those facilities specified by these Contract Documents, required by law, or as ordered by the District or its authorized representative. Said work is intended to provided prevention, control and abatement of water pollution to streams, oceans and other bodies of water. Full compensation for conforming to the requirements in this entire section shall be considered as included in the prices paid for the various contract items of work, and no additional compensation will be allowed therefore.

Housekeeping/Cleanup: The Contractor shall prevent pollution of stormwater from cleanup and disposal operations by using good housekeeping methods. When fluids or dry materials spill, cleanup should be immediate, thorough, and routine. The Contractor shall never attempt to wash them away with water, or bury them. The Contractor shall report significant spills to the appropriate spill response agencies immediately. The Contractor shall recognize that different types of materials have different disposal requirements and follow appropriate practices. The Contractor shall confine non-hazardous debris to dumpsters, covered at night or during wet weather, and taken to a landfill for recycling or disposal. The Contractor shall handle hazardous debris in accordance with specific laws and regulations and dispose of as a hazardous waste. A separate permit is required. Common hazardous debris found on construction sites include, but are not limited to: liquid residues from paints, thinners, solvents, glues, and cleaning fluids, leaching agents form lumber such as formaldehyde, arsenic, copper, creosote and chromium, motor oil, gear oil, antifreeze fluids, brake fluids, etc., unused pesticides.

Sanitary Waste Management: The Contractor shall prevent the discharge of sanitary waste to stormwater by providing convenient, properly located, well maintained facilities. The Contractor shall hire a licensed portable sanitary facility leasing company which will clean the facilities regularly and keep them in good working order. The Contractor shall make sure that portable sanitary facilities are located on relatively level ground away from traffic areas, drainage courses, and storm drain courses, and storm drain inlets. The Contractor shall regularly inspect the facilities for any leaks, and have defective units replaced.

Vehicle and Equipment Management: The Contractor shall use and maintain construction vehicles and equipment in a manner that prevent leaks and spills of fluids, contains wash waters, and controls off-site tracking. The Contractor shall not allow leaking vehicles and equipment on-site and shall inspect equipment and vehicles frequently for leaks and repair them immediately. The Contractor shall clean up spills and leaks promptly with absorbent materials, and shall not flush with water.

The Contractor shall fuel, maintain, and repair vehicles and equipment off-site whenever possible, and on-site only in designated areas. The Contractor shall prevent run-on and run-off from designated areas, provide containment devices and cover if necessary.

The Contractor shall wash vehicles and equipment on-site in designated, contained areas, allowing wash waters to infiltrate into the ground. The Contractor shall use phosphate-free, biodegradable soaps, and steam clean in confined areas only.

When not in use, the Contractor shall store equipment and vehicles in designated, contained areas and place drip pans and absorbent material under stored equipment that is prone to leaking and dripping (e.g. paving equipment).

If the Contractor must drain and replace motor oil, radiator coolant, or other fluids on-site, use drip pans or drop cloths to catch drips and spills. The Contractor shall collect all spent fluids, store in separate containers, and recycle whenever possible. Note: For recycling purposes, such liquids must not be mixed with other fluids. Non-recycled fluids generally must be disposed of as hazardous waste.

Surface and Subsurface Water Control: The Contractor shall prevent or reduce the discharge of pollutants to stormwater from surface and subsurface water control operations by using the following methods:

For surface water control operations where the flow is routed to bypass the construction area, establish stable (erosion resistant) conveyance routes for the diverted flow. Trap any significant sediment (e.g., mud) generated by the rerouted flow in a sediment trap, filtering berm, or basin.

In subsurface pumping or other subsurface water control operations where significant amounts of sediment (e.g., mud) are present in the removed water, capture the sediment in a sediment trap, filtering berm, or basin.

If a sediment trap or basin is required for the surface or subsurface water control operations, the facility should be designed such that the sediment is settled or trapped in the facility prior to discharging of the water.

In areas suspected of groundwater pollution, sample the groundwater near the excavation/pumping site and have the water tested for known or suspected pollutants at a certified laboratory.

Any proposed discharge of groundwater may be subject to requirements of the Regional Water Quality Control Board if water is discharged to groundwater or land.

Concrete and Mortar Products: The Contractor shall prevent or reduce the discharge of pollutants to stormwater from concrete waste by conducting washout at appropriate off-site locations, performing on-site washout in a designated area, and training employees and subcontractors.

The Contractor shall store and mix dry and wet materials either off-site or under cover, away from drainage areas.

For washout of concrete trucks the Contractor shall provide appropriate off-site locations or designated contained areas, at least 50 feet away from storm drains, open ditches, streets, or streams.

The Contractor shall prevent run-off from designated washout areas by constructing a temporary pit or bermed area large enough for liquid and solid waste. When concrete sets, breakup and dispose of it in construction fills per direction of soils engineer or as solid waste or recycle.

The Contractor shall inform concrete suppliers of the designated washout locations and disposal sites for concrete and mortar products.

Asphalt and Bituminous Products: Dispose of old asphalt properly. Collect and remove all broken asphalt from the site and recycle whenever possible. Do not dispose of asphalt products into waterways. Follow the stormwater permitting requirements for industrial activities if paving involves an on-site mixing plant.

Construction Water: The Contractor shall reduce or eliminate excessive construction water that may cause erosion and carry pollutants from the site. The Contractor shall:

Store construction water in leak proof tanks, located away from the drainage system. Use construction water conservatively. Whenever possible, dispose of excess water on-site, by allowing it to soak into the ground.

Saw Cut Slurry: Saw cut slurry contains pollutants that must be contained and disposed of properly. The Contractor shall: Prevent saw cut slurry from entering catch basins, manholes and storm drains. Direct slurry into a temporary pit. Dispose of by shoveling or vacuuming the slurry into a truck and removing from the site. Place drip pans or absorbent materials under saw cutting equipment when not in use. Clean up spills with absorbent materials rather than burying. Dispose of absorbent material properly.

Except as otherwise provided in the Standard Specifications or elsewhere in these Special Provisions, full compensation for conforming to the requirements in this section shall be considered as included in the prices paid for the various contract items of work, and no additional compensation will be allowed therefore.

15. SAFETY, SANITARY AND MEDICAL REQUIREMENTS

The Contractor, his employees, his subcontractors and their employees shall promptly and fully carry out the existing safety, sanitary and medical requirements as may from time to time be prescribed by the Industrial Safety Commission and by County or State Health Departments to the end that proper work shall be done and the safety and health of the employees and of the community may be conserved and safeguarded. In case the Contractor does not observe any such regulations and orders, the District at the Contractor's expense may enforce them.

16. ELECTRICAL POWER

Unless otherwise provided in the Special Provisions, the Contractor shall provide, at his own expense, all necessary electrical power required for his operations under the contract.

17. PROTECTION OF UNDERGROUND FACILITIES

Attention is directed to the possible existence of underground facilities not known to the owner or in a location different from that, which maybe indicated on the plans, or in these Special Provisions. The Contractor shall take steps to ascertain the exact location of all underground facilities prior to doing work that may damage such facilities or interfere with their service. If the Contractor discovers underground facilities not indicated on the Plans or in these Special Provisions, he shall immediately give the District written notification of the existence of such facilities. Such facilities shall be protected from damage as directed by the District and the Contractor will be paid for such work as extra work as provided in Section 3-3 of the Standard Specifications.

18. AIR POLLUTION CONTROL

Section 7-8.2, "Air Pollution," of the Standard Specifications is supplemented by the following:

The Contractor shall comply with all air pollution control rules, regulations, ordinances and statutes which apply to any work performed pursuant to the contract, including any air pollution control rules, regulations, ordinances and statutes specified in Section 11017 of the Government Code.

In the absence of any applicable air pollution control rules, regulations, ordinances or statutes governing solvents, all solvents including, but not limited to the solvent portions of paints, thinners, curing compounds, and liquid asphalt used on the project shall comply with the applicable material requirements of the Bay Area Air Quality Management District. All containers of paint, thinner, curing compound or liquid asphalt shall be labeled to indicate that the contents fully comply with said requirements.

19. PROJECT APPEARANCE

The Contractor shall maintain a neat appearance to the work. **The project streets and any streets adversely affected by the Contractor's activities shall be kept clean at all times.**

A motorized vacuum sweeper is required pursuant to the second paragraph of Subsection 7-8.1 of the Standard Specifications.

In any area visible to the public, the following shall apply: When practicable, broken concrete and debris developed shall be disposed of concurrently with its removal. If stockpiling is required, the material shall be placed in an area, which does not impact, public or private landscaping or irrigation and the material shall be removed or disposed of daily.

Should the Contractor appear to be neglectful or negligent in maintaining a clean project site, the District may direct the Contractor's attention to the existence of such condition(s). The Contractor shall provide all necessary measures immediately, at his expense. If attention is directed to the existence of such condition(s), and the Contractor fails to provide an appropriate remedy, any expense incurred by the District for providing correcting actions may be deducted from the pay estimates and the total contract price for the work, including a Fifty Dollar ($50.00) penalty per calendar day the condition(s) exist from date of notification.

Full compensation for conforming to the provisions in this section not otherwise provided for shall be considered as included in prices paid for the various contract items of work involved, and no additional compensation will be allowed therefore.

20. WORK HOURS

The Contractor's working hours shall be limited to the hours between 8:00 a.m. and 5:00 p.m., Monday through Friday, excluding those District holidays listed in Section II.A.5 of the Special Provision on page SP-2. Deviation from normal working hours will not be allowed without prior consent of the District.

In the event work is allowed by the District outside of the normal working hours, at the request of and for the benefit of the Contractor, inspection service fees shall be levied against the Contractor at a rate of $84.00 per hour, plus travel time where applicable. The above

charge may also be levied if inspection services are deemed necessary by the District as a matter of public safety or to otherwise ensure the quality of the work.

If work is permitted after sunset, the Contractor shall provide, at its expense, adequate light for proper prosecution of the work for the safety of the workmen and the public, and for proper inspection.

21. CONSTRUCTION STAKING

Contractor shall be required to provide any and all necessary construction staking required to construct the project. The Contractor shall be responsible for hiring a licensed land surveyor or a civil engineer authorized to survey, to provide a layout and construction staking of all improvements being constructed as part of this project. The contractor shall provide the District with cut sheets at least 24 hours prior to proceeding with new work.

Payment

Full Compensation for this item shall be considered included in the various bid items of this project and therefore, no additional compensation shall be allowed.

END OF SECTION

[INTENTIONALLY LEFT BLANK]

CHECKLIST FOR BIDDERS

The following information is required of all Bidders and are to be submitted with the bid:

____ Signed Proposal Sheet

____ Completed Bid Sheet(s) and bid schedule

____ Acknowledgement of each addendum issued by the District, if any, with complete signed and dated copies of each addendum attached

____ Executed Statement Acknowledging Penal and Civil Penalties Concerning the Contractor's Licensing Law

____ Designation of Subcontractors

____ Bid Security

____ Non-Collusion Affidavit

[INTENTIONALLY LEFT BLANK]

PROPOSAL

Kensington Fire Protection District Public Safety Building Seismic Renovation

TO THE KENSINGTON FIRE PROTECTION DISTRICT

The undersigned, as bidder, declares that: (1) this proposal is made without collusion with any other person, firm or corporation, and that the only persons or parties interested as principals are those named herein; (2) bidder has carefully examined the project plans, specifications, instructions to bidders, proposal, notice to contractors and all other information furnished therefore and the site of the proposed work; (3) bidder has investigated and is satisfied as to the conditions to be encountered, the character, quality and quantities of work to be performed and materials to be furnished. Furthermore, bidder agrees that submission of this proposal shall be conclusive evidence that such examination and investigation have been made and agrees, in the event this contract be awarded to bidder, to enter into a contract with the KENSINGTON FIRE PROTECTION DISTRICT, to perform said proposed work in accordance with the plans, if any, and the terms of the specifications, in the time and manner therein prescribed, and to furnish or provide all materials, labor, tools, equipment, apparatus and other means necessary so to do, except such thereof as may otherwise be furnished or provided under the terms of said specifications, for the following stated unit prices or lump-sum price as submitted on the Schedule attached hereto:

Accompanying this proposal is _____ _____(Insert "$_____cash," "Cashier's Check," "certified check," or "Bid Bond," as the case may be) in the amount equal to at least ten percent (10%) of the bid price.

The undersigned further agrees that should he/she be awarded the contract on the basis hereof and thereafter, defaults in executing the required contract, with necessary bonds and documents, within fifteen (15) working days, after having received notice that the contract has been awarded and is ready for signature, the proceeds of the security accompanying his bid shall become the property of the KENSINGTON FIRE PROTECTION DISTRICT and this proposal and the acceptance thereof may be considered null and void.

Licensed in accordance with an act providing for the registration of contractors, California Contractor's License No. _____, Class _____, Expiration Date _____.
DIR# _____

Signature(s) of bidder:_____
If an individual, so state. If a firm or co-partnership, state the firm name and give the names of all individual co-partners composing the firm. If a corporation, state legal name of corporation, also names of president, secretary, treasurer, and manager thereof. Two notarized officer's signatures and the corporate seal are required for corporations.

Legal Business Name: _____

Address: _____

Telephone: _____

Contact: _____

Proposals which do not show the number and date of the Bidder's License under the provisions of Chapter 9 of Division 3 of the Business & Professional Code will be rejected. To be submitted with each bid to contract for:

Kensington Fire Protection District Public Safety Building Seismic Renovation.

Bid Date _____

This information must include all construction work undertaken in the State of California by the bidder and partnership joint venture or corporation that any principal of the bidder participated in as a principal or owner for the last five calendar years and the current calendar year prior to the date of bid submittal. Separate information shall be submitted for each particular partnership, joint venture, corporate or individual bidder. The bidder may attach any additional information or explanation of data which bidder would like to be taken into consideration in evaluating the safety record. An explanation must be attached of the circumstances surrounding any and all fatalities.

KENSINGTON FIRE PROTECTION DISTRICT
BID PRICING SCHEDULE

NAME OF COMPANY:_____

To the Kensington Fire Protection District and its Board of Directors:
In compliance with the Notice Inviting Sealed Bids, the undersigned hereby agrees to enter into a contract to furnish all labor, materials, equipment and supplies for the project identified as **Public Safety Building Seismic Renovation** in accordance with the specifications and plans in the Contract Documents which are on file with the District to the satisfaction and under the direction of the District at the following prices:

Item	Description	Quantity	Unit	Total Amount
1	Division 01 – Mobilization/Demobilization	1	LS	
2	Division 01 – Insurance	1	LS	
3	Division 01 – Supervision, Administration	1	LS	
4	Division 01 – Testing, Inspection, Q.C.	1	LS	
5	Division 01 – Temporary Facilities	1	LS	
6	Division 01 – Janitorial and Protection	1	LS	
7	Division 01 – Project Closeout	1	LS	
8	Division 01 – Permits and Fees	1	LS	
9	Division 01 – Scaffolding	1	LS	
10	Division 01 – General Conditions Other	1	LS	
		Division 01 Total:		
11	Division 02 – Removal Work	1	LS	
12	Division 02 – Asphalt Concrete Paving	1	LS	
13	Division 02 – Site Utilities	1	LS	
14	Division 02 – Site Drainage	1	LS	
15	Division 02 – Site Other	1	LS	
		Division 02 Total:		
16	Division 03 – Concrete	1	LS	
		Division 03 Total:		
17	Division 04 – Masonry, Slabwork	1	LS	
		Division 04 Total:		
18	Division 05 – Ornamental Metals	1	LS	
		Division 05 Total:		
19	Division 06 – Wood and Plastics	1	LS	
20	Division 06 – Structural Carpentry	1	LS	
21	Division 06 – Finish Carpentry	1	LS	
22	Division 06 – Architectural Millwork	1	LS	
23	Division 06 – Cabinetwork/Shelves	1	LS	
		Division 06 Total:		
24	Division 07 – Roofing and Waterproofing	1	LS	
25	Division 07 – Building Insulation	1	LS	
26	Division 07 – Metal Roofing and Sheet Metal	1	LS	

KENSINGTON FIRE PROTECTION DISTRICT
BID PRICING SCHEDULE

27	Division 07 – Skylights	1	LS	
	Division 07 Total:			
28	Division 08 - Wood Doors and Frames	1	LS	
29	Division 08 - Exterior Doors and Frames	1	LS	
30	Division 08 - Windows	1	LS	
31	Division 08 - Hardware	1	LS	
	Division 08 Total:			
32	Division 09 - Gypsum Wallboard	1	LS	
33	Division 09 - Ceramic & Stone Tile	1	LS	
34	Division 09 - Flooring	1	LS	
35	Division 09 - Painting	1	LS	
36	Division 09 - Finishes Other	1	LS	
	Division 09 Total:			
37	Division 10 - Toilet, Bath, & Accessories	1	LS	
38	Division 10 - Mirror & Shower Doors	1	LS	
39	Division 10 - Other	1	LS	
	Division 10 Total:			
40	Division 11 - Equipment	1	LS	
	Division 11 Total:			
41	Division 12 - Furnishings	1	LS	
	Division 12 Total:			
42	Division 13 - Special Construction	1	LS	
	Division 13 Total:			
43	Division 14 - Elevator	1	LS	
	Division 14 Total:			
44	Division 15 - HVAC	1	LS	
45	Division 15 - Plumbing	1	LS	
	Division 15 Total:			
46	Division 16 - Communications/AV	1	LS	
47	Division 16 - Lighting	1	LS	
48	Division 16 - Electrical Other	1	LS	
	Division 16 Total:			
49	Division 17 – Misc Other	1	LS	
	Division 17 Total:			
50	Misc Other Division Work	1	LS	
	Misc Other Division Work Total:			
	Base Bid Grand Total:			

BASE BID TOTAL AMOUNT IN WORDS: _____

Bid schedule is provided for reference only. Bidder's base bid price should include costs for all the scope on the bid documents and addendums.

Bidder acknowledges receipt of the following addendum(s), cost of which is included in the base bid:

Addendums	Date	Initial

The undersigned further agrees to deliver and to complete the work within **365 working days**, from the date of issuance, by the District, of notice to proceed with the work, and within **15 days** of the date of mailing of the notice of award, to enter into and execute and provide to the District the necessary contract with the necessary bonds and other required documents, and in case of default in executing the necessary contract within the time fixed by the Instructions to Bidders, the bidder's security accompanying this bid shall become the property of and be forfeited to the District

Prime Contractor _____

DIR # _____

License # _____ Expiration Date _____

Contractors License number and expiration date are herein stated under penalty of perjury.

By: _____ Title: _____

Dated this _____ day of _____, 20_____

INTENTIONALLY LEFT BLANK

STATEMENT ACKNOWLEDGING PENAL AND CIVIL PENALTIES CONCERNING THE CONTRACTORS' LICENSING LAWS
[Business & Professions Code 7028.15]
[Public Contract Code 20103.5]

I, the undersigned, certify that I am aware of the following provisions of California law and that I, or the entity on whose behalf this certification is given, hold a currently valid California contractor's license as set forth below:

Business & Professions Code 7028.15:

(a) **It is a misdemeanor for any person to submit a bid to a public agency in order to engage in the business or act in the capacity of a contractor within this state without having a license therefore**, except in any of the following cases:

(1) The person is particularly exempted from this chapter.

(2) The bid is submitted on a state project governed by Section 10164 of the Public Contract Code or on any local agency project governed by Section 20103.5 of the Public Contract Code.

(b) If a person has been previously convicted of the offense described in this section, the court shall impose a fine of 20 percent of the price of the contract under which the unlicensed person performed contracting work, or four thousand five hundred dollars ($4,500), whichever is greater, or imprisonment in the county jail for not less than 10 days nor more than six months, or both.

In the event the person performing the contracting work has agreed to furnish materials and labor on an hourly basis, "the price of the contract" for the purposes of this subdivision means the aggregate sum of the cost of materials and labor furnished and the cost of completing the work to be performed.

(c) This section shall not apply to a joint venture license, as required by Section 7029.1. However, at the time of making a bid as a joint venture, each person submitting the bid shall be subject to this section with respect to his or her individual licensure.

(d) This section shall not affect the right or ability of a licensed architect, land surveyor, or registered professional engineer to form joint ventures with licensed contractor to render services within the scope of their respective practices.

(e) Unless one of the foregoing exceptions applies, a bid submitted to a public agency by a contractor who is not licensed in accordance with this chapter shall be considered non-responsive and shall be rejected by the public agency. Unless one of the foregoing exceptions applies, a local public agency shall, before awarding a contract or issuing a purchase order, verify that the contractor was properly licensed when the contractor submitted the bid. Notwithstanding any other provision of law, unless one of the foregoing exceptions applies, the registrar may issue a citation to any public officer or employee of a public entity who knowingly awards a contract or issues a purchase order to a contractor who is not licensed pursuant to this chapter. The amount of civil penalties, appeal, and finality of such citations shall be subject to Sections 7028.7 to

7028.13 inclusive. **Any contract awarded to, or any purchase order issued to, a contractor who is not licensed pursuant to this chapter is void**.

(f) Any compliance or noncompliance with subdivision (e) of this section, as added by Chapter 863 of the Statutes of 1989, shall not invalidate any contract or bid awarded by a public agency during which time that subdivision was in effect.

(g) A public employee or officer shall not be subject to a citation pursuant to this section if the public employee, officer, or employing agency made an inquiry to the board for the purposes of verifying the license status of any person or contractor and the board failed to respond to the inquiry within three business days. For purposes of this section, a telephone response by the board shall be deemed sufficient.

Public Contract Code 20103.5:

In all contracts subject to this part where federal funds are involved, no bid submitted shall be invalidated by the failure of the bidder to be licensed in accordance with the laws of this state. However, at the time the contract is awarded, the contractor shall be properly licensed in accordance with the laws of this state. The first payment for work or material under any contract shall not be made unless and until the Registrar of Contractors verifies to the agency that the records of the Contractor's State License Board indicate that the contractor was properly licensed at the time the contract was awarded. Any bidder or contractor not so licensed shall be subject to all legal penalties imposed by law including, but not limited to, any appropriate disciplinary action by the Contractor's State License Board. The agency shall include a statement to that effect in the standard form of prequalification questionnaire and financial statement. Failure of the bidder to obtain proper and adequate licensing for an award of a contract shall constitute a failure to execute the contract and shall result in the forfeiture of the security of the bidder.

License No.: _____

Class: : _____

Expiration Date: _____

DIR# : _____

Date: _____

Signature: _____

DESIGNATION OF SUBCONTRACTORS

[Public Contract Code section 4104]

Public Contract Code section 4104 provides as follows:

Any officer, department, board or commission taking bids for the construction of any public work or improvement shall provide in the specifications prepared for the work or improvement or in the general conditions under which bids will be received for the doing of the work incident to the public work or improvement that any person making a bid or offer to perform the work, shall, in his or her bid or offer, set forth:

(a)(1) The name and the location of the place of business of each subcontractor who will perform work or labor or render service to the prime contractor in or about the construction of the work or improvement, or a subcontractor licensed by the State of California who, under subcontract to the prime contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of 1 percent of the prime contractor's total bid or, in the case of bids or offers for the construction of streets or highways, including bridges, in excess of one-half of 1 percent of the prime contractor's total bid or ten thousand dollars ($10,000), whichever is greater.

(2)(A) Subject to subparagraph (B), any information requested by the officer, department, board, or commission concerning any subcontractor who the prime contractor is required to list under this subdivision, other than the subcontractor's name and location of business, may be submitted by the prime contractor up to 24 hours after the deadline established by the officer, department, board, or commission for receipt of bids by prime contractors.

(B) A state or local agency may implement subparagraph (A) at its option.

(b) The portion of the work that will be done by each subcontractor under this act. The prime contractor shall list only one subcontractor for each portion as is defined by the prime contractor in his or her bid.

FORM A-1

KENSINGTON FIRE PROTECTION DISTRICT
PUBLIC SAFETY BUILDING SEISMIC RENOVATION
BIDDER STATEMENT OF SUBCONTRACTOR
(Attach Additional Sheets if needed)

Subcontractor's Name, Address, Contact Information	DIR #	License #	Proposed Scope

INTENTIONALLY LEFT BLANK

Bond No. _____

BID BOND

(Bidders must use this form; use of any other bond form may render a bid non-responsive)

KNOW ALL PERSONS BY THESE PRESENTS that:

WHEREAS the Kensington Fire Protection District _____

(A Public Agency), has issued an invitation for bids for the work described as follows: Public Safety Building Seismic Renovation,

WHEREAS _____

_____

(Name and address of Bidder)

(Principal), desires to submit a bid to Public Agency for the work.

WHEREAS, bidders are required under the provisions of the California Public Contract Code to furnish a form of bidder's security with their bid.

NOW, THEREFORE, we, the undersigned Principal, and _____

_____

_____,

(Name and address of Surety)

(Surety) a duly admitted surety insurer under the laws of the State of California, as Surety, are held and firmly bound unto the Public Agency in the penal sum of _____

_____

Dollars ($_____), being not less than ten percent (10%) of the total bid price, in lawful money of the United States of America, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if the hereby bounded Principal is awarded a contract for the work by the Public Agency and, within the time and in the manner required by the bidding specifications, enters into the written form of contract included with bidding specifications, furnishes the required bonds, one to guarantee faithful performance and the other to guarantee payment for labor and materials, and furnishes the required insurance coverages, then this obligation shall become null and void; otherwise, it shall be and remain in full force and effect.

In case suit is brought upon this bond, Surety further agrees to pay all court costs incurred by the Public Agency in the suit and reasonable attorneys' fees in an amount fixed by the court. Surety hereby waives the provisions of California Civil Code Section 2845.

IN WITNESS WHEREOF, this instrument has been duly executed by Principal and Surety, on the date set forth below, the name of each corporate party being hereto affixed and these presents duly signed by its undersigned representative(s) pursuant to authority of its governing body.

Dated: _____

Principal	Surety
_____	_____
_____	_____
By: _____	By: _____
Its	Its
By: _____	By: _____
Its	Its
(Seal)	*(Seal)*

Note: This bond must be dated, all signatures must be notarized, and evidence of the authority of any person signing as attorney-in-fact must be attached.

NONCOLLUSION AFFIDAVIT
TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID
[Title 23 United States Code Section 112 and Public Contract Code Section 7106]

State of California)
) ss.
County of _____)

In accordance with Title 23 United States Code Section 112 and Public Contract Code Section 7106 _____, being first duly sworn, deposes and says that he or she is _____

_____

of _____

the party making the foregoing bid, that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

Signature _____

Subscribed and sworn to before me on _____
(Date)

(Notary Seal)

Signature _____
Notary Public

KENSINGTON FIRE PROTECTION DISTRICT
CHECKLIST FOR EXECUTION OF CONSTRUCTION CONTRACT

TO BE SUBMITTED BY SUCCESSFUL BIDDER:

_____ Two Executed Notarized Copies of the Contract

_____ Payment Bond in 100% of the Amount of Contract

_____ Performance Bond in 100% of the Amount of Contract

_____ General Liability Insurance Certificate in the Amount of $1 Million, naming the District as an additional insured

_____ Property Damage Insurance ($1 Million minimum), naming the District as an additional insured

_____ Automobile Insurance Certificate in the Amount of $1 Million, naming the District as an additional insured

_____ Workers Compensation Certificate ($1,000,000 minimum)

_____ Agreement to Comply with California Labor Law Requirements (C-10 Attached)

_____ Indemnification and Hold Harmless Agreement (C-11 Attached)

Note: The above documents must remain valid during the life of the contract.

INTENTIONALLY LEFT BLANK

KENSINGTON FIRE PROTECTION DISTRICT

CONTRACT

For

Public Safety Building Seismic Renovation

THIS AGREEMENT is made and entered this_____day of _____, 2022, by and between the KENSINGTON FIRE PROTECTION DISTRICT, hereinafter referred to as "District" and _____, hereinafter referred to as "Contractor."

WITNESSETH:

WHEREAS, Contractor and Contractor's Surety are providing the bonds attached hereto and incorporated by this reference, and

WHEREAS, District desires to contract with Contractor to perform the services detailed in this contract, including the Proposal, and

WHEREAS, Contractor has represented that it is fully qualified to assume and discharge such responsibility;

NOW, THEREFORE, the parties hereto do agree as follows:

1. Scope of Services. District hereby employs Contractor to perform the work and provide the services and materials for the project identified as: **Public Safety Building Seismic Renovation**, as described in these Plans and Specifications, attached hereto and incorporated herein by this reference, including miscellaneous appurtenant work. Such work shall be performed in a good and workmanlike manner, under the terms as stated herein and in these Plans and Specifications. In the event of any conflict between the terms of this agreement and any of the above-referenced documents, the terms of this agreement shall be controlling.

2. Compensation. In consideration of the services rendered hereunder, Contractor shall be paid _____ dollars in accordance with the prices as submitted on the Bid Sheet of the Proposal, attached hereto as a part of these Plans and Specifications and in accordance with the Special Provisions.

3. Independent Contractor. It is specifically understood and agreed by all parties hereto that Contractor is, for the purposes of this Agreement, an independent contractor and not an employee of the District. Accordingly, Contractor shall not be deemed the District's employee for any purpose whatsoever. Contractor shall not incur or have the power to incur any debt, obligation or liability whatever for or against District.

4. Assignment. This agreement may not be assigned by Contractor, in whole or in part, without the prior written consent of District.

5. Termination. This Agreement may be canceled by District at any time without penalty upon thirty (30) days' written notice. In the event of termination without fault of Contractor, District shall pay Contractor for all services rendered prior to date of termination, and such payment shall be in full satisfaction of all services rendered hereunder.

6. Worker's Compensation Insurance. California Labor Code Sections 1860 and 3700 provide that every contractor will be required to secure the payment of compensation to its employees. In accordance with the provisions of California Labor Code Section 1861, the Contractor hereby certifies as follows:

> "I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for worker's compensation or to under take self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract."

7. Prevailing Wages and General Rate of Per Diem Wages. Pursuant to the Labor Code of the State of California, the Director of Industrial Relations has determined the general prevailing rate of wages and employer payments for health and welfare, vacation, pension and similar purposes applicable to the work to be done. This rate and scale are on file with the District and copies will be made available to any interested party on request. The Contractor to whom the contract is awarded, and the subcontractors under him must pay not less than these rates for this area to all workers employed in the execution of this contract.

8. Dispute resolution is subject to the provision of Article 1.5 (commencing at Section 20104) of Division 2, Part 3 of the California Public Contract Code regarding the resolution of public works claims of less than $375,000. Article 1.5 mandates certain procedures for the filing of claims and supporting documentation by the contractor, for the response to such claims by the contracting public agency, for a mandatory meet and confer conference upon the request of the contractor, for mandatory non-binding mediation in the event of litigation is commenced, and for mandatory judicial arbitration upon the failure to resolve the dispute through mediation. This contract hereby incorporates the provisions of Article 1.5 as though fully set forth herein.

9. Suit; Recovery of Attorney Fees & Costs. Should either party bring any action to protect or enforce its rights hereunder, the prevailing party in such action shall be entitled to recover, in addition to all other relief, its reasonable attorneys' fees and court costs.

10. Severability. If any term or provision or portion of a term or provision of this contract is declared invalid or unenforceable by any court of lawful jurisdiction, then the remaining terms and provisions or portions of terms or provisions will not be affected thereby and will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed the within Agreement the day and year first above written.

KENSINGTON FIRE PROTECTION DISTRICT

By: _____ Title: _____

_____
Printed Name Date

ATTEST:

By: _____ Title: _____

_____
Printed Name Date

CONTRACTOR:

By: _____

_____
Printed Name Date

Approved as to Form

_____
District Counsel

KENSINGTON FIRE PROTECTION DISTRICT

INSTRUCTIONS FOR EXECUTION OF INSTRUMENTS

THIS IS INSTRUCTION ONLY - IT IS NOT TO BE SIGNED OR USED IN CONJUNCTION WITH THE AGREEMENT OR ANY OTHER FORMS THAT MUST BE TURNED INTO THE KENSINGTON FIRE PROTECTION DISTRICT - IT IS SIMPLY A FORMAT TO USE WHEN FILLING OUT DOCUMENTS.

1. By an Individual. The individual must sign the instrument, and if he/she is doing business under a fictitious name, the fictitious name must be set forth. The signature must be acknowledged before a Notary Public, using the proper form of acknowledgment.

2. By a Partnership. The name of the partnership must be set forth followed by the signatures of less than all of the partners will be acceptable only if submitted with evidence of authority to act on behalf of the partnership. The signatures must be acknowledged before a Notary Public, using the proper form of acknowledgment.

3. By a Corporation. The name of the corporation must be set forth, followed by the signatures of the President or Vice President and Secretary or Assistant Secretary. The signatures must be acknowledged before a Notary Public, using in substance the following form of acknowledgment.

4. By a Surety. The name of the surety must be set forth, followed by an authorized signature. The signatures must be acknowledged before a Notary Public, using the proper form of acknowledgment.

STATE OF _____)
) SS.
COUNTY OF _____)

On _____, 20____, before me, the undersigned, appeared _____ known to me to be the President or Vice President and known to be to be the Secretary or Assistant Secretary of the corporation that executed the within instrument, and acknowledged to me that such corporation executed the within instrument pursuant to its by-laws or a resolution.

WITNESS my signature and seal.

Notary Public

(Seal)

INSURANCE REQUIREMENTS FOR KENSINGTON FIRE PROTECTION DISTRICT
Public Works Contract

The Contractor shall at all time during the term of this Agreement carry, maintain, and keep in full force and effect, with an insurance company admitted to do business in California and approved by the District (1) a policy or policies of broad-form comprehensive general liability insurance with minimum limits of $2,000,000.00 combined single limit coverage against any injury, death, lose, or damage as a result of wrongful or negligent acts by the Contractor, its officers, employees, agents, and independent contractors in performance of services under this Agreement; (2) property damage insurance with a minimum limit of $2,000,000.00; (3) automotive liability insurance with a minimum combined single limits coverage of $2,000,000.00; and (4) worker's compensation insurance with a minimum limit of $2,000,000.00 or the amount required by law, whichever is greater. The District, its officers, employees, attorneys, and volunteers shall be named as additional insureds on the policy(ies) as to comprehensive general liability and property damage.

1. All insurance policies shall provide that the insurance coverage shall not be non-renewed, canceled, reduced, or otherwise modified (except through addition of additional insureds to the policy) by the insurance carrier without the insurance carrier giving the District thirty (30) day's prior written notice thereof. The Contractor agrees that it will not cancel, reduce or otherwise modify said insurance coverage.

2. The Contractor agrees that if it does not keep the aforesaid insurance in full force and effect, and such insurance is available at a reasonable cost, the District may take out the necessary insurance and pay the premium thereon, and the repayment thereof shall be deemed an obligation of the Contractor and the cost of such insurance may be deducted, at the option of the District, from payments due the Contractor.

3. The Contractor shall submit to the District (1) insurance certificates indicating compliance with the minimum worker's compensation insurance requirements above, and (2) insurance policy endorsements above, not less than one (1) day prior to beginning of performance under this Agreement. Endorsements must be executed on the District's appropriate standard forms entitled "Additional Insured Endorsement," copies of which are attached hereto.

Bond No. _____

PAYMENT BOND
(LABOR AND MATERIALS)

KNOW ALL PERSONS BY THESE PRESENTS that:

WHEREAS the Kensington Fire Protection District (A Public Agency), has awarded to _____

_____

_____

(Name and address of Contractor)

(Principal), a contract (the Contract) for the work described as follows:

Public Safety Building Seismic Renovation

WHEREAS, Principal is required under the terms of the Contract and the California Civil Code to secure the payment of claims of laborers, mechanics, materialmen, and other persons as provided by law.

NOW, THEREFORE, we, the undersigned Principal, and _____

_____

_____,

(Name and address of Surety)

(A Surety) a duly admitted surety insurer under the laws of the State of California, as Surety, are held and firmly bound unto the Public Agency in the penal sum of _____

_____

Dollars ($_____), this amount being not less than 100% of the total contract price, in lawful money of the United States of America, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if the hereby bounded Principal, his, her or its heirs, executors, administrators, successors or assigns, or subcontractors shall fail to pay any of the persons named in Section 9100 of the California Civil Code, or any amounts due under the Unemployment Insurance Code with respect to work or labor performed under the Contract, or for any amounts required to be deducted, withheld, and paid over to the Employment Development Department from the wages of employees of the Principal and subcontractors pursuant to Section 13020 of the Unemployment Insurance Code, with respect to work or labor performed under the Contract, the Surety will pay for the same in an amount not exceeding the penal sum specified in this bond; otherwise, this obligation shall become null and void.

This bond shall inure to the benefit of any of the persons named in Section 9100 of the California Civil Code so as to give a right of action to such persons or their assigns in any suit brought upon the bond. In case suit is brought upon this bond, Surety further agrees to pay all court costs and reasonable attorneys' fees in an amount fixed by the court.

Further, the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, addition or modification to the terms of the Contract, or of the work to be performed thereunder, or the specifications for the same, shall in any way affect its obligations under this bond, and it does hereby waive notice of any such change, extension of time, alteration, addition, or modification to the terms of the Contract or to the work or to the specifications thereunder. Surety hereby waives the provisions of California Civil Code sections 2845 and 2849.

IN WITNESS WHEREOF, two (2) identical counterparts of this instrument, each of which shall for all purposes be deemed an original hereof, have been duly executed by Principal and Surety, on the date set forth below, the name of each corporate party being hereto affixed and these presents duly signed by its undersigned representative(s) pursuant to authority of its governing body.

Dated: _____

Principal	Surety
_____	_____
_____	_____
By:_____	By:_____
Its	Its
By:_____	By:_____
Its	Its

(Seal)

APPROVED AS TO SURETY AND
PRINCIPAL AMOUNT

By:_____
Insurance Administrator

Note: This bond must be executed in duplicate and dated, all signatures must be notarized, and evidence of the authority of any person signing as attorney-in-fact must be attached.

Bond No. _____

PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS that:

WHEREAS the Kensington Fire Protection District (A Public Agency), has awarded to _____

_____

_____

(Name and address of Contractor)

(Principal), a contract (the Contract) for the work described as follows:

Public Safety Building Seismic Renovation

WHEREAS, Principal is required under the terms of the Contract to furnish a bond for the faithful performance of the Contract.

NOW, THEREFORE, we, the undersigned Principal, and _____

_____

_____,

(Name and address of Surety)

(A Surety) a duly admitted surety insurer under the laws of the State of California, as Surety, are held and firmly bound unto the Public Agency in the penal sum of _____

_____

Dollars ($_____), this amount being not less than the total contract price, in lawful money of the United States of America, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if the hereby bounded Principal, his, her or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform all the undertakings, terms, covenants, conditions and agreements in the Contract and any alteration thereof made as therein provided, on the Principal's part to be kept and performed, all within the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and hold harmless the Public Agency, its officers, agents, and others as therein provided, then this obligation shall become null and void; otherwise, it shall be and remain in full force and effect.

In case suit is brought upon this bond, Surety further agrees to pay all court costs and reasonable attorneys' fees in an amount fixed by the court.

FURTHER, the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, addition or modification to the terms of the Contract, or of the work to be performed thereunder, or the specifications for the same, shall in any way affect its obligations under this bond, and it does hereby waive notice of any such change, extension of time, alteration, addition, or modification to the terms of the Contract or to the work or to the specifications thereunder. Surety hereby waives the provisions of California Civil Code 2845 and 2849. The District is the principal beneficiary of this bond and has all rights of a party hereto.

IN WITNESS WHEREOF, two (2) identical counterparts of this instrument, each of which shall for all purposes be deemed an original hereof, have been duly executed by Principal and Surety, on the date set forth below, the name of each corporate party being hereto affixed and these presents duly signed by its undersigned representative(s) pursuant to authority of its governing body.

Dated: _____

Principal	Surety
_____	_____
_____	_____
By: _____	By: _____
Its	Its
By: _____	By: _____
Its	Its

(Seal)

APPROVED AS TO SURETY AND
PRINCIPAL AMOUNT

By: _____
Insurance Administrator

Note: This bond must be executed in duplicate and dated, all signatures must be notarized, and evidence of the authority of any person signing as attorney-in-fact must be attached.

WORKER'S COMPENSATION CERTIFICATE OF INSURANCE

WHEREAS, the Kensington Fire Protection District has required certain insurance to be provided by:

_____

NOW THEREFORE, the undersigned insurance company does hereby certify that it has issued the policy or policies described below to the following named insureds and that the same are in force at this time:

1. This certificate is issued to:

   Kensington Fire Protection District
   217 Arlington Avenue, Kensington, CA 94707

2. The insureds under such policy or policies are:

_____

3. Worker's Compensation Policy or Policies in a form approved by the Insurance Commissioner of California covering all operations of the named insureds as follows:

Policy Number	Effective Date	Expiration Date
_____	_____	_____
_____	_____	_____
_____	_____	_____

4. Said policy or policies shall not be canceled, nor shall there be any reduction in coverage or limits of liability, unless and until thirty days' written notice thereof has been served upon the Kensington Fire Protection District

   _____

   _____

   By: _____
   Its Authorized Representative

[INTENTIONALLY LEFT BLANK]

AGREEMENT TO COMPLY WITH CALIFORNIA LABOR LAW REQUIREMENTS

[Labor Code Sections 1720, 1773.9, 1773.11, 1775, 1776, 1777.5, 1813, 1860, 1861, 3700]

The undersigned Contractor certifies that it is aware of and hereby agrees to fully comply with the following provisions of California law:

1. Contractor acknowledges that this contract is subject to the provisions of Division 2, Part 7, Chapter 1 (commencing with Section 1720) of the California Labor Code relating to public works and the awarding public agency (Agency) and agrees to be bound by all the provisions thereof as though set forth in full herein.

2. Contractor agrees to comply with the provisions of California Labor Code Section 1773.9 which requires the payment of per diem wages to each worker needed to execute the work to the extent required by law, as well as California Labor Code Section 1773.11, which requires payment of holiday and overtime wages to each worker needed to execute the work to the extent required by law.

3. Contractor agrees to comply with the provisions of California Labor Code Sections 1774 and 1775 concerning the payment of prevailing rates of wages to workers and the penalties for failure to pay prevailing wages. The Contractor shall, as a penalty to the Agency, forfeit not more than two hundred dollars ($200) for each calendar day, or portion thereof, for each worker paid less than the prevailing rates as determined by the Director of Industrial Relations for the work or craft in which the worker is employed for any public work done under the contract by Contractor or by any subcontractor.

4. Contractor agrees to comply with the provisions of California Labor Code Section 1776 which require Contractor and each subcontractor to (1) keep accurate payroll records, (2) certify and make such payroll records available for inspection as provided by Section 1776, and (3) inform the Agency of the location of the records. The Contractor is responsible for compliance with Section 1776 by itself and all of its subcontractors.

5. Contractor agrees to comply with the provisions of California Labor Code Section 1777.5 concerning the employment of apprentices on public works projects, and further agrees that Contractor is responsible for compliance with Section 1777.5 by itself and all of its subcontractors.

6. Contractor agrees to comply with the provisions of California Labor Code Section 1813 concerning penalties for workers who work excess hours. The Contractor shall, as a penalty to the Agency, forfeit twenty-five dollars ($25) for each worker employed in the execution of the contract by the Contractor or by any subcontractor for each calendar day during which such worker is required or permitted to work more than 8 hours in any one calendar day and 40 hours in any one calendar week in violation of the provisions of Division 2, Part 7, Chapter 1, Article 3 of the California Labor Code.

7. California Labor Code Sections 1860 and 3700 provide that every contractor will be required to secure the payment of compensation to its employees. In accordance with the provisions of California Labor Code Section 1861, Contractor hereby certifies as follows:

   I am aware of the provisions of Section 3700 of the Labor Code, which require every employer to be insured against liability for worker's compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract.

Date _____ Signature _____

[INTENTIONALLY LEFT BLANK]

INDEMNIFICATION AND HOLD HARMLESS AGREEMENT AND WAIVER OF SUBROGATION AND CONTRIBUTION

Contract/Agreement/License/Permit No. or description: _____

_____

Indemnitor(s) *(list all names)*:

To the fullest extent permitted by law, Indemnitor hereby agrees, at its sole cost and expense, to defend, protect, indemnify, and hold harmless the Kensington Fire Protection District and its elected officials, officers, attorneys, agents, employees, volunteers, successors, and assigns (collectively Indemnitees) from and against any and all damages, costs, expenses, liabilities, claims, demands, causes of action, proceedings, expenses, judgments, penalties, liens, and losses of any nature whatsoever, including fees of accountants, attorneys, or other professionals and all costs associated therewith (collectively Liabilities), arising or claimed to arise, directly or indirectly, out of, in connection with, resulting from, or related to any act, failure to act, error, or omission of Indemnitor or any of its officers, agents, servants, employees, subcontractors, materialmen, suppliers or their officers, agents, servants or employees, arising or claimed to arise, directly or indirectly, out of, in connection with, resulting from, or related to the above-referenced contract, agreement, license, or permit (the Agreement) or the performance or failure to perform any term, provision, covenant, or condition of the Agreement, including this indemnity provision. This indemnity provision is effective regardless of any prior, concurrent, or subsequent active or passive negligence by Indemnitees and shall operate to fully indemnify Indemnitees against any such negligence. This indemnity provision shall survive the termination of the Agreement and is in addition to any other rights or remedies which Indemnitees may have under the law. Payment is not required as a condition precedent to an Indemnitee's right to recover under this indemnity provision, and an entry of judgment against an Indemnitee shall be conclusive in favor of the Indemnitee's right to recover under this indemnity provision. Indemnitor shall pay Indemnitees for any attorney's fees and costs incurred in enforcing this indemnification provision. Notwithstanding the foregoing, nothing in this instrument shall be construed to encompass (a) Indemnitees' sole negligence or willful misconduct to the limited extent that the underlying Agreement is subject to Civil Code 2782(a) or (b) the contracting public agency's active negligence to the limited extent that the underlying Agreement is subject to Civil Code 2782(b). This indemnity is effective without reference to the existence or applicability of any insurance coverages which may have been required under the Agreement or any additional insured endorsements which may extend to Indemnitees.

Notwithstanding the foregoing, to the extent that this Agreement includes design professional services under Civil Code Section 2782.8, as may be amended from time to time, such duties of Consultant to indemnify shall only be to the full extent permitted by Civil Code Section 2782.8.

Indemnitor, on behalf of itself and all parties claiming under or through it, hereby waives all rights of subrogation and contribution against the Indemnitees, while acting within the scope of their duties, from all claims, losses and liabilities arising out of or incident to activities or operations performed by or on behalf of the Indemnitor regardless of any prior, concurrent, or subsequent active or passive negligence by the Indemnitees.

In the event there is more than one person or entity named in the Agreement as an Indemnitor, then all obligations, liabilities, covenants and conditions under this instrument shall be joint and several.

Indemnitor

Name_____ Name_____

By:_____ By:_____

Its Its

APPENDICES

APPENDIX I

CONTRACT DRAWINGS

APPENDIX II

SPECIFICATIONS

END OF DOCUMENT 00 1000

SECTION 01 1100

SUMMARY OF WORK

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work specifically includes all work as represented by the Drawings and Specifications issued for construction and subsequent approved revisions and addenda.

B. If certain features are not fully shown or called for on the Drawings, their construction shall be of the same character, quality and level of performance as for similar conditions that are shown, called for, or reasonably inferred.

C. Provide all labor, equipment, and materials required to provide a complete, properly operating, and safe building.
   1. The extent of the Work, as indicated on the Drawings and as described in the Specifications, shall include all that may be reasonably inferred to be required for proper execution or installation of Work and for complete systems.
   2. If certain features are not fully shown or called for on the Drawings, their construction shall be of the same character, quality, and level of performance as for similar conditions that are shown, called for, or reasonably inferred.

D. The Drawings shall be recognized as diagrammatic in nature and not completely descriptive of all requirements for construction. Whatever work that may be specified and not drawn or drawn and not specified shall be executed as fully as if described in both these ways. And, should any workmanship or material be necessary that is not either directly or indirectly noted in these Specifications or shown on the Drawings but is nevertheless necessary for properly carrying out the obvious intention thereof, Contractor shall understand it to be implied and shall provide for the same as fully as if it were particularly described or delineated.

1.2 DEVIATIONS AND DISCREPANCIES

A. Should the Contract Documents contradict themselves, Contractor shall provide the more stringent or higher quality or quantity, unless otherwise accepted by Owner.

B. Deviations from or discrepancies to the Drawings, Specifications, and/or submittal requirements shall be brought to the immediate attention of the Architect, in writing with sufficient details to permit proper analysis. This notification shall be made prior to the continuation or performance of any additional work.

1.3 DEFERRED APPROVAL AND DELEGATED-DESIGN ITEMS

A. Permits for Deferred Approval and Delegated Design items are the responsibility of the Contractor.
   1. Where Drawings and/or Specifications exist for Deferred Approval and Delegated Design, such Drawings and Specifications represent only a general outline of the work required of the Contractor. The actual scope of work shall be as determined by all entities having jurisdiction.
   2. The Contractor shall verify the scope of work and permits required for all Deferred Approval and Delegated Design items with all entities having jurisdiction and shall include all costs associated with such permits and work in the Contractor’s fee. If the scope of work required by all entities having jurisdiction is less than or different from

the scope outlined in the Contract Documents, the Contractor shall include the greater scope in their fee or bring the discrepancy to the Architect's attention before providing a proposed fee. If the scope of work required by the entities having jurisdiction is greater than the scope outlined in the Contract Documents, the Contractor is responsible for the required scope of work at no additional cost to the Owner.

3. The Contractor is responsible for obtaining the stamps and signatures of qualified engineers as required by all agencies having jurisdiction over the Deferred Approval and Delegated Design items.

B. The Contractor or Contractor's subcontractor shall have a minimum of five years of continuous experience with the type of work included in the Deferred Approval and Delegated Design items on projects in the same jurisdiction and of similar type and size to this Project.

C. Deferred Approval items are noted on the Drawings.

D. Delegated Design items are noted on the Drawings and/or the Specifications. See additional requirements in Section 01 3573, "Delegated Design Procedures."

1.4 FIELD CONDITIONS

A. Verify existing conditions and proposed dimensions before commencing work.
1. Determine dimensions where necessary.
2. Immediately notify Architect of any discrepancies, and until they are resolved, do not proceed with affected work.

B. Archeological Discovery.
1. If archeological remains are uncovered, work at the place of discovery shall be halted immediately until a qualified archeologist can evaluate the finds and suggest appropriate mitigation measures.
2. If human remains are encountered, excavation or disturbance of the location must be halted in the vicinity of the find, and the County Coroner contacted. If the Coroner determines the remains are Native American, the Coroner will contact the Native American Heritage Commission for identification of the person or persons believed to be most likely descended from the deceased Native American. The most likely descendent shall make recommendations regarding treatment of the remains with appropriate dignity.

C. Additional requirements of all parties to the Contract are included in the Contract Forms and Conditions of the Contract.

1.5 HAZARDOUS MATERIALS

A. A Hazardous Materials (HazMat) report will be the responsibility of the bidder prior to demolition.

B. The abatement of asbestos containing materials (ACM) and other hazardous material identified in the HazMat report, and any additional hazardous materials encountered during demolition operations, whether identified in the HazMat report or not, shall be abated by the Contractor under the scope of work of this Project.

1.6 DEFINITIONS

A. The following definitions apply to the language used in these Specifications.

B. The term "Owner" refers to Kensington Fire Protection District.

C. The term "Architect" refers to the firm of MARJANG Architecture.

D. The term "Contractor" refers to the General Contractor.

E. Where the terms, "Plumbing Contractor," "Electrical Contractor," or instances of similar terminology are used, it is for convenience only and shall in no way affect the overall responsibility of the General Contractor.

F. Where the terms "as required" and "required" are used, it shall mean "to meet the Contract Documents, to meet Code requirements, to meet good building practice, to meet the condition prevailing, to meet performance requirements, and to provide complete systems."

G. Where the term "General Conditions" is used, it shall mean "General Conditions of the Contract for Construction."

H. Where the term "Agreement" is used, it shall mean "Agreement between Owner and Contractor."

1.7 SPECIFICATIONS AND DRAWINGS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. The General Conditions, Supplementary Conditions, and Division 01, “General Requirements,” apply to the work of all Sections.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations as scheduled on the Drawings.

1.8 LISTING OF RELATED WORK

A. Listings of related requirements in the various Sections are not necessarily complete listings. Said listings are provided for information and convenience only and are intended to highlight related or similar work specified in other Sections or on the Drawings.

B. Related work listings and omissions from such listings are not intended to control the Contractor in dividing the Work among subcontractors or in establishing the extent of the Work to be performed by any trade.

1.9 SUPERINTENDENCE

A. If not already designated, the Contractor shall designate, before starting work, a Project Manager who shall have complete authority to represent and act for the Contractor.
   1. Project Manager shall be acceptable to the Owner and Architect.
   2. Project Manager shall be present at the site at all times while Work is actually in progress on the Contract. During periods when Work is suspended, make arrangements acceptable to the Owner for any required emergency work.

B. If such approval is withdrawn by Architect and/or Owner, Contractor shall, as soon as is practicable after having received written notice of such withdrawal, remove Project Manager from the Project and shall not thereafter employ that person as Contractor's Project Manager on the Project. Contractor shall replace Project Manager with another representative acceptable to Owner and Architect as specified above.

1.10 OWNER FURNISHED PRODUCTS

A. Contractor shall coordinate delivery schedule with Owner.

B. Contractor shall make arrangements with Owner to ascertain required arrangements for warehousing, delivery to Project site, and installation.

C. Contractor shall be responsible for Owner-furnished products when they are delivered to the site or are turned over by the Owner's vendor or distributor.

D. Contractor's warranty for Owner-furnished items shall be limited to installation only.

1.11 OWNER OCCUPANCY

A. The Contractor shall allow, subject to City of Kensington approval, the Owner to take possession of and use any completed or partially completed portion of the structures during the progress of the Work as soon as is possible without interference to the Work. Contractor shall not be responsible for damages caused by Owner or others outside of Contractor's control. Inspect areas to verify existing conditions prior to Owner's occupancy.

B. Possession, use of structure or Work, and the placing and installation of equipment by Owner shall not in any way evidence the completion of the Work or any part of it.

END OF SECTION

SECTION 01 2500

SUBSTITUTION PROCEDURES

1.1 SUMMARY

A. Section Includes:
   1. Specific requirements for submission and approval of products other than those specified or noted on the Drawings.

B. Related Requirements:
   1. Submittal Procedures: Section 01 3300.
   2. Product Requirements: Section 01 6000; product selection procedures.

C. Requests for substitutions shall follow the procedures specified below in the Article "Consideration of Substitutions."

1.2 DEFINITIONS

A. Substitutions - General: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

B. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

C. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 INTENT OF SPECIFICATIONS – PRODUCT SELECTION

A. When a definite specification is used, it is to denote the quality standard or the article desired.

B. When the name of a certain brand, make, or manufacturer is listed and the words "accepted equal," "or equal," "or approved equal," or similar language are absent, provide only the named product or products. Substitutions are permitted only as specified in this Section.

C. Provide only the named product or products where products are specified followed by the words "no substitution." Substitutions are not allowed.

D. For products specified by naming one or more products or manufacturers followed by "or accepted equal," "or equal," "or approved equal," or similar language, the Architect will consider Contractor's request for comparable products in accordance with the conditions for consideration of comparable products specified in Section 01 6000, “Product Requirements.”

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit for each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles as applicable.
   1. Substitution Request Form: CSI Form 13.1A or other form as mutually agreed upon by Architect and Contractor.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
   b. List of any changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the work specified.
   d. Drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. Certificates and qualification data, where applicable or requested.
   g. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners.
   h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
   j. Effect substitution will have on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
   k. Cost information, including a proposal of change, if any, in the Contract Sum.
   l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
   m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

B. Submittal Timing:
   1. Substitutions for Cause: Immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
   2. Substitutions for Convenience: Within 60 days after commencement of the Work or the Notice to Proceed, if issued by the Owner. Requests received after that time may be considered or rejected at discretion of Architect.

C. Architect's Action:
   1. If necessary, Architect will request additional information or documentation for evaluation after receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 working days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
   2. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

1.5 AVAILABILITY OF SPECIFIED ITEMS

A. Verify that specified items will be available in time for installation during orderly and timely progress of the Work. Notify the Architect if specified item or items will not be available.

B. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be deducted from the Contract as necessary and will not be borne by the Owner.

1.6 CONSIDERATION OF SUBSTITUTIONS

A. Substitutions for Cause: Architect will consider Contractor's request for substitution for cause when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   2. Substitution request is fully documented and properly submitted.
   3. Requested substitution will not adversely affect the Project Construction Schedule.
   4. Requested substitution has received necessary approvals of authorities having jurisdiction, if applicable.
   5. Requested substitution is compatible and has been coordinated with other portions of the Work.
   6. Requested substitution provides specified warranty, if applicable.

B. Substitutions for Convenience: Architect will consider Contractor's request for substitution for convenience when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
   2. Requested substitution does not require revisions to the Contract Documents.
   3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   4. Substitution request is fully documented and properly submitted.
   5. Requested substitution will not adversely affect the Project Construction Schedule.
   6. Requested substitution has received necessary approvals of authorities having jurisdiction, if applicable.
   7. Requested substitution is compatible and has been coordinated with other portions of the Work.
   8. Requested substitution provides specified warranty, if applicable.

C. Additional Consideration Requirements:
   1. Failure to propose the substitution of a product for evaluation in ample time before its scheduled installation, or in a format to allow for line by line comparison, may be deemed sufficient cause for the denial of the request for substitution.
   2. A substitution submitted by the Contractor for any material, product, or equipment for that specified may be subject to such tests as will determine its quality.
      a. Handling, testing, and inspection costs pertaining to testing shall be paid by the Contractor.
      b. Tests shall be made upon the request of the Architect or at option of Contractor to verify quality of its proposed substitution.
   3. The Contractor shall pay for any added costs caused by the substitution, including Architect's and consultant's review time and/or services for improperly submitted substitution requests.

4. Substitutions or alternate products will not be considered because of the Contractor's tardiness in preparing and forwarding required submittals for Architect's review.

D. All substitutes will be accepted by the Architect, in writing. Substituted products shall not be ordered or installed without written acceptance.

E. The Architect's acceptance shall not relieve the Contractor from complying with the requirements of the Contract Documents, and the Contractor shall be responsible, at its own expense, for any changes resulting from and subsequently becoming apparent from its proposed substitutions that affect other parts of its own work or the work of other contractors.

END OF SECTION

SECTION 01 2613

REQUESTS FOR INTERPRETATION

1.1 SUMMARY

A. Section Includes: Procedures for processing of Contractors “Requests for Interpretation” (RFI) questions.

1.2 PREPARATION AND SUBMISSION

A. Questions from the Contractor shall be submitted in written form as a “Request for Interpretation” or “RFI.”

B. Subcontractors shall submit their request to the Contractor, who shall make a diligent effort to answer the question from Contractor’s overall knowledge of the Project, the Contract and the Construction Documents.

C. If Contractor finds that he cannot answer the subcontractor’s request, Contractor shall prepare a written RFI. Each RFI shall be given a unique, consecutive number such as “001,” “002,” “003,” etc. Revisions or resubmittal of the same RFI shall maintain the original RFI number but be otherwise identified with a suffix such as “001A” for first revision, “001B” for second revision, etc.

D. RFI shall contain Contractor’s interpretation or proposed answer, and/or may contain a proposed alternate solution to the issue. In addition, each RFI shall state if the proposed interpretation or alternate solution involves a change to the Contract amount or Schedule.

E. RFIs shall be submitted by Contractor to Architect for review and/or distribution.

F. Contractor shall maintain a log of all RFIs which shall indicate each RFI’s status. Log shall be maintained current and shall be distributed at each regular jobsite meeting of Owner, Architect, and Contractor.

1.3 RESPONSE TO RFI’S

A. Architect’s response to RFIs shall be in writing and shall be submitted to Contractor in a timely manner.
   1. Architect shall respond to the RFI by stating its concurrence with Contractor’s proposed answer or alternate solution or by stating its interpretation, which shall be consistent with the design intent of the Drawings.
   2. Architect may furnish an alternate solution for Contractor’s consideration.
   3. Architect may submit proposed answers and/or alternate solutions to any of the consultants for review prior to responding to Contractor.
   4. Architect may submit proposed answers and/or alternate solutions to Owner for approval prior to responding to Contractor.
   5. Architect shall indicate, for the benefit of Owner, whether the time expended in providing alternative solutions is billable time under the Construction Phase of the Owner-Architect agreement.

B. Each RFI, and the Architect’s response thereto, shall become a part of the Contract Documents, and unless specifically indicated otherwise, shall not change the Contract

amount or schedule. It is Contractor's responsibility to obtain Owner's approval for any change to the Contract amount or Schedule.

C. To the extent that Architect's response to RFIs changes, modifies, or amends any portion of the Contract Documents, the response shall be deemed sufficient. Revised Contract Documents will not be issued unless the RFI response is insufficient in providing direction to Contractor. Whenever possible, revised Contract Documents will be issued for inclusion with the response to the RFI.

D. The Contractor shall allow an average of 10 working days for Architect to review and process RFIs. It is acknowledged and understood that some RFIs will take a longer or shorter time to answer.

END OF SECTION

SECTION 01 3119

PROJECT MEETINGS

1.1 RELATED DOCUMENTS AND PROVISIONS

A. All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:
   1. General Conditions.
   2. Special Conditions.

1.2 PROGRESS MEETINGS

A. Contractor shall schedule and hold regular weekly progress meetings after a minimum of one week's prior written notice of the meeting date and time to all Invitees as indicated below.

B. Location: Contractor's field office.

C. The Contractor shall notify and invite the following entities (“Invitees”):
   1. Owner’s Representative.
   2. Contractor's Project Manager.
   3. Contractor's Superintendent.
   4. Subcontractors, as appropriate to the agenda of the meeting.
   5. Suppliers, as appropriate to the agenda of the meeting.
   6. Construction Manager, if any.
   7. Architect.
   8. Engineer(s), if any and as appropriate to the agenda of the meeting.
   9. Others, as appropriate to the agenda of the meeting.

D. The Owner's, the Architect’s, and/or an engineer's Consultants will attend at their discretion, in response to the agenda.

E. The Owner’s Representative, the Construction Manager, and/or another Owner’s agent shall take and distribute meeting notes to attendees and other concerned parties. If exceptions are taken to anything in the meeting notes, those exceptions shall be stated in writing to the Owner’s Representative within 5 working days following Owner's Representative’s distribution of the meeting notes.

1.3 PRE-INSTALLATION/PERFORMANCE MEETING

A. Contractor shall schedule a meeting prior to the start of each of the following portions of the Work: cutting and patching of plaster and roofing, and other weather-exposed and moisture-resistant products.
   1. Contractor shall invite all Invitees to this meeting, and others whose work may affect or be affected by the quality of the cutting and patching work.

B. Contractor shall review in detail prior to this meeting, the manufacturer's requirements and specifications, applicable portions of the Contract Documents, Shop Drawings, and other submittals, and other related work.
   1. At this meeting, invitees shall review and resolve conflicts, incompatibilities, or inadequacies discovered or anticipated.

C. Contractor shall review in detail Project conditions, Schedule, requirements for performance, application, installation, and quality of completed Work, and protection of adjacent Work and property.

D. Contractor shall review in detail means of protecting the completed Work during the remainder of the construction period.

END OF DOCUMENT

SECTION 01 3233

PHOTOGRAPHIC DOCUMENTATION

1.1 SUMMARY

A. Section Includes:
1. Preconstruction photographs.
2. Construction progress photographs.

1.2 PRECONSTRUCTION PHOTOGRAPHS

B. Before commencement of Work on the site, take digital photographs of the following:
1. Areas of the Project site and exterior building envelope impacted by work under this Contract, including existing items to remain during construction, from different vantage points.
2. Interior improvements to remain within and adjacent to the areas of demolition.

C. Show existing conditions of adjoining construction and site improvements. Intent of photographic documentation is to visually document finish surfaces that might be misconstrued as cracking or other damage caused by construction operations.

D. Submit digital file as specified for periodic construction photographs.

E. Submit before Work begins.

1.3 CONSTRUCTION PHOTOGRAPHS

F. Provide photographs taken weekly of site and construction from beginning of site work to completion of exterior work. Photographs shall be at the quality level expected from a commercial photographer.

G. Photographs shall:
1. Provide factual presentation.
2. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

H. Views:
1. In addition to site work, photographs shall document construction progress for each structure.
2. Consult with Architect for instructions on views required.
3. View and location for each orientation shall be maintained throughout Project.

I. Digital File:
1. File Format: Joint Photographic Experts Group (JPEG), unless otherwise directed by Architect.
2. Minimum Resolution: 5 mega pixels.
3. Provide digital date/time imprint on each picture.
4. Digital images shall be exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

J. Deliver electronically to Architect with each Application for Payment together with a table of contents. Prints are not required.

K. See additional photographic requirements specified in Section 02 4119, “Selective Demolition.”

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for the following:
      a. Submittal Schedule.
      b. Project Directory.
      c. Shop drawings.
      d. Delegated Design.
      e. Product data.
      f. Samples.
      g. Informational submittals.
      h. Color and pattern submittals.
      i. Operating and maintenance manuals.
      j. Composite coordination drawings.
   2. Final distribution of submittals.
   3. Electronic Data Transfer Agreement.

B. Related Requirements:
   1. Substitution Procedures: Section 01 2500; submittal procedures for substitutions.
   2. Requests for Interpretation: Section 01 2613.
   3. Delegated Design Procedures: Section 01 3573; additional submittal requirements for design-build work.
   4. Individual requirements for submittals also are described in other Sections of these Specifications.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

B. Informational Submittals: Written and graphic information and physical samples indicated in individual Specification Sections as informational submittals that do not require Architect's responsive action.

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 GENERAL

A. Comply with the requirements specified in addition to submittal review procedures and requirements of the General Conditions.

B. Do not commence any portion of the Work requiring submission of a shop drawing, product datum, or sample until the submittal has been reviewed by Architect and appropriate consultant. Such portions of the Work shall be in accordance with reviewed submittals.

C. Shop drawings, product data, and samples are in no case to be considered Contract Documents but are to be treated only as instruments of convenience and facility to further the progress of the Work.

D. Shop drawings, product data, samples and supporting data shall be prepared by Contractor or its suppliers but shall be submitted to Architect by Contractor as the instruments of the Contractor.
   1. Contractor shall check the drawings of its suppliers as well as its own drawings before submitting them to Architect.
   2. Contractor shall ascertain that shop drawings, product data, and samples meet requirements of the Contract Documents and conform to the structural and space conditions. If shop drawings, product data, and samples show variations from Contract Documents, whether because of standard shop practice or other reasons, Contractor shall make special mention thereof in its letter of transmittal and describe the reasons why there are variations.
   3. Contractor shall be fully responsible for observing the need for and making changes in arrangement and manner of installation of piping, connections, wiring, and similar items that may be required by equipment it proposes to supply, both as pertains to its own work and work affected under other parts, headings, or Divisions of the Contract Documents.
   4. Prior to submittal to Architect, each shop drawing, product datum, and sample submitted for review shall be stamped, dated, and signed by Contractor, verifying that it has been checked by Contractor to be in accordance with the Contract Documents. Submittals not signed by Contractor will be returned without review by the Architect.

E. Miscellaneous systems not specifically specified but installed to meet code requirements or for other reasons, are subject to Architect's review prior to installation.

1.4 COORDINATION OF SUBMITTALS

A. Prior to submittal, use all means necessary to fully coordinate all material, including, but not necessarily limited to:
   1. Determine and verify all interface conditions, catalog numbers and other data.
   2. Coordinate with other trades as required.
   3. Clearly indicate all deviations from requirements of the Contract Documents.
   4. Verify that each item, and the submittal for it, conforms in all respects with the requirements of the Contract Documents.

B. The following products do not require further review except for interface within the Work, unless indicated otherwise:
   1. Products specified by reference to standard specifications such as ASTM and similar standards.
   2. Products specified by manufacturer's name and catalog model number.

C. By affixing the Contractor's signature to each submittal, the Contractor certifies that this coordination has been performed.

1.5 GROUPING OF SUBMITTALS

A. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.
   1. Partial submittals may be rejected as not complying with the provisions of the Contract.
   2. The Contractor may be held liable for delays so occasioned.

1.6 SUBSTITUTIONS

A. Substitution requests shall be written, timely, and submitted in accordance with the procedures specified in Section 01 2500, “Substitution Procedures.”

B. A delay in construction caused by requests of Contractor to substitute materials, items of equipment or assemblies of construction shall be the responsibility of the Contractor; the Owner will not entertain any request for damages caused by such delays. Approvals by the Owner of substituted items shall not relieve the Contractor of its responsibilities under the Contract and the various guarantees provided therein.

1.7 IDENTIFICATION OF SUBMITTALS

A. Each submittal shall have a unique identifier including revision identifier. Identifier shall be the appropriate Specification Section number followed by a sequential number. Resubmittals shall include an alphabetic suffix.

B. File names for electronic submittals shall use a project identifier and Specification Section number followed by a decimal point and then a sequential number. Resubmittals shall include an alphabetic suffix after another decimal point.

C. Accompany each submittal with a letter of transmittal showing all information required for identification and checking. The Owner shall be provided with a copy of transmittals only, unless otherwise requested by the Owner.

D. On at least the first page of each copy of each submittal, and elsewhere as required for positive identification, clearly show the submittal number in which the item was included.

E. When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new transmittal number. On resubmittals, reference the original submittal number.

F. Maintain an accurate submittal log for the duration of the Work, showing current status of all submittals at all times. Make the submittal log available to the Architect and Owner for their review.

G. Quality Control Set: Maintain returned final set of submittals at project site, in suitable condition and available for quality control comparisons by Architect, Owner, or their representatives.

H. Mockups: Where mockups and similar samples are indicated in individual Specification Sections recognized as a special type of sample, comply with requirements for "samples" to greatest extent possible, and process transmittal forms to provide a record of activity.

I. Refer to Part 3 for additional identification requirements.

PART 2 - SUBMITTALS

2.1 SUBMITTAL SCHEDULE

A. Contractor shall prepare and submit to Architect a "Submittal Schedule" when required by the General Conditions showing scheduled dates of submittals and date required for return of submittals to Contractor.

B. Contractor shall provide in schedule a minimum of 10 working days for Architect to review and check submittals as may be necessary provided it is not a deferred approval item. Based on the number and complexity of submittals at any one time, Architect's review period may be longer than 10 days.

C. Dates on "Submittal Schedule" shall be agreed upon by both Architect and Contractor.

2.2 PROJECT DIRECTORY

A. Prior to commencement of Work, Contractor shall submit to Architect a Project Directory listing subcontractors and vendors on the Project and giving a brief description of their scope of work, firm name, contact person, address, phone number, e-mail of contact person, and firm fax number.

2.3 SHOP DRAWINGS

A. Shop drawings shall be accurately drawn to a scale, completely dimensioned, and sufficiently large to show all pertinent aspects of the item and its method of connection to the Work, or as specifically indicated elsewhere in other sections of these Specifications.
   1. Show plans and sections as necessary to clearly show construction details and methods.

B. Title shop drawings with name of the Project and list applicable Divisions, Sections, Article, or reference on each sheet.

C. Submit separate items on separate sheets.

D. The reproduction of any Contract Documents for use in a shop drawing submittal is not permitted.
   1. If the Contractor requires, it may request drawings/backgrounds from the Architect to use in its preparation of shop drawings. Drawings will be made available to the Contractor in electronic format only after the Electronic Data Transfer Agreement, a sample of which is included at the end of this Section, has been executed and returned:
      a. Contractor to complete, sign, and return the Agreement.
      b. Requests for drawings prepared by Architect's consultants shall be directed to consultant's office and be subject to their company's policy. Architect's consultants retain the right to issue/not issue electronic copies of their drawings to be used for shop drawing preparation.
   2. Unless an Electronic Data Transfer Agreement is executed, the Contractor shall assume in its agreed cost to the Owner that it will not have access to electronic drawings to use for its preparation of shop drawings.
   3. The Owner shall be provided with a copy of shop drawing transmittals only, unless otherwise requested by the Owner.

2.4 PRODUCT DATA

A. Manufacturer's standard drawings shall be modified to delete information which is not applicable and shall be supplemented to provide additional information where so required.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data shall:
   1. Have each copy clearly marked to identify pertinent materials, products, models, finishes, etc.

2. Show clearly standard options included.
3. Show dimensions and clearances required.
4. Show performance characteristics and capacities.
5. Show wiring diagrams and controls, and show necessary rough-in requirements for utility services and connections, where applicable.
6. Include manufacturer's installation instructions.

C. Identify each item of product data by reference to sheet and detail numbers of Contract Drawings and/or specific reference to Articles or paragraphs of a Specification Section.

D. Where product data, as submitted, contains extraneous information, unmarked options, or is incomplete, it will be returned to Contractor without review.

2.5 SAMPLES

A. Contractor shall forward to Architect, at its own expense, samples designated for use on the Project. Include material, equipment, textures, colors, and fabrics in sizes and quantities as required by the Drawings and Specifications or as requested by Architect. Where there is an expected range of color or texture variations for the specified item, submit sufficient number of samples to illustrate range.

B. Submit and resubmit samples until accepted by Architect.

C. No review of a sample shall be taken in itself to change or modify the Contract requirements.

D. Finishes, materials, and workmanship in the completed Project shall match accepted samples.

E. Samples of value will be returned to Contractor when requested in writing at time of submittal, for its use in the Project after review, analysis, comparison, or testing as may be required by Architect.

F. Samples shall not be incorporated into the Work unless otherwise specified or specific approval is given by Architect.

2.6 DELEGATED DESIGN DRAWINGS

A. Engineering design/shop drawings shall be furnished in a computer-aided drafting file format, AutoCAD or accepted equal, unless otherwise directed. Drawings shall plot at a minimum 1/8-inch = 1-foot-0-inch scale.

2.7 COLORS

A. Unless the color and pattern are shown or specified, whenever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to Architect for review and selection.

B. Completely describe the relative costs and capabilities of each color and pattern, unless available colors and patterns have identical costs and wearing capabilities.

2.8 ENVIRONMENTAL PLANS

A. Unless otherwise not required by governing authorities or waived by the Owner, within 21 days of the date of commencement as stated in the Notice to Proceed, prepare and submit the following items:
   1. A completed Health and Safety Plan acceptable to the Owner.
   2. A completed Decontamination Plan.
   3. A completed Storm Water Pollution Prevention Plan.
   4. A completed Dust and Odor Control Plan.
   5. A Transportation Plan.
   6. Waste Management Plan.

2.9 COMPOSITE DRAWINGS

A. Prepare composite drawings for the following to solve field conditions for equipment and systems to be installed in tight or restricted spaces and for equipment and systems intended to be exposed to view:
   1. Structural framing with openings and clearances.
   2. Light fixtures.
   3. Electrical items and conduit.
   4. Fire alarm and detection items.
   5. Security items.
   6. HVAC system and ducts.
   7. Plumbing system.
   8. Fire sprinklers and sprinkler lines.

B. Drawings shall consist of dimensioned plans and elevations. Provide complete information, particularly as to size and location of sleeves, inserts, attachments, openings, conduit, ducts, boxes, and structural interferences.

C. Composite shop drawings and field installation layouts shall be coordinated in field by Contractor and its subcontractors for proper relationship to work of applicable trades based on field conditions and shall be checked and approved by them for submission to the Architect for its final approval. Contractor shall have competent personnel readily available for coordinating and checking as well as for supervision of field installation layouts.

2.10 REQUESTS FOR INTERPRETATION (RFI'S)

A. Comply with requirements specified in Section 01 2613, “Requests for Interpretation.”

2.11 OPTIONS AND/OR CLARIFICATIONS

A. If the Construction Documents have not detailed an item of work called for in the Contract, Contractor shall advise Owner of "how to" recommendations on materials and methods for installation in Project.
   1. The proposal shall be submitted to Owner by drawings and descriptive material, with a cost breakdown, if any.
   2. The means of work recommended shall not create a hardship on the Project Schedule.
   3. Work as proposed shall not be started without written approval by Owner.

PART 3 - EXECUTION

3.1 TIMING OF SUBMITTALS

A. Make submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, necessary approvals, possible revisions, resubmittals, and for placing orders and securing delivery.

B. In scheduling, allow for review by the Architect in a timely manner, following the Architect's receipt of the submittal.

C. Submittals received by Architect after 1:00 p.m. on Friday (or 1 p.m. Thursday if Friday is a nationally recognized holiday) of the work week will be considered as received the next working day Monday (Tuesday if Monday is a nationally recognized Holiday).

D. Delays caused by tardiness in receipt of submittals will not be an acceptable basis for extension of the Contract completion date.

3.2 PROCEDURES FOR ACTION SUBMITTALS

A. General:
1. Submit as required by the General Conditions and the respective Specification Sections.
2. Submittal documents shall be made via secure file transfer protocol format as setup for this Project.
3. Subcontractors shall make submittals to Contractor. Submittals shall not be made directly to the Architect's or Owner's other consultants. Even if a submittal is reviewed and returned by the Architect's or Owner's consultant, such submittal shall be considered as not reviewed if not submitted through the Architect.
4. If more than one resubmittal of the same item or its component is required, the Contractor will be billed for additional review time and materials at current billing rates of the Architect and/or consultant.

B. Copies required in each Action Submittal shall be as follows unless otherwise mutually agreed:
1. Shop Drawings and Product Data: Electronic copy in digital PDF (Portable Document Format) via secure file transfer protocol format as setup for this Project.
a. Digital submittals shall be fully compatible with Adobe Acrobat Reader.
b. All parties shall view and print with Adobe Acrobat (fully up-to-date) to ensure compatibility, unless agreed upon otherwise.
c. Architect reserves the right to request hard copies of submittals as follows, unless otherwise requested:
1) Shop Drawings: One set of bond prints.
2) Product Data: One set.
2. Samples:
a. Unless otherwise specified or mutually agreed, submit samples in the quantity which is required to be returned, plus 2 which will be retained by the Architect.
b. By prearrangement in specific cases, a single sample may be submitted for review, and when reviewed, be installed in the Work at a location agreed upon by the Architect.

C. Identification:
1. Properly identify each submittal with name of Project, Contractor, subcontractor, and date.

2. Stamp each shop drawing, product datum, and sample to certify that it has been coordinated and checked for completeness and compliance with requirements of the Work, Project, and Contract Documents.
3. Accompany each submittal by an acceptable transmittal form referring to Project name and Specifications Section number, and paragraph number, when applicable, for identification of each item.
4. Consecutively number shop drawings for each Section of work; retain numbering system throughout all revisions.
5. Allow clear space on each drawing, product datum, and sample for stamp of Contractor and Architect.

D. Architect's Review:
1. General:
a. Except for finish, color, and other aesthetic matters left to Architect's decision by Contract Documents, Architect's review of shop drawings, product data, and samples is only for Contractor's convenience in following work and does not relieve Contractor from responsibility for deviations from requirements of Contract Documents.
b. Do not construe Architect's review as a complete check or relief from responsibility for errors or omissions of any sort in shop drawings or schedules or from necessity of furnishing work required by Contract Documents that may not have been shown on shop drawings.
c. Architect's review of a separate item does not indicate review of complete assembly in which it functions.
d. Review comments of the Architect (or its consultants) will be shown when it is returned to the Contractor. The Contractor shall make and distribute such copies as are required for its purposes.
2. Submittals not stamped by Contractor and submittals which in Architect's opinion are incomplete, contain numerous errors, or have not been checked or have only been checked superficially will be returned to Contractor for resubmittal.

E. Consultants' Review:
1. Submittals requiring review by Architect’s or Owner’s consultants shall be sent to the Architect. Architect will forward submittal to applicable consultant for their review.

F. Processing:
1. Architect will review shop drawings, product data, and samples in accordance with agreed upon "Submittal Schedule" and will return them to Contractor with Architect's stamp.
2. Returned items will consist of the following:
a. One copy of shop drawings and product data.
b. Balance of available samples.
3. Submittals Reviewed by Consultants:
a. Processing shall be in accordance with consultant’s stamp.
b. If action required by consultant’s stamp is not clear, Contractor shall immediately notify the Architect for a clarification.
c. If returned submittal also includes the Architect’s stamp, processing shall be in accordance with the Architect’s stamp.
4. Notations by Architect or consultant which increase Contract cost or time of completion shall be brought to Architect's attention before proceeding with work. Failure to do so will result in the increased costs being borne by the Contractor.
5. Each submittal will be stamped indicating appropriate action as specified.

6. If for any reason the Contractor cannot comply with the notations, Contractor shall re-submit submittal. In the transmittal letter accompanying the re-submittal, clearly describe the reason(s) for not being able to comply with the notations.

G. Revisions:
1. Make revisions pertinent to comments noted on the submittal.
2. If for any reason the Contractor cannot comply with the notations on a returned submittal, Contractor shall re-submit submittal. In the transmittal letter accompanying the re-submittal, clearly describe the reason(s) for not being able to comply with the notations.
3. If the Contractor considers any required revision to be a change, they shall so notify the Architect and Owner as provided for in the General Conditions.
4. Show each revision by number, date, and subject in a revision block on the submittal.

H. Revisions after Final Review: When a submittal has been reviewed by the Architect, resubmittal for substitution of materials or equipment will not be considered unless accompanied by an acceptable explanation as to why the substitution is necessary, or unless directed by the Owner.

3.3 PROCEDURES FOR INFORMATIONAL SUBMITTALS

A. General:
1. Prepare and submit “Informational Submittals” where required by the Specifications.
2. Number of Copies: Submit PDF as specified for Action Submittals or two paper copies of each submittal, unless otherwise indicated. Architect will not return copies.
3. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
4. Test and Inspection Reports: Comply with requirements specified in Section 01 4529, “Testing Laboratory Services.”

B. The following items shall be considered “Informational Submittals” whether or not identified as such in the respective Specification Sections:
1. Qualification Data.
2. Certificates for or from the following:
   a. Installers.
   b. Manufacturers.
   c. Products and materials.
3. The following Reports:
   a. Material and Product Test Reports.
   b. ICC-ES Reports.
   c. Preconstruction Test Reports.
   d. Compatibility Test Reports.
   e. Field Test Reports.
4. Maintenance Data.
5. Design Data.
6. Manufacturer's Instructions.
7. Manufacturer's Field Reports.
8. Insurance Certificates and Bonds.
9. Photographic documentation.

3.4 PROCEDURES FOR DELEGATED DESIGN SUBMITTALS

A. Delegated Design submittals shall first be submitted to the Architect. If the Architect reviews the submittal with corrections noted, those corrections must be addressed and the submittal returned to the Architect. Once the Architect has no comments on a submittal, it will be returned and shall be resubmitted with approval by all government agencies having jurisdiction.

B. The Contractor shall then submit to these agencies and make revisions required by these agencies until approval by all government agencies having jurisdiction is obtained.

C. When approval has been obtained by all governing agencies having jurisdiction, the approved submittal shall be resubmitted to the Architect for final approval. It is the responsibility of the Contractor to verify acceptability of government agency required revisions with the Architect. If the resubmittal to the Architect includes revisions that had not been previously approved by the Architect in writing, the Architect has the right to reject these revisions. It is then the Contractor's responsibility to resubmit to government agencies having jurisdiction to obtain approval of the Architect's noted corrections.

D. See Section 01 1100, "Summary of Work," and Section 01 3573, "Delegated Design Procedures," for further requirements.

3.5 PROCEDURES FOR CLOSEOUT AND MAINTENANCE MATERIAL SUBMITTALS

A. Comply with requirements specified in Section 01 7700, "Closeout Procedures."

3.6 FINAL DISTRIBUTION AFTER REVIEW

A. In addition to copies of submittals required by Contractor, subcontractors, suppliers, and fabricators, Contractor shall make distribution to:
1. Contractor's jobsite file.
2. Project Record Documents file; see additional requirements specified in Section 01 7839, "Project Record Documents."

3.7 ELECTRONIC MEDIA AGREEMENT

A. Refer to "Sample" included on the following pages

.

ELECTRONIC DATA TRANSFER AGREEMENT

This Electronic Data Transfer Agreement ("EDTA") is dated [_____] and is between [_____] located at [_____] ("Recipient") and [_____] located at [_____] ("___") and is effective from the earlier of date of this EDTA or the date of first exchange of Electronic Data (as defined below) between [___] and Recipient. [___] and Recipient are referred to individually as "Party" and collectively as "Parties."

The Parties agree as follows:

1.0 ELECTRONIC DATA

1.1 "Electronic Data" refers to all Drawings, Specifications, calculations, models, designs and other information stored in editable digital form and includes, without limitation, computer-aided design and building information modeling.

2.0 PURPOSE

2.1 All Electronic Data transferred from [_____] to Recipient is intended for use solely in connection with the planning, design, construction, maintenance and/or use of the following "Project:"

Kensington Fire Protection District
Public Safety Building
Kensington CA, 94707

3.0 RIGHTS

3.1 Recipient acknowledges that the Electronic Data is provided for Recipient's convenience and may be used solely for the purpose stated above. No other right (including copyright) is conveyed by transfer of the Electronic Data. [_____] retains all common law and statutory rights (including copyrights) in the Electronic Data to the extent such rights are retainable by [_____].

4.0 CONDITION OF ELECTRONIC DATA

4.1 Electronic Data is furnished in the format in which it is commonly stored and used by [_____].

4.2 Recipient understands that the transmission and/or conversion of Electronic Data from the system and format used by [_____] to an alternative system or format may result in the introduction of inconsistencies, anomalies and errors.

4.3 Because of the possibility that Electronic Data may be easily altered, whether inadvertently or otherwise, [_____] reserves the right to retain the originals of all Electronic Data in electronic form and/or hard copy. Recipient acknowledges the hard copy and/or electronic originals of Electronic Data retained by [_____] govern in the event of any inconsistency between information delivered to Recipient and such originals retained by [_____]. [_____] has no obligation to inform Recipient about changes in the Electronic Data or to correct, update, enhance or maintain the Electronic Data for Recipient.

4.4 Recipient accepts the electronic data "as-is," without any express or implied warranty including, without limitation, any warranty the electronic data is complete, technically accurate, free of defects, and/or fit for use as intended by recipient.

4.5 Recipient warrants that it is not relying on any contrary representation from [_____].

5.0 RELEASE/ INDEMNIFICATION

5.1 Recipient acknowledges that any alteration or modification of the Electronic Data may result in adverse consequences which [_____] can neither predict nor control. Recipient waives and forever discharges [_____], (including its officers, directors, employees and related entities) from every kind of claim, demand and cause of action to recover every kind of damage, cost, expense, fee and other loss resulting from: (i) the transfer of Electronic Data by any means; (ii) the use, modification or misuse of the Electronic Data by or through Recipient (including, without limitation,

creating derivative works based on the Electronic Data); (iii) the decline of accuracy or readability of the Electronic Data; (iv) the incompatibility of the Electronic Data with Recipient's software and/or hardware; and/or (v) any error, discrepancy, inaccuracy, variation or other defect in the Electronic Data (collectively referred to herein as "Liability"). Recipient has a duty to indemnify, defend and hold [_____] harmless from Liability resulting from Recipient's use of Electronic Data.

6.0 CONFIDENTIAL INFORMATION

6.1 The Electronic Data together with all information, discussions and communications related to the Electronic Data, the Project and this EDTA are confidential ("Confidential Information"). Recipient has a duty to maintain in strict confidence all Confidential Information and will not discuss, disclose, or divulge Confidential Information to any third parties without written authorization from [_____] or Client. In the event disclosure of Confidential Information is required by law, Recipient shall provide [_____] with prior written notice of such event. Such notice shall be received in sufficient time to enable [_____] to seek a protective order or other protective arrangement permitted by law.

7.0 MISCELLANEOUS

7.1 Mutually Binding. The Parties, respectively, bind themselves, their partners, successors, assigns and legal representatives to the other party to this EDTA and to the partners, successors, assigns and legal representatives of such other party with respect to all covenants of this EDTA. Neither Party may assign this EDTA without the written consent of the other.

7.2 Severability: If any provision or part of a provision of this EDTA is determined to be superseded, invalid, illegal, or otherwise unenforceable pursuant to any applicable law or court order, such determination will not impair or otherwise affect the validity, legality, or enforceability of the remaining provision or parts of the provision of this EDTA, which remain in full force and effect as if the unenforceable provision or part were deleted.

7.3 No Waiver. The failure of either Party to insist, in any one or more instances, on the performance of any obligation or right under this EDTA does not constitute a waiver or relinquishment of such obligation or right with respect to future performance.

7.4 Notices & Representatives: Notices are sufficient if in writing and delivered by hand, email or by regular mail to the authorized representative of the other Party; notices sent by regular mail will also be transmitted by facsimile or email at the time of mailing. Unless otherwise designated in writing, the signatories to this EDTA are the Parties' authorized representatives for all purposes.

7.5 Counterparts. This EDTA may be executed simultaneously in two or more counterparts, each of which is deemed an original. When proving this EDTA, it is only necessary to produce the counterpart signed by the party against whom such proof is presented.

This Agreement is accepted for:

[_____]:	RECIPIENT:
By: _____	By: _____
(*Signature*)	(*Signature*)
_____	_____
(Printed Name and Title)	*(Printed Name and Title)*
_____	_____
(Address)	*(Address)*
_____	_____
(Telephone)	*(Telephone)*
_____	_____
(Email)	(Email)

END OF SECTION

SECTION 01 3573

DELEGATED DESIGN PROCEDURES

1.1 SUMMARY

A. Section Includes: Requirements of Contractor for delegated design work on the Project including professional engineering design and obtaining necessary approvals of regulatory agencies.

B. Components of the Work to which Delegated Design Requirements Apply: As required in individual technical Sections of the Specifications and noted on the Drawings.

1.2 DEFINITIONS

A. Delegated Design Work: Design services and certifications provided by a professional or engineer in responsible charge registered in California related to systems, materials, and equipment required for the Work to satisfy design and performance criteria established by the Contract Documents. Delegated design does not include professional services required of the Contractor to fulfill their responsibilities under the Contract, including but not limited to, construction means, methods and sequence.

B. Seal: Certification that delegated design drawings, computations and specifications were designed and prepared under the direct supervision of the architect or engineer in responsible charge and whose name appears thereon.

1.3 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall be responsible for the design, calculations, submittals, and permits, for these delegated design components.

B. The Contractor is responsible to submit all delegated design documents required for approval by regulatory agencies for each delegated design item.

C. Each designated design item requiring review by the governing authorities shall be provided by the Contractor and all fees and costs associated therewith shall be the Contractor's responsibility at no additional cost to the Owner unless otherwise mutually agreed.

1.4 COORDINATION

A. The Owner will not be responsible to pay for costs or damages due to failure by the Contractor to coordinate delegated design work with the work of the Project.

B. The Contractor is responsible to coordinate and submit all material required by governing authorities, so review and processing of submittals and permits will not adversely affect the Construction Schedule.

1.5 DESIGN AND PERFORMANCE CRITERIA

A. As required in individual technical Sections of the Specifications.

1.6 SUBMITTALS

A. General:
1. Procedures: In accordance with Section 01 3300, “Submittal Procedures.”
2. Review of submittals will be for compliance with design intent and shall neither lessen nor shift the responsibility from the Contractor or its subcontractors to the Owner or the Owner’s consultants.
3. Submittals shall be prepared under the control of the professional or engineer in responsible charge, and shall bear the professional stamp and signature of the responsible design professional.
4. Submittals not stamped and signed by the Architect or engineer in responsible charge are incomplete, and submittals that have not been reviewed by the Contractor will be rejected.
5. Submittals shall include necessary documentation to verify compliance with design and performance requirements including calculations, details, fabrication and assembly information, and shall demonstrate coordination by Contractor with supporting work and other components to be integrated into delegated design assemblies.

B. Delegated Design Summary Sheet: List entities who the Contractor has assigned delegated design responsibilities to, and the registered engineer’s name and contact information.

C. Delegated Design Documents:
1. Show all members, dimensions, connections, and materials used. Indicate how the component or assembly is attached to the main structure, reactions associated with those connections.
2. Shop drawings and erection drawings are not acceptable as delegated design drawings.
3. Calculations including criteria, design assumptions, substantiating computations and such additional data sufficient to show the correctness of the documentation and compliance with the applicable codes and regulations.

D. Record Documents: Final delegated design documents representing as-built conditions shall be provided to the Owner.

1.7 QUALITY ASSURANCE

A. Delegated design submittals shall be approved by regulatory authorities and the Owner’s Representative prior to starting fabrication of the work regardless of whether a building permit has been previously issued.

B. Where the Contractor is required to provide services of a licensed design professional, comply with the specified design and performance criteria.

C. Except for field quality assurance testing specified to be performed by the Owner, provide laboratory and field tests to establish performance characteristics of the delegated design work at no additional cost to Owner.

1.8 DELEGATED DESIGN SCHEDULE

A. The above performance and design criteria applies to, but is not limited to, work of the following: Fire sprinklers.

END OF SECTION

SECTION 01 4100

REGULATORY REQUIREMENTS

1.1 SUMMARY

A. Section Includes:
   1. Codes, standards, and relevant requirements applicable to the Work required under this Contract.
   2. The following, as used in the Project Manual and Specifications:
      a. Code and regulatory abbreviations.
      b. Requirements for standard references.
      c. Standard reference abbreviations.

1.2 GENERAL

A. The latest (or applicable) editions of various local and state codes and other nationally accepted authorities, including any other authority or body with jurisdiction over construction in Project area, shall govern work called for on Drawings and in Specifications.

B. Throughout the Contract Documents, reference is made to codes and standards which establish qualities and types of workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics. Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is the Contractor's responsibility to provide materials and workmanship which meet or exceed the specifically named code or standard. Abbreviations and acronyms are used in the Contract Documents to identify reference standards. Refer to Article “Specification Abbreviations” in this Section.

C. It is the Contractor's responsibility, when so required by the Contract Documents or by written request from the Architect, to deliver to the Architect required proof that the materials and workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested in writing by the Architect, and generally will be required to be copies of a certified report of tests conducted by an approved testing agency.

1.3 STATUTORY AND JURISDICTIONAL REGULATIONS

A. Codes which apply to this Project include, but are not limited to, those listed on the Drawings and the following including additions, changes, and interpretations adopted by the enforcing agency in effect as of the date of these Contract Documents:
   1. California Code of Regulations (CCR), Title 24, Part 7, California Elevator Safety Construction Code.
   2. California Occupational Safety and Health Act Standards (Cal-OSHA).
   3. California Department of Transportation (Caltrans): Standard Specifications, latest edition.
   4. Americans with Disabilities Act (ADA): Accessibility Guidelines for Buildings and Facilities.
   5. Environmental Regulations, including:
      a. National Emission Standards for Hazardous Air Pollutants (NESHAP).
      b. Air Quality Standards of the South Coast Air Quality Management District (SCAQMD) of the California Air Resources Board.
      c. 22 CCR, Section 66260 et seq.; California Hazardous Waste Management Regulations.

d. 40 CFR, Part 260 et seq.; Hazardous Waste Management System.
e. 42 USC, Section 6901 et seq.; Resource Conservation and Restoration Act (RCRA).
f. National Pollutant Discharge Elimination System (NDPES).

B. References in the Specifications to "code" or to "building code," not otherwise identified, shall mean the foregoing specified codes and regulations, together with the additions, changes, amendments, and interpretations adopted by the enforcing agency and in effect on the date of the Contract. Nothing on the Drawings or in the Specifications shall be interpreted as requiring or permitting work that is contrary to these rules, regulations, and codes.

C. Where other regulatory requirements are referenced in these Specifications, the affected work shall meet or exceed the applicable requirements of such references.

D. Regulatory requirements referred to shall have full force and effect as though printed in these Specifications.

E. Where the Drawings or Specifications call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by said laws, codes, rules, and regulations, the provisions of the Drawings and Specifications shall take precedence over said laws, codes, rules, and regulations.

1.4 OTHER APPLICABLE LAWS AND REGULATIONS

A. All applicable federal, state, and local laws and the rules and regulations of governing utility districts and the various other authorities having jurisdiction over the construction and completion of the Project, including the latest rules and regulations of the state fire marshal, OSHA, and the California Labor Code, shall apply to the Contract throughout, and they shall be deemed to be included in the Contract the same as though printed in these Specifications.

1.5 CONFLICTS

A. If a conflict exists between referenced regulatory requirements or between referenced regulatory requirements and the Contract Documents, Contractor shall bring to the attention of the Architect for resolution. The fact that the Contract Documents may establish higher or more costly requirements than the minimum Code or other regulatory requirements referenced above shall not constitute a "conflict."

1.6 STANDARD SPECIFICATIONS

A. The Contract Documents contain references to various standard specifications, codes, practices, and requirements for materials, work quality, installation, inspections, and tests published and issued by the organizations, societies, and associations. Such references are hereby made part of the Contract Documents to the extent required.

B. When standard specifications are included by abbreviation and number only, it is assumed that the Contractor is familiar with and has ready access to the specified standards.

C. When the effective date of a reference standard is not given, it shall be understood that the current edition or latest revision thereof and any amendments or supplements thereto in effect on the date of original issue of these Contract Documents, as indicated on the cover, shall govern the Work.

D. Reference standards are not furnished with the Contract Documents, because the Contractor, subcontractors, manufacturers, suppliers, and the trades involved are assumed to be familiar with their requirements.

E. Contractor shall obtain its own copies of required specified referenced publications.

F. The specification or standard referred to shall have full force and effect as though printed in these Specifications.

G. In addition to those standards specifically referenced in the Specifications, comply with the accepted industry standards and trade association recommendations for the respective portions of Work.

H. In the case of difference between referenced standards and the Contract Documents, the more stringent requirements shall prevail.

1.7 QUALITY ASSURANCE

A. Familiarity with Pertinent Codes and Standards: In procuring all items used on this Project, it is the Contractor's responsibility to verify the detailed requirements of the specifically named codes and standards and to verify that the items procured for use in this Work meet or exceed the specified requirements.

B. Rejection of Non-Complying Items: The Architect and/or Owner reserves the right to reject items incorporated into the Work which fail to meet the specified minimum requirements. The Architect and/or Owner further reserves the right, and without prejudice to other recourse the Architect and/or Owner may take, to accept non-complying items subject to an adjustment in the Contract Amount as approved by the Owner.

C. Specification Content: Because of the methods by which these Project Specification have been produced, certain general characteristic of content, and conventions in use of language are explained as follows:
   1. Specifying Methods: The techniques or methods of specifying to record requirements varies throughout text, and may include "prescriptive," "open generic descriptive," "compliance with standards," "performance," "proprietary," or a combination of these. The method used for specifying one unit of work has no bearing on requirements for another unit of work.
   2. Overlapping and Conflicting Requirements: Where compliance with 2 or more industry standards or sets of requirements is specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, the more stringent requirement (which is generally recognized to be also more costly) is intended, and will be enforced unless specifically detailed language written into the Contract Documents (not by way of reference to an industry standard) clearly indicates that a less stringent requirement is to be fulfilled. Refer apparently-equal-but-different requirements, and uncertainties as to which level of quality is more stringent, to the Owner for a decision before proceeding.

D. Minimum Quality/Quantity: In every instance, quality level or quantity shown or specified is intended as minimum for the work to be performed or provided. Except as otherwise specifically indicated, actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable limits. In complying with requirements, indicated numeric values are either minimums or maximums as noted or as appropriate for context of requirements. Refer instances of uncertainty to the Owner for decision before proceeding.

E. Specialists; Assignments: In certain instances, Specification text requires (or at least implies) that specific work be assigned to specialists or expert entities, who must be engaged for performance of those units of work. These must be recognized as special requirements over which Contractor has no choice or option. These assignments must not be confused with (and are not intended to interfere with) normal application of regulations, union jurisdictions and similar conventions. One purpose of such assignments is to establish which party or entity involved in a specific unit of work is recognized as "expert" for indicated construction processes or operations. Nevertheless, final responsibility for fulfillment of entire set of requirements remains with Contractor.

F. Trades: Except as otherwise indicated, the use of titles such as "carpentry" in Specification text, implies neither that the work must be performed by an accredited or unionized tradesman of the corresponding generic name (such as "carpenter"), nor that specified requirements apply exclusively to work by tradesmen of that corresponding generic name.

1.8 SPECIFICATION ABBREVIATIONS

A. The language of Specifications is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual work abbreviations of a self-explanatory nature have been included in the text.

B. Specific abbreviations have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in schedules. These are frequently defined in Section at first instance of use.

C. Trade association names and titles of general standards are frequently abbreviated. Singular words will be interpreted as plural and plural works will be interpreted as singular where applicable and where full context of the Contract Documents so indicates.

D. In addition to abbreviations indicated on the Drawings, references in the Project Manual to trade associations, technical societies, recognized authorities, and other institutions may include the following organizations, which are sometimes referred to by only the corresponding abbreviations. Not all abbreviations are listed, and not all listed abbreviations are used.

E. Abbreviations:

1.	AA	Aluminum Association
2.	AAADM	American Association of Automatic Door Manufacturers
3.	AAMA	Architectural Aluminum Manufacturer's Association
4.	AAADM	American Association of Automatic Door Manufacturers
5.	AASHTO	American Association of State Highway and Transportation Officials
6.	ACI	American Concrete Institute
7.	AIA	American Institute of Architects
8.	AISC	American Institute of Steel Construction, Inc.
9.	ANSI	American National Standards Institute
10.	APA	APA - The Engineered Wood Association
11.	ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
12.	ASTM	ASTM International
13.	AWS	American Welding Society, Inc.
14.	AWPA	American Wood Preservers Association
15.	BHMA	Builders Hardware Manufacturers Association
16.	CalTrans	State of California, Business and Transportation Agency, Department of Transportation

17.	CBC	California Building Code
18.	CRSI	Concrete Reinforcing Steel Institute
19.	CS	Commercial Standard of National Bureau of Standards, U.S. Department of Commerce
20.	DHI	Door and Hardware Institute
21.	FM	Factory Mutual
22.	FS	Federal Specification of General Services Administration
23.	ICC-ES	International Code Council Evaluation Service, Inc.
24.	LABC	Los Angeles Building Code.
25.	MIL	Military Specification of U.S. Department of Defense
26.	NAAMM	National Association of Architectural Metal Manufacturers
27.	NAAWS	North American Architectural Woodwork Standards
28.	NEC	National Electric Code
29.	NEMA	National Electrical Manufacturers' Association
30.	NFPA	National Fire Protection Association
31.	NIST	National Institute of Standards and Technology
32.	PCI	Precast Concrete Institute
33.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association, Inc.
34.	SDI	Steel Door Institute
35.	SSPC	SSPC: The Society for Protective Coatings
36.	TCNA	Tile Council of North America
37.	UL	Underwriters Laboratories, Inc.
38.	WCLIB	West Coast Lumber Inspection Bureau
39.	WDMA	Window and Door Manufacturers Association
40.	WI	Woodwork Institute
41.	WWPA	Western Wood Products Association

1.9 DRAWING SYMBOLS

A. Except as otherwise indicated, graphic symbols used on Drawings are those symbols recognized in the construction industry for purposes indicated.

END OF SECTION

SECTION 01 4339

MOCKUP REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Additional requirements for in-place mockups specified in the respective Specification Sections.

B. Related Requirements:
1. Review requirements specified in other Sections for materials incorporated into the mockups.

1.2 DESIGN AND PERFORMANCE REQUIREMENTS

A. Mockups will be used to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, interface, testing, and operation of various building components.

B. Each mockup is intended to permit verification of workmanship and visual qualities of the final completed installation.

C. Accepted mockups shall be used as a visual standard for the final installation.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action and Informational Submittals shall be submitted in accordance with Airport Requirements in Division 01 Specification Sections.

1.4 ACTION SUBMITTALS

A. Samples: Initial samples for materials to be incorporated into a mockup shall be reviewed and approved prior to mockup construction. Where actual final finished materials are not available for inclusion in mockup, facsimile materials shall be reviewed with the Architect for approval.

1.5 QUALITY ASSURANCE

A. Mockup components shall be finished as required for completed installation including selected colors.

B. Obtain approval from Architect of all mockups before starting work, fabrication or construction.

C. Allow in Construction Schedule a minimum of 7 days for initial review and each re-review of each mockup.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Except as otherwise specified or approved, materials for mockups shall be as shown and specified in the respective Specification Sections.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Locate mockups in locations determined in coordination with the Architect.

B. Upon completion of each mockup construction, notify Architect and make arrangements for review. Notify the Architect not less than 21 calendar days in advance of the dates and times when mockups will be available for review.

C. Modify the mockups, or construct new components if requested by the Architect, for further evaluation and until final acceptance is obtained.

D. Following acceptance, mockups shall serve as a visual standard of quality and appearance of the work it represents, including interface with adjacent materials and components.

E. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

3.2 MAINTENANCE

A. Maintain each mockup in a neat, clean, and “as accepted” condition.

B. Where appropriate and at the discretion of the Architect, in-place mockups specified in the respective Specification Sections and field samples, when accepted, may remain as part of finished work.

C. Remove all mockups not approved for incorporation into the work prior to completion of Project but not before the work they are being used to judge has been accepted by the Architect.

END OF SECTION

SECTION 01 4520

CONCRETE MOISTURE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Testing for Moisture Vapor Emission Rate (MVER) and alkalinity at cementitious floors scheduled to receive applied floor coverings.

B. Related Requirements:
   1. Concrete Floor Sealer: Section 09 6120.
   2. Resilient Flooring and Base: Section 09 6500.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

1.3 INFORMATIONAL SUBMITTALS

A. Qualifications of personnel or laboratory to perform testing.

B. Results of substrate moisture testing for each location and maximum allowable levels specified in respective Specification Sections for the intended floor finish.

1.4 QUALITY ASSURANCE

A. If areas of concrete are not within the floor covering manufacturer's maximum allowable emission rate and slab area fails the moisture test, do not proceed with installation and notify the Architect.

1.5 FIELD CONDITIONS

A. Ambient Conditions:
   1. Area to be tested shall match that of the finished floor covering.
   2. Spaces shall be conditioned to temperature and humidity levels expected for final Owner occupancy or as follows:
      a. Interior temperature shall be 75 degrees F, plus or minus 10 degrees F.
      b. Relative humidity shall be 50 percent, plus or minus 10 percent.
   3. Maintain the above conditions for 48 hours prior to and throughout the duration of the tests.

PART 2 - PRODUCTS

2.1 MATERIALS FOR TEST PROCEDURES

A. Alkalinity Tests: Test kit by American Moisture Test, Inc., Irvine, CA, Taylor Tools, or accepted equal pH meter.

B. MVER Tests:
   1. Calcium Chloride Test Kits: Pre-packaged and of commercial consistency; American Moisture Test, Inc., Irvine, CA, Taylor Tools, or accepted equal. Kit shall include sealed dish of anhydrous calcium chloride, a metering dome with gasket, and instructions.
   2. Relative humidity (RH) probe that has been verified for accuracy within the past year.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean concrete surfaces of any residues resulting from pour of concrete which will affect the moisture vapor drive.

B. Plastic dome of test kit shall be sealed airtight to prevent ambient humidity from influencing the test results.

3.2 TESTING

A. General:
   1. Perform moisture tests based on the Moisture Vapor Emission Rate (MVER) content in accordance with ASTM F1869, relative humidity tests in accordance with ASTM F2170, and alkalinity tests in accordance with ASTM F710, on concrete subfloors. Results of these tests will be used to determine suitability of substrate to receive flooring materials.
   2. Number of tests shall be determined by the square footage of each flooring material. Provide minimum of three tests for the first 1,000 square feet, and one test kit per each additional 1,000 square feet, with consideration to separation of test areas.
   3. Results of these tests will be used to determine suitability of substrate to receive flooring materials.
   4. Unless otherwise approved in writing by Architect, tests shall be performed by an independent testing agency.

B. MVER Test Kit:
   1. Verify temperature of slab is up to service temperature.
   2. Duration of MVER test shall be 60 to 72 hours.
   3. Dish shall be measured one-hour before and one-hour after testing with weight calculated within 0.1 grams.
   4. Where calcium chloride test results are satisfactory but there is reason to suspect that unacceptable moisture levels below the upper two centimeters of the concrete may still exist, a relative humidity probe shall be used to test the full depth of the slab.

C. RH Probe:
   1. Verify concrete slabs are up to service temperature at least 48 hours prior to testing.
   2. Depth of probes shall be 40 percent on slabs drying from the top only and 20 percent for slabs drying from both sides.
   3. Probe shall be allowed to acclimate and checked for drift less than 1 percent relative humidity over a 5 minute period.
   4. Elapsed time for test shall be 48 hours.

D. Where tests are not satisfactory and substrates exceed the moisture vapor and alkalinity limits required by floor material manufacturers, do not proceed with installation. Notify Architect and Owner for review of conditions and to determine a resolution acceptable to the Architect and Owner including application of a topical barrier coat.

END OF SECTION

SECTION 01 4529

TESTING LABORATORY SERVICES

1.1 SUMMARY

A. Section Includes:
   1. Owner’s testing and inspection requirements.
   2. Contractor’s testing and inspection requirements.
   3. Testing Agency qualifications.
   4. Manufacturer's field services.

B. Related Requirements:
   1. Inspections and Testing Required by Laws, Ordinances, Rules, Regulations, Orders, or Approvals of Public Authorities: Conditions of the Contract.
   2. Additional requirements for inspections and testing are included in the General Conditions.

1.2 GENERAL

A. Requirements for testing are included in governing codes and described in various Sections of the Specifications.

B. The Owner will employ and pay for the services of an Independent Testing Agency to perform testing and inspection requirements required by code and other tests and inspections when specified to be performed and paid for by the Owner.
   1. Employment by the Owner of the Testing Agency shall in no way relieve Contractor's obligations to perform the Work of the Contract.
   2. Agency shall comply with qualification requirements specified below.

C. Tests required by the Specifications and not specified or required by Code to be performed and paid for by the Owner shall be performed by a testing laboratory employed and paid for by the Contractor and meeting the same qualification requirements specified in this Section for the Owner’s Testing Agency.

D. Where no testing requirements are described, but the Owner decides that testing is required, the Owner may require such testing be performed under current pertinent standards for testing. Payment for such testing will be by the Owner.

E. Inspections, tests, and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with the Contract Documents.

1.3 CONFLICTING REQUIREMENTS

A. If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the more stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated

numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 QUALIFICATION OF OWNER'S TESTING AGENCY

A. Meet "Recommended Requirements for Independent Laboratory Qualification," published by American Council of Independent Laboratories.

B. Meet basic requirements of ASTM E329, "Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection."

C. Authorized to operate in the State of California.

1.5 TESTING AGENCY DUTIES

A. Contractor to cooperate with testing agency in notifications, information, scheduling, storage, and access as necessary to meet requirements for service without causing delays on Project.

B. Perform specified inspections, sampling, and testing of materials and methods of construction.

C. Comply with specified standards.

D. Ascertain compliance of materials with requirements of Contract Documents.

E. Notify Architect and Contractor when test or inspection reveals undesirable conditions, nonconformance, or failure to meet requirements.

F. Promptly submit written report of each test and inspection, with copies to Architect, Contractor, and governing agencies as required.
1. Include all samples taken and tests made, regardless of results.
2. Include reports to show specified requirements, and state whether or not test results comply with requirements.

G. Perform additional tests as required by Architect and Owner.

1.6 LIMITATIONS OF AUTHORITY OF TESTING AGENCY

A. Testing Agency is not authorized to:
1. Release, revoke, alter, or enlarge the requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Contractor.

1.7 CONTRACTOR'S RESPONSIBILITIES

A. It is the Contractor’s responsibility to coordinate the services of all testing and inspection required by the separate Specification Sections whether or not to be performed by the Owner’s Testing Agency.

B. Contractor shall furnish promptly, without additional charge, all reasonable facilities; labor and materials necessary for safe, thorough, and convenient inspection; and tests that may be required by the Contract Documents.

C. Prepare and submit to Architect and Development Manager a schedule of tests required of Owner's Testing Agency at least 15 business days in advance of first test. In addition, Contractor shall give minimum 48 hours' notice to Testing Agency for required tests and inspections.

D. Furnish, prepare, and deliver test samples and specimens as required by Testing Agency except where such preparation and handling is to be performed by Testing Agency. Contractor shall be solely responsible for delays due to such samples not being submitted, and resubmitted if necessary, in the time required to allow for tests or inspections before material is incorporated into the Work.

E. Cooperate with Testing Agency personnel in providing access to materials being tested or inspected.

F. Make necessary repairs to in-place work caused by removal of required test samples.

G. Materials furnished and installed on the Project shall be equal to approved test samples in every respect.

H. Samples which are of value after testing will remain the property of the Contractor, but no such samples shall be incorporated in the Work without written approval of the Architect.

1.8 REQUIRED TESTS AND INSPECTIONS

A. "Special Inspections" as required by the City of Kensington.

B. Additional Tests and Inspections: See the various technical Sections of the Specifications.

1.9 TESTING REPORTS

A. Testing Agency shall furnish test reports to the following:
1. One copy to Architect.
2. One copy to Owner.
3. One copy to Architect's and Owner's affected consultants.
4. One copy to Contractor.
5. One copy to Contractor's affected subcontractor/supplier.
6. One copy for Project Records Documents file (in care of the Contractor).
7. One copy to City Building Department, if required.

1.10 FAILURE TO PASS TESTS

A. Failure of any material or article to pass specified tests will be sufficient cause for refusal to consider any further samples of the same brand or make of that material or article.

B. Where an individual material is to be part of an assembly with other materials for incorporation into the Work, failure of the material to pass specified tests or to conform to indicated standards will be sufficient cause for its rejection and removal and replacement, regardless of whether tests or inspections have been made or not in an assembled or in an unassembled condition.

1.11 MANUFACTURER'S FIELD SERVICES

A. When specified in respective Specification Sections, Contractor shall require supplier or manufacturer to provide qualified personnel to observe field conditions, conditions of

surfaces and installation, quality of workmanship, start-up of equipment, testing, adjusting and balancing of equipment as applicable, and to make appropriate recommendations. Contractor is responsible for proper notification of manufacturer's representative before installation of applicable work and for obtaining necessary inspection certificate stating that installation was observed and approved.

B. Product Performance Verification: The supplier of products specified based on performance criteria shall, at the request of the Agency, inspect the installed product and certify conformance of the product to specified criteria under the installed conditions.

C. Manufacturer's representative shall submit written report to the Architect listing observations and recommendations.

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Temporary facilities during construction, including but not necessarily limited to those included under the following general categories:
      a. Temporary utilities.
      b. Construction facilities including field office and sanitary facilities.
      c. Construction aids including hoists and crane.
      d. Site access and parking.
      e. Temporary barriers and enclosures.
      f. Temporary controls.
      g. Project identification.

B. Related Requirements:
   1. Construction and Demolition Waste Management: Section 01 7419; removal and disposal of demolition and construction waste.
   2. Final Cleaning: Section 01 7423.
   3. Permanent installation and hookup of utility lines as described in other Sections.

1.2 GENERAL

A. Establish and initiate use of each temporary facility at time first reasonably required for proper performance of the Work.

B. Install, operate, maintain, and protect temporary facilities in a manner and at locations which will be safe, nonhazardous, sanitary and protective of persons and property, and free of deleterious effects. Relocate services as necessary.

C. The types of services required include but are not limited to, water, surface drainage, electrical power and telephones.

D. Where possible and reasonable, connect to existing utilities for required services and comply with service companies' recommendations on materials and methods, or engage service companies to install services.

E. Equipment normally furnished by individual trades in execution of their own portions of the Work shall comply with requirements of pertinent safety regulations.

1.3 UTILITY COORDINATION

A. During the performance of the entire Contract, existing utilities such as sewer, water and gas mains, telephone, cable, and electrical ducts which are required for work under this Contract and servicing adjacent properties shall be protected and maintained in service.
   1. Contractor and subcontractors shall take precautions not to disturb these lines, or any other lines which may be encountered, until arrangements for rerouting these services are completed.

2. Send notices, make necessary arrangements, and provide services required for the care of gas mains, water pipes, sewer pipes, conduits, cables, and other equipment or property.

B. Arrange with utility companies for fees required to move or remove their meters, poles, cables, guy wires, or equipment as noted on the Drawings or set under the property which will interfere with the demolition and construction work or which will not be required in the new construction.

C. The Contractor shall immediately notify the Owner and applicable utility authority if a utility line or service is encountered unexpectedly. Protect and maintain the encountered utility line until instructions for its disposition can be issued by the appropriate utility company.

D. Additional specific responsibilities of the Contractor and its subcontractors for work on or in connection with existing utilities, other than general stipulations of this Article, may be set forth in appropriate Sections of Specifications and on the Drawings.

1.4 QUALITY CONTROL

A. Construction operations at the Building site shall be in accordance with "The Manual for Accident Prevention" (AGC) and shall be subject to all applicable laws, governmental rules and regulations.

B. Comply with applicable standards referenced in Section 01 4100, "Regulatory Requirements," including conformance with SCAQMD guidelines relating to emissions and dust as specified in this Section, and standards of the City of Kensington Noise Ordinance.

1.5 PRODUCT HANDLING

A. Maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

B. Make all connections to existing utility systems with minimum disruption to services in the existing utility systems.

C. Furnish, install, and pay for meters, equipment, wiring, and piping necessary to provide such utilities.

D. Provide written notification to the Owner to request use of new building equipment for temporary facilities. New building equipment shall not be used for temporary facilities without prior written approval from Owner.

PART 2 - TEMPORARY FACILITIES AND CONTROLS

2.1 MATERIALS

A. General: Materials may be new or used but shall be adequate in capacity for the required usage, shall not create unsafe conditions, and shall not violate requirements of applicable codes and standards.

B. Tools, extension cords, and electrical equipment shall conform to Underwriters Laboratory standards and OSHA requirements and shall be in proper working order to preclude hazard to occupants and premises.

2.2 TEMPORARY UTILITIES

A. Water: Provide necessary temporary piping and water supply.
   1. Provide and pay for water used in construction including metering costs.
   2. Include provisions for drinking water.

B. Electricity: Provide necessary temporary lighting and wiring.
   1. Provide weatherproof, grounded, power distribution system sufficient to accommodate construction operations requiring power, electrical heating, lighting, and startup testing of permanent electrical-powered equipment prior to its permanent connection to electrical system.
   2. Provide overload protection.
   3. Provide area distribution boxes located so individual trades may furnish and use 100 foot maximum length extension cords to obtain power and lighting at points where needed for work, inspection, and safety.
   4. Provide sufficient lighting for safe and adequate working conditions and to insure proper execution of the work throughout project including night security lighting.
      a. Provide general lighting with local switching which will enable energy conservation during periods of varying activity.
      b. Lighting shall meet OSHA and other requirements of governing authorities.

C. Heating: Provide and maintain heat necessary for proper conduct of operations needed in the Work.
   1. Temporary heating and ventilating shall maintain temperatures of at least 55 degrees F, except:
      a. After drywall finishing commences, and until the Project is complete, reasonably uniform temperatures and acceptable humidity shall be maintained in the 65 to 75 degree F range to prevent cracks caused by overheating or by colder temperatures.
      b. See individual Specification Sections for other ambient condition requirements.
   2. Exercise complete control over the adequacy of heat, ventilation and proper drying out of the Work or any portion thereof, for the entire construction period until date of Substantial Completion. Work damaged by Contractor’s failure to maintain required ambient conditions shall be removed and replaced to the satisfaction of the Architect and at no cost to the Owner.
   3. Provide supplementary ventilation if necessary to reduce humidity and to provide proper drying and prevent damage to materials from excess moisture.
   4. Areas surrounding heating devices shall be kept clear and free of hazardous materials. Provide sufficient supervision of operation and maintenance of all heating devices consistent with the safety and wellbeing of personnel. Devices shall bear UL, FM, or other approval labels appropriate for application. Vent all fuel burning devices to outside, and equip all units with individual unit thermostatic controls.
   5. The new systems may be used for heating and ventilating prior to Substantial Completion if authorized in writing by the Owner.
      a. Operation shall be at Contractor's risk who shall assume full responsibility to assure system is acceptable at time of Substantial Completion.
      b. Throw-away filters shall be replaced with new filters. Other filters shall be replaced or reconditioned.

D. Telephone:
   1. Contractor and its Superintendent shall have a cell phone for communication with the Architect and Owner when at the Project site.
   2. See additional requirements under Paragraph “Contractor’s Field Office.”

E. Fire Protection:
1. General: Comply with NFPA 241, “Standard for Safeguarding Construction, Alteration, and Demolition Operations” and any additional temporary fire protection requirements of Owner's Insurance Representative and governing authorities.
2. Smoking:
a. Contractor shall prohibit smoking in all areas of the Project and shall use due diligence to see that such prohibition is enforced.
b. No Smoking signs shall be furnished and posted in accordance with governing fire regulations.
3. Fire Extinguishers:
a. During the progress of work, there shall be at the jobsite an adequate number and type of fire extinguishers accessible for use.
b. Provide Type A extinguishers at locations of low-potential hazard for either electrical or grease-oil-flammable liquids fires; provide Type ABC dry chemical extinguishers at other locations; comply with recommendations of NFPA No. 10.
c. Post warning and quick-instructions at each extinguisher location, and instruct personnel at Project site, at time of their first arrival, on proper use of extinguishers and other available facilities at Project site.
d. Locate fire extinguishers where convenient and effective for their intended purpose with not less than one extinguisher on each floor at or near each usable stairwell.
4. Provide temporary, battery operated, heat detectors until permanent detection and alarm system is activated. Provide not less than five detectors on each Floor separated and located based on area layout.
5. Post the Kensington Fire Department call number in the Field Office, on each telephone instrument at Project site, and at other locations where appropriate.
6. Additional fire protection measures shall be implemented if required by the Owner’s insurance carriers.

F. Trash Removal:
1. Store trash or rubbish resulting from construction within the Contract work area.
2. Provide the necessary on-site containers for the collection of recycling materials, waste materials and debris.
3. Remove recycling materials, waste materials and debris from the site regularly and dispose of at recycling centers or legal disposal sites.
4. Keep the work area clean at all times. Increase frequency of trash removal when requested by the Owner to conform to this requirement.
5. Waste material and debris shall not be buried or burned at the site.
6. See additional requirement in Section 01 7419, “Construction and Demolition Waste Management.”

2.3 CONSTRUCTION FACILITIES

A. Contractor's Field Office:
1. Furnish and install a temporary Contractor’s Field Office for use by the Contractor's superintendent, complete with meeting space, drinking water, plan table, lighting, adequate storage facilities, and telephone and duplication service as specified.
2. Office shall be made available to the Architect, Owner, and their representatives when they visit the jobsite.
3. Contractor shall comply with City Ordinances and requirements regarding but not limited to the number and location of all temporary trailers, offices, and equipment. Contractor shall apply and pay for all required permits.

4. In addition to specified cell phone service, Contractor shall arrange and provide the following minimum temporary services in the Field Office:
   a. A combination FAX/copy/scanner machine.
   b. PC based computer with high speed internet access capable of sending and receiving large files. Service shall provide a minimum 5 megabits per second symmetrical upload and download speed.
   c. Internet access and copy/fax/scanner machine shall be made available at all times, free and unrestricted, to the Architect, Owner, and their representatives for transmissions in direct connection with the Work.
5. Provide additional facilities as agreed upon with the Owner.

B. Sanitary Facilities:
1. The Contractor shall furnish, install, and maintain the necessary temporary toilet facilities for its workers. Toilets shall be in place at the time work starts and maintained until the permanent toilet facilities are in operation if approved for use by the Owner.
2. Temporary toilets shall be of the chemical type.
3. The number and maintenance of temporary toilets shall meet the requirements of State and local health regulations and ordinances.
4. Locate on the site so as not to be visually offensive and in locations acceptable to the Owner.
5. Sanitary waste from the portable toilets shall be collected as required but not more than weekly.

C. Contractor shall provide for the secure storage of tools and equipment.

2.4 CONSTRUCTION AIDS

A. Staging and Hoists - General:
1. Furnish and maintain hoists, staging, rigging, and runways required in the execution of the Work and necessary for hoisting materials and personnel.
2. Erect, equip and maintain temporary hoists and cranes in accordance with the statutes, laws, ordinances, rules and regulations of the State and other authorities and Owner's and Contractor's insurance company requirements.

B. Material and Personnel Hoist:
1. Provide systems as selected by the Contractor and meeting with the requirements of governing authorities including all required safeguards and equipment necessary for operation.
2. Comply with the following:
   a. California Title 8, State Elevator Safety Order 3041c, and other applicable state and local codes.
   b. "American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks," ANSI A17.1.
   c. California Elevator Safety Construction Code.

C. Material Hoist and Crane System: The overhead crane system selected by the Contactor shall meet the requirements of the following specifications, standards, rules and codes as applicable to the system selected by the Contractor.
1. AISC, "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings."
2. ANSI MH 27.1, "Specifications for Underhung Cranes and Monorail Systems."
3. ANSI B30.16, "Overhead Underhung and Stationary Hoists."
4. ANSI B30.11, "Monorails and Underhung Cranes."

5. ANSI/NFPA 70, “National Electrical Code,” Article 610, Cranes and Hoists.
6. ASME HST-4, “Performance Standard for Overhead Electric Wire Rope Hoists.”
7. ASME NOG-1, “Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder.)”
8. AWS D1.1/D1.1M, “Structural Welding Code - Steel.”
9. Hoist Manufacturer’s Institute Standard Specification for Electric Wire Rope Hoists.
10. OSHA 29 CFR Part 1910.179, “Overhead and Gantry Cranes.”

D. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

2.5 VEHICULAR ACCESS AND PARKING

A. Parking: If on-site parking after demolition and commencement of earth moving activities is not possible, Contractor shall make arrangements with adjacent public parking facilities to accommodate vehicles of construction personnel. Cost of parking is the responsibility of the Contactor and/or its subcontractors.

B. Maintenance of Traffic and Access:
1. Throughout progress of Work, do not interfere with use of or access to adjacent buildings or property except as otherwise arranged by the Contractor through agreements with the adjacent property owners.
2. Do not close or otherwise obstruct sidewalks or streets without obtaining and paying for encroachment permits from the City.
3. Move and relocate utility and public service items obstructed by Project barricades and operations.
4. Maintain accessibility from street at all times to fire hydrants within construction area.
5. Construction traffic shall be routed to minimize noise impacts on the surrounding neighborhood.
6. Construction period for trucks hauling fill and piling materials shall be restricted to nonpeak hours to minimize impact to rush hour traffic.
7. Vehicles’ wheels shall be cleaned before leaving site so as to minimize impact on City streets. Contractor shall be responsible for cleaning Public streets muddied or littered from construction activity to the satisfaction of the City.
8. Comply with any additional requirements imposed by the City under the approval for this Project.

2.6 TEMPORARY BARRIERS AND ENCLOSURES

A. Security:
1. Provide and maintain for the duration of construction a temporary opaque site construction fence around the site of design and type needed to prevent entry onto the Work by the public and to protect the Work from unauthorized entry, vandalism, and theft.
   a. Fence shall be covered with an aesthetic treatment, or graphics if requested by Architect or Owner.
   b. Fencing shall comply with local ordinances and may incorporate existing fencing to the extent practicable.
2. Security provisions shall be provided during non-working hours, 7 days a week, including holidays, until acceptance of the Project by Owner.
3. Provide Owner and Architect with the name and 24-hour telephone number of a contact person who shall have primary responsibility for security.
4. In addition to the above, and in light of recent catastrophic arson related fires at area building construction sites involving wood frame construction, additional precautionary

measures to assure security of the site shall be reviewed and implemented, if required, in coordination with the Owner and the Owner's insurance advisors.

B. Safety and Protection:
   1. Follow construction procedures necessary to provide safe working conditions through all phases of the Project. Procedures shall conform to the Safety Orders, Division of Industrial Safety, Title 8, California Code of Regulations.
   2. Contractor shall take whatever care is necessary to avoid damage to existing facilities or to utilities to remain, whether on the Project or adjacent to it, and shall be liable for any damage thereto or interruption of service as a result of its operations.
   3. In addition to security fencing, provide and maintain for the duration of construction other temporary barricades, signs, and warning lights as required for the safety of persons in compliance with Federal, State, and local laws and regulations having jurisdiction.
      a. Temporary enclosures shall include facility entrances.
      b. Contractor is solely responsible for outlining safety procedures to be followed by its workers, subcontractors, and related trades working on its Project. Provide for safety of the public both day and night where they are exposed to construction operations.
      c. Conform to applicable requirements of the California Occupational Safety and Health Act Standards (Cal-OSHA).
      d. The Architect, Owner's Representative, City, and field inspectors are not hired to review or approve safety procedures followed by the Contractor.

C. See additional requirements for temporary site fencing, protection canopies, and barricades included on the Drawings.

D. Where temporary use is to be made of Building elevators prior to completion of the entire Project, provide temporary enclosures, guards, or other protection of hoistway openings, equipment, cab interiors, and operators as necessary to permit safe operation of elevators.

2.7 TEMPORARY CONTROLS

A. Use and Storage of Hazardous or Flammable Materials:
   1. Use and store hazardous or flammable chemicals, liquids, or gases brought onto the Project site in approved containers, conforming to local, state, and national fire codes.
   2. Use hazardous materials in a manner that will prevent their accidental release into other areas.
   3. Do not discard hazardous materials into the jobsite waste-disposal facilities.
   4. Remove empty containers from the premises immediately, and dispose of in a legal manner.

B. Welding: During the progress of work requiring welding and cutting equipment or heat-, flame-, or spark-producing devices, there shall be at the jobsite adequate shields, guards, or covering placed so as to protect adjacent persons or property.

C. Water Control: The Building and site shall be kept free of standing water during construction.
   1. Keep excavations free from water and properly dispose of collected water.
   2. Provide pumps, piping and other equipment as required and provide adequate standby pumps and equipment. Permanent sump pumps, if any, shall not be used during construction.
   3. Protect excavations, trenches, and Building from damage by rain water, spring water, ground water, backing up of drains, sewers or other water sources.

D. Dust Control:
   1. Hazardous Excavated Material: Excavated material may be contaminated with hazardous or toxic materials that may be dangerous if airborne. In order to reduce health risks to workers and to the public, the Contractor shall minimize dust generation.
   2. The Contractor shall adhere strictly to the following requirements to achieve a goal of "No Visible Dust Emissions."
      a. Water for dust control shall be treated with a biodegradable, non-polluting, non-toxic dust control chemical. Water so treated shall be considered "amended" water.
      b. Provide continuous water misting using as fine a spray or mist as possible in any area of excavation, drillings and other dust generating activity.
      c. Areas around the immediate excavation shall be wetted down as required.
      d. During all excavation and dirt moving activities, wet sweep/vacuum the above mentioned streets as required and at the end of the shift.
      e. Wet sweeping shall be done with a vacuum sweeper vehicle with sufficient suction so as to ensure that, while sweeping, the vehicle does not blow dust towards neighboring businesses or residences.
      f. Haul trucks carrying excavated material shall be loaded so that the material does not extend above the walls or back of the truck bed. The surface of all loads shall be tightly covered before the haul trucks leave the loading area and wetted prior to covering if required.
      g. To reduce pollutant emissions from the Contractor's and subcontractors' equipment and vehicles, the idling of motors for more than 15 minutes shall be prohibited.
      h. Also comply with:
         1) The requirements of the South Coast Air Quality Management District (SCAAQMD) regulations for particulate matter and visible emissions, odorous substances, and hazardous pollutants.
         2) The California Health and Safety Code, Division 26 (Air Resources), Chapter 3 (Emission Limitations) Section 41700 (Prohibited Conduct), Section 41701.5 (Diesel pile driving hammers) and related regulations.
   3. The Contractor shall be responsible and pay for cleanup of any spillage, including clean soils, on City Streets directly or indirectly caused by actions of employees of the Contractor or its subcontractors.
   4. If the Contractor fails to provide adequate dust control as determined by the Architect, the Owner reserves the authority to have the necessary work performed by others and/or to deduct or withhold all monies required thereto.

E. Moisture and Mold Control:
   1. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
   2. Exposed Construction Phase: Provide the following minimum protection before installation of weather barriers when materials are subject to wetting and exposure and to airborne mold spores:
      a. Protect porous materials from water damage.
      b. Protect stored and installed material from flowing or standing water.
      c. Keep porous and organic materials from coming into prolonged contact with concrete.
      d. Remove standing water from decks.
      e. Keep deck openings covered or dammed.
   3. Partially Enclosed Construction Phase: Provide the following minimum protection after installation of weather barriers but before full enclosure and conditioning of

Building, when installed materials are still subject to infiltration of moisture and ambient mold spores:

a. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed Building.
b. Keep interior spaces reasonably clean and protected from water damage.
c. Periodically collect and remove waste containing cellulose or other organic matter in complying with waste management requirement specified in Section 01 7419, “Construction Waste Management and Disposal.”
d. Discard or replace water-damaged material.
e. Do not install material that is wet.
f. Discard, replace, or clean stored or installed material that begins to grow mold.
g. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

4. Controlled Construction Phase of Construction: Maintain the following after completing and sealing of the Building enclosure but prior to the full operation of permanent HVAC systems:
   a. Control moisture and humidity inside Building by maintaining effective dry-in conditions.
   b. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
      1) Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
      2) Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
      3) Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.
      4) The above time limits may be reduced or modified if material based on a field observation of the moisture damage by the Architect and suitability of restoring wet materials to dry condition.

F. Pest Control:
   1. Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion.
   2. Perform control operations lawfully, using environmentally safe materials.

2.8 PROJECT IDENTIFICATION

A. Contractor shall post and maintain all signs and notices required by law or ordinance. No advertisements will be permitted on the premises without approval of the Owner.

B. Project Sign:
   1. Contractor shall provide a project sign in accordance with requirements provided by the Development Manager or Architect.
   2. Sign graphics shall include as a minimum, the following:
      a. Project name.
      b. Owner's name.
      c. Architect's name and address.
      d. Contractor's name and address.

e. Project rendering.

3. Artwork, in format suitable for incorporation into the sign graphics, will be provided to the Contractor.
4. Location of sign shall be selected in coordination with Owner's Representative.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:
1. The Contractor shall provide cleaning throughout the construction period to maintain the site in a neat and orderly condition at all times until completion and acceptance by Owner.
2. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process shall not fall on wet, newly painted or finished surfaces.

B. As required preparation to installation of succeeding materials, clean surfaces and Building areas to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.

C. Following the installation of finish floor materials, maintain the flooring in a clean condition at all times while work is being performed in the space in which finish materials are installed. "Clean" shall mean free from all foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.

D. Vacuum clean interior of Building areas when ready to receive finish painting, and continue vacuum cleaning on an as-needed basis until Building is ready for Substantial Completion or occupancy.

3.2 PROJECT PROTECTION

A. Contractor is responsible for taking reasonable precautions to prevent damage or loss to:
1. Work, materials and equipment to be incorporated in Project, whether in storage on or off the site, under the care, custody or control of the Contractor or any of its subcontractors.
2. Other property at the site or adjacent thereto, including walks, pavements, structures and utilities not designated for removal, relocation, or replacement in the course of Work under this Contract.

B. Damage or loss to property referred to above caused in whole or in part by the Contractor, any subcontractor, or anyone directly or indirectly employed by any of them, shall be remedied at no cost to Owner.

C. At earliest possible date, secure completed construction against unauthorized entrance at times when Contractor's personnel are not working. Provide secure temporary enclosures at locations of possible entry, with locked entrances.

3.3 USE OF PERMANENT SYSTEMS FOR CONSTRUCTION PURPOSES

A. Obtain Owner's prior written authorization of use of permanent systems. Authorization will indicate:
1. Reason for use.
2. Condition of use.

3. Which parts of system may be used.
4. Disconnection from source, restoration and cleaning of system.

3.4 MAINTENANCE AND REMOVAL

A. Maintain temporary facilities and controls as long as needed for safe and proper completion of the Work.

B. Remove and relocate temporary devices to avoid interference with other trades.

C. Temporary Facility Changeover:
1. Terminate use and remove facilities at earliest reasonable time, when no longer needed, as directed by the Owner, or when permanent facilities have, with authorized use, replaced the need.
2. Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion, unless otherwise instructed in writing by the Owner.

D. Termination and Removal:
1. Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion.
2. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

3.5 ADJUSTING

A. Complete, or if necessary restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

B. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

C. Restore existing facilities used for temporary services to specified or to original condition.

3.6 CLEAN UP

A. Contractor shall be responsible for controlling, containing and cleaning up of all construction debris throughout construction period. See additional requirements for final cleaning specified in Section 01 7423, “Final Cleaning.”

B. Full compensation for cleanup shall be included in the Contract. No separate compensation will be allowed for work pertaining to cleanup or disposal of material.

END OF SECTION

SECTION 01 5050
EROSION CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all materials, labor and equipment necessary to complete all work as specified herein, including but not limited to the following:
   1. Apply specified treatments to all cuts and fill slopes, soil stockpiles, and all disturbed areas.
   2. Install all temporary erosion control devices per Plans and Specifications.

B. All other labor and materials reasonably incidental to the satisfactory completion of the work, including cleanup of the site.

1.2 RELATED DOCUMENTS

A. Caltrans Standard Specifications, 2015

B. Association of Official Seed Analysts Procedures

C. California State Seed Law of the Department of Food and Agriculture

1.3 CONTRACTOR SUBMITTALS

A. The Contractor shall submit manufacturer's letters of compliance and manufacturer's literature for the following items:
   1. Seed Mixes (or individual items)
   2. Mulches
   3. Binders/Tackifiers
   4. Fertilizer
   5. Humate
   6. Soil inoculates
   7. Straw (Weight receipts from scales shall be required)
   8. Erosion Control Blanket

1.4 SITE CONDITION

A. It is the responsibility of the Contractor to visit the site to determine existing conditions including access to the site, the nature and extent of existing improvements upon adjacent public and private property, the nature of materials to be encountered, and other factors that may affect the work of this section.

B. It is the responsibility of the Contractor to have finished the grading of the slopes, including track walking the areas to be treated with erosion control treatments.

1.5 WORK SCHEDULE

A. The work shall progress as soon as the site becomes available consistent with normal seasonal limitations.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All products shall be delivered to the site in manufacturer's unopened standard containers bearing original labels showing quantity, analysis and name of manufacturer.

B. All materials shall be stored in designated areas and in such a manner as to protect them from weather or other conditions that might damage or impair the effectiveness of the product.

1.7 ANALYSIS OF SAMPLES AND TESTS

A. Samples: The Kensington Fire Protection District reserves the right to take and analyze samples of materials for conformity to the Specifications at any time. On request, seed shall deliver to Owner's Representative 30 days prior to seeding so seed can be tested. Seed samples shall be drawn in accordance with procedures outlined in Association of Official Seed Analysts.

B. Rejected material: Rejected materials shall be removed immediately from the site at Contractor's expense. Contractor shall pay the cost of testing replacement materials.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products shall be in conformance with the Specifications listed below. Any changes to products to be used shall be approved, in writing, by the Kensington Fire Protection District or Owner's representative prior to job site delivery.

2.2 SEED MIX [SEED MIX NEEDS TO BE PROVIDED BY LANDSCAPE CONSULTANT OR SEED COMPANY FOR THE PROJECT AREA]

A. Seed shall conform to the provisions in Section 21-2.02F, "Seed," of the Standard Specifications. Individual seed species shall be measured and mixed in the presence of the Owner's Representative.

B. Seed shall be delivered to the project site in unopened separate containers with the seed tag attached. Containers without a seed tag attached will not be accepted.

C. Composition:

Species	**Common Name**	**PLS lbs. /acre**
Gazania	*Trailing Gazania*	*4 lbs. /acre*

NON-LEGUME SEED

Botanical Name (Common Name)	Percent Germination (Minimum)	Kilograms Pure Live Seed Per Hectare (Slope Measurement)
Baccharis pilularis var. pilularis (Coyote Bush)	20	0.05
Artemisia californica (California Sagebrush)	25	0.5
Mimulus aurantiacus.	25	.1

(Sticky Monkeyflower)		
Elymus glaucus, (Blue Wildrye,)	40	9
Festuca idahoensis (Idaho Festuca)	35	4
Hordium brachyantherum californicum (Meadow Barley)	40	8
Regreen	60	45.0

D. Quality
   1. All seed shall be in conformance with the California State Seed Law of the Department of Food and Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. In addition, the container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained.
   2. Prior to seeding at the request of the Kensington Fire Protection District, the Contractor shall provide a letter of certification, original Association of Official Seed Analysts (AOSA) seed test results, and calculations of PLS.
   3. All legume seed shall be pellet-inoculated. Inoculant sources shall be species specific and shall be applied at a rate of 2 pounds of inoculant per one hundred pounds of seed.

2.3 MULCH

A. Mulch shall be 100% wood hydroseed and shall be composed of wood fiber derived from whole wood chips with no growth or germination inhibiting substances, and shall be manufactured in such a manner that when thoroughly mixed with seed, fertilizer, organic stabilizer, and water, in the proportions specified, will form a homogeneous slurry which is capable of being sprayed to form a porous mat.

B. The fibrous mulch in its air-dry state shall contain no more than 15% by weight of water. The fiber shall have a temporary green dye and shall be accompanied by a certificate of compliance stating that the fiber conforms to these Specifications.

2.4 ORGANIC STABILIZER/TACKIFIER

A. Stabilizer and tackifier shall be an organic substance supplied in powder form and shall be psyllium-based and packed in clearly marked bags stating the contents of each package. The California Department of Food and Agriculture shall certify the material as an Auxiliary Soil Chemical.

2.5 FERTILIZER

A. Fertilizer shall be of commercial quality, conform to the requirements of the California Department of Food and Agriculture Code, shall have a guaranteed analysis for nitrogen, phosphorus and potassium of 7-2-3. Products specified as slow-release shall have been tested and demonstrate a nearly linear release curve.

2.6 HUMATE

A. Humate shall be OMRI listed and contain at least 40 % Humic acid. It shall be a natural granual humic acid-based material that functions as an organic chelator and microbial stimulator. Humate shall not burn plant material and shall be non-toxic and non-staining.

B. Humate Soil Conditioner

Humic Acids (from Leonardite)	40 .00 %
Organic matter	40 .00 % - 50.00%
Carbon	50.00 % - 60.00%
Nitrogen	0.05 % - 1%
Phosphoric Acid	0.07 %
Potash	0.13 %
Sulfur	0.21 %
Magnesium	0.18 %
Calcium	0.32 %
pH	4.0
Soluble Salts	1.8

2.7 MYCORRHIZAL INOCULUM

A. Endo (arbuscular) mycorrhizal inoculum shall be registered by the California Department of Food and Agriculture and consist of spores, mycelium and mycorrhizal root fragments in a solid carrier suitable for handling by hydro-seeding. The carrier shall be the material in which the inoculum was originally produced, and may include organic materials, vermiculite, perlite, calcined clay, or other approved materials consistent with mechanical application and with good plant growth.

B. Each endomycorrhizal inoculum shall carry a supplier's guarantee of 80,000 propagules minimum per kilogram. The minimum propagule count shall be shown on each label provided. If more than one fungal species is claimed by the supplier, the label shall include a guarantee for each species of mycorrhizal fungus claimed.

C. Endomycorrhizal fungal species shall be suitable for the pH of the soil at the planting site. If the inoculum consists of a mixture of species, no more than 20% of the claimed propagule count shall consist of fungal species known to be unsuitable for the pH of the soil at the planting site.

D. A sample of approximately 28 grams (one ounce) of inoculum will be taken from each inoculum container by the Owner’s Representative. The number of propagules will be determined by laboratory testing. Propagules shall include live spores, mycelial fragments and viable mycorrhizal root fragments.

E. Endomycorrhizal inoculum shall be stored, transported and applied at temperatures of less than 32° C (90° F).

2.8 STRAW

A. Shall be derived from irrigated rice or clean cereal grain straw.

B. The Contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw from outside the County in which it is to be used is delivered to the site of the work.

C. Straw that has been used for bedding is prohibited.

2.9 EQUIPMENT

A. Equipment used for application of slurry shall be a commercial-type Hydro-Seeder and have a built-in agitation system with an operation capacity sufficient to agitate, suspend and homogeneously mix slurry.

B. Tank capacity shall be a minimum of 1,500 gallons and shall be mounted on a truck to allow access to the site.

C. Pump shall be able to generate 150 psi at the nozzle.

D. Straw blowers: Equipment shall be specifically designed and manufactured for the application of straw and shall be of sufficient horsepower to break up and distribute straw at the specified application rate.

2.10 WATER

A. Water shall be furnished by Kensington Fire Protection District and shall be made readily available at the sites indicated on the project map. Water shall be of potable quality.

B. Contractor shall add 4-6 lbs. of Vulpia Microstachys or 20 lbs. of Regreen per acre if hydroseeding occurs in the fall or winter months.

C. Hydroseed mix can be obtained from Pacific Coast Seed, Inc., (925) 373-4417.

1.11 EROSION CONTROL BLANKETS

A. Erosion control must be Erosion Control Technology Council (ECTC) Type 2D and made of processed natural fibers that are mechanically, structurally, or chemically bound together to form a continuous matrix that is surrounded by 2 natural nets. Erosion control blanket must comply with the requirements shown in the following table:

Erosion Control Blanket

Quality characteristic	Test method	Requirement		
		Type A	Type B	Type C
Roll width (min, inches)	--	72		
Matrix (%) Straw/coconut Woven coir (coconut fiber) Wood excelsior (6 inches or longer)	--	 70/30 -- --	 -- 100 --	 -- -- 80
USLE C-Factor for a 1:1 (H:V) unvegetated slope	--	≤ 0.20		
Shear stress (max, psf)	ASTM D6460	1.75		
Tensile strength (min, psf)	ASTM D5035	75		
Functional longevity (months)	--	12		

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. No soil amendments shall be required except as noted on the Plans.

B. Verification: Contractor shall verify:
1. That all areas to receive erosion control treatments are free of vegetation and other objectionable material.
2. That grades are final for permanently treated areas and within reasonable standard for temporary treatments.
3. That all sloped areas are uniformly compacted: wherever possible, the surface compaction of the top 1 foot shall be 85% or less.

3.2 EROSION CONTROL BLANKET INSTALLATION

A. Before placing the erosion control blankets, Contractor shall ensure the subgrade has been graded smooth and has no depressed voids. The subgrade must be free from obstructions, such as tree roots, projecting stones, or foreign matter greater than 1 inch in diameter. Overlap the end of the erosion control blanket by 24 inches. Use 18 inch staples staked at maximum of 4 feet on center in staggered pattern. Do not drive vehicles on the erosion control blanket.

3.3 HYDROSEEDED AREA

A. Areas to receive erosion control treatments include all graded areas as shown on the site plan and other areas as determined by the Kensington Fire Protection District.

B. Perform erosion control treatments on a section by section basis. On approval of the Kensington Fire Protection District, and as soon as possible after grading, complete treatments in the following order of priority: stream zones, graded slopes, non-trafficked road and parking areas, building pads and other flat areas.

C. Contractor shall be available to re-treat areas disturbed by on-going activities.

D. Preparation: All slurry preparation to be conducted at the job site.
1. Water, mulch, fertilizer, compost, binder and other ingredients shall be added to the tank simultaneously so that the finished load is a homogenous mix of the specified ingredients.
2. Seed shall be added last and shall be discharged within 2 hours. Loads held over 2 hours will be recharged with ½ the seed rate before application.
3. Once fully loaded, the complete slurry shall be agitated for 3-5 minutes to allow for uniform mixing.

E. Application: Apply specified slurry in a sweeping motion to form a uniform application.
1. Step One - with hydroseeder apply:
   a. Seed Mix Total 4 lbs./acre
   b. 100% Cellulose Fiber Mulch 500 lbs./acre
   c. Biosol 7-2-3 (Organic Fertilizer) 1,600 lbs./acre
   d. AM120 (Mycorrhizal Inoculant) 60 lbs./acre
2. Step Two - with straw blower apply:
   a. Rice or Clean Cereal Grain Straw 4,000 lbs./acre
3. Step Three - with hydroseeder apply:
   a. 100% Cellulose Fiber Mulch 500 lbs./acre

b. M-Binder 100 lbs./acre

4. Under suitable conditions straw shall be uniformly spread at the specified rates. The straw may be pneumatically applied as long as the resulting straw in predominately 3 to 6 inches in length. The straw shall be treated with mulch and tackifier before it can blow off the site but in no case shall straw be left untreated for more than 24 hours. The Contractor will clean up areas of straw which are blown from the site, and the areas shall be retreated at no additional expense to the Kensington Fire Protection District.

F. Protection: Contractor is to stay off treated areas.

G. Unused Loads: If mixture remains in tank for more than 8 hours it shall be removed from the job site at Contractor's expense.

H. Preliminary Inspection: Notify the Owner's Representative 48 hours in advance of all seeding. Inspection and favorable review of completed work shall begin the plant establishment period.

3.4 PLANT ESTABLISHMENT MAINTENANCE

A. General plant maintenance shall immediately follow seeding and continue for **90 days**.

B. Protect areas against all damage, including erosion and trespass, and provide proper safeguards. Maintain and keep in good repair all temporary barriers erected to prevent trespassing. Check all barrier and temporary fencing daily, and make immediate repairs or replacements

C. Repair all damage to seeded areas.

D. Maintain constant moisture depth in soil to insure vigorous growth.

3.5 FINAL INSPECTION AND ACCEPTANCE:

A. Final inspection will be conducted upon completion of maintenance, replacements and corrective work. Five (5) days' notice shall be given. If project improvements, corrective work, and maintenance have not been performed as specified and to the satisfaction of the Owner's Representative, maintenance shall continue at Contractor's expense until such time as work has been successfully completed.

3.6 GUARANTEE AND REPLACEMENT

A. Guarantee all planting to be in a healthy, thriving condition until the end of the maintenance period or beyond that time until active growth is evident and for one year from date of acceptance.

B. Replace all seeded areas not in vigorous condition as soon as directed by Owner's Representative. Seed mixture used for replacement must be of the same kind and quantity as specified in this section.

3.7 CLEAN-UP

A. Erosion control work areas shall be maintained in a neat and orderly condition. Keep paved area free of erosion treatment, soil, and other debris.

B. Overspray: Installing Contractor is responsible for washing or otherwise cleaning excess material off all areas not intended to receive treatment.

C. Debris: Clean up and remove erosion control associated materials and debris from project site before Final Acceptance.

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

1.1 SUMMARY

A. Section Includes:
1. Administrative and procedural requirements for selection of products for use in Project.
2. Product delivery, storage, and handling.
3. Requirements for manufactured and fabricated products.
4. Comparable products.

B. Related Requirements:
1. Substitution Procedures: Section 01 2500; requests for substitutions.
2. Submittal Procedures: Section 01 3300.

1.2 DEFINITIONS

A. Aesthetic Design: Incorporates components that elicit sensory responses primarily but not exclusively visual, in anyone who may have contact with the product, with the intention of communicating the Owner’s values and the Facility’s purpose.

B. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

C. Basis-of-Design: A specific manufacturer's product is named and accompanied by the words "basis-of-design product," or the words “or equal,” including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the Specification.

D. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the Specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

E. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
   1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
   2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

F. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 3300, "Submittal Procedures."

G. Substitution: Refer to Section 01 2500, "Substitution Procedures," for definition and limitations on substitutions.

1.3 ACTION SUBMITTALS

A. Comparable Product Requests: Identify product or fabrication or installation method to be replaced.
   1. Include Specification Section number and title and Drawing numbers and titles as applicable.
   2. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 5 working days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 working days of receipt of request, or 5 working days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Section 01 3300, "Submittal Procedures."
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Submittal: Comply with requirements in Section 01 3300, "Submittal Procedures." Show compliance with specified requirements.

1.4 QUALITY ASSURANCE

A. General:
   1. Conform to applicable Specifications and standards.
   2. Comply with size, make, type, and quality specified.
   3. Do not use material or equipment for any purpose other than that for which it is designed or specified.
   4. Contractor shall be responsible for its material and equipment.
   5. Only new material and equipment shall be used, unless otherwise specified.
   6. Use materials prior to their expiration dates.
   7. Products for building systems and components shall be the product of a single manufacturer to ensure single source responsibility.

B. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
   1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.5 PRODUCT SELECTION PROCEDURES

A. General: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and for indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected" or “as selected by Architect,” Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   6. For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or accepted equal," comply with requirements in Article "Comparable Products - Conditions for Consideration" to obtain approval for use of an unnamed product or manufacturer.
   7. If proposed product does not meet the requirements for consideration as a comparable product, comply with requirements in Section 01 2500, "Substitution Procedures," for proposal of product.

B. Product Selection Procedures:
   1. Where Specifications name a single manufacturer and product, provide the named product that complies with requirements.
   2. Where Specifications name a single manufacturer or source but not a specific product, provide a product by the named manufacturer or source that complies with requirements. Provision of an unnamed product is not considered a substitution if the product complies with requirements.
   3. Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Provision of an unnamed product is not considered a substitution, if the product complies with the specified requirements.
   4. Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with the specified requirements.
   5. Basis-of-Design Product:
      a. Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers.
      b. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
      c. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
      d. For approval of products by unnamed manufacturers, comply with requirements in Section 01 2500, "Substitution Procedures," for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample.
   1. Architect's decision will be final on whether a proposed product matches.

2. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 2500, "Substitution Procedures," for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes, unless otherwise specified, both standard and premium items.

1.6 PRODUCT DELIVERY AND HANDLING

A. Arrange deliveries of products in accordance with the Construction Progress Schedule. Coordinate to avoid conflict with work and conditions at the site.

B. Deliver materials in undamaged condition, in original unopened containers normally packaged in the factory, bearing manufacturer's name, registered brand and trade mark, or other designation (such as Federal Specification to which material complies, grade, or similar standard) specified in the corresponding Specifications Sections. Label shall clearly identify manufacturer, brand name, fire-hazard classification, lot number, and quality or grade, as applicable.

C. Immediately upon delivery, inspect shipments to assure compliance with requirements of Contract Documents and accepted submittals, and that products are properly protected and undamaged.

D. Provide equipment and personnel to handle products by methods that will prevent soiling or damaging of products or packaging.

1.7 PRODUCT STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Maintain temperature and humidity within ranges required by manufacturer's instructions.

B. Arrange storage to provide easy access for inspection.

C. Make periodic inspections of stored products in order to assure that products are maintained under specified conditions and are free from damage or deterioration.

D. Protect material and equipment after installation.
1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations.
2. Remove when no longer needed, unless otherwise specified or requested by the Architect.
3. Follow recommendations of manufacturer and installer, as applicable, to ensure material and equipment will be without deterioration or damage at time of acceptance by Owner.

1.8 MANUFACTURED AND FABRICATED PRODUCTS

A. General:
1. Design, fabricate, and assemble in accordance with best engineering and shop practices.

2. Manufacture like parts of duplicate units to standard sizes and gages to be interchangeable.
3. Two or more items of the same kind shall be identical and by the same manufacturer.
4. Products shall be suitable for service conditions.
5. Equipment capacities, sizes, and dimensions shown or specified shall be adhered to, unless variations are specifically accepted in writing.

B. Manufacturer's Instructions:
1. Unless otherwise specified, the Contract Documents require that installation of work shall comply with manufacturer's printed instructions. Contractor shall obtain and distribute copies of such instructions to parties involved in the installation. Maintain one set of complete instructions at the jobsite during installation and until completion.
2. Handle, install, connect, clean, condition, and adjust products in strict accordance with such instructions and in conformance with specified requirements.
   a. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Architect.
   b. Do not proceed with work without clear instructions.
3. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure, unless specifically modified or exempted by the Contract Documents.

C. Trade Materials and Standards:
1. The various Sections of the Specifications list trade manuals and standards that govern the quality and workmanship adopted as criteria by the trades involved. Contractor, and its subcontractors and suppliers, shall be familiar with the requirements of these documents.
2. A copy of each listed manual or standard shall be available for reference, or the Architect will furnish information as to how copies of manuals and standards may be obtained.

1.9 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence the proposed product does not require revisions to the Contract Documents, it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. Colors, patterns, finishes and dimensions of comparable products shall match that of the specified product color listed to be considered for acceptance.
5. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
6. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 3300, "Submittal Procedures."
1. Form of Approval of Submittal: As specified in Section 01 3300, "Submittal Procedures."

2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

END OF SECTION

SECTION 01 7329

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Contractor's responsibilities for all cutting, fitting, and patching required to complete the Work and to:
   1. Make its several parts fit together properly.
   2. Uncover portions of the work to provide for installation of ill-timed work.
   3. Remove and replace defective work.
   4. Remove and replace work not conforming to requirements of Contract Documents.
   5. Provide routine penetrations of nonstructural surfaces for installation of electrical conduit, plumbing, and ductwork.
   6. Remove samples of installed work as specified for testing.

1.2 VISUAL REQUIREMENTS

A. Do not cut and patch work exposed on the exterior or in its occupied spaces, in a manner that would, in the opinion of the Owner, result in lessening the Building's aesthetic qualities.

B. Do not cut and patch work in a manner that would result in substantial visual evidence of cut and patch work.

C. Remove and replace work judged by Owner to be cut and patched in a visually unsatisfactory manner.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Proceed with the work only when forecasted weather conditions are favorable.

B. Do not attempt repairing of feature on exterior in rainy or foggy weather.

C. Do not apply materials when ambient conditions are outside limits of the respective material's manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with specifications and standards for each specific product involved.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

C. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions of the completed Project including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, examine the conditions affecting the installation of products or performance of the Work.

C. Notify Owner of any visible change in the integrity of the material or component whether environmental, such as biological attack, ultraviolet degradation, or structural defects such as cracks, movement, or distortion.

D. Report unsatisfactory or questionable conditions in writing. Do not proceed with the work until unsatisfactory conditions have been resolved to the satisfaction of the Owner.

3.2 PREPARATION

A. Provide adequate temporary support as necessary to assure the structural value or integrity of the affected portion of the work.

B. Provide devices and methods to protect other portions of the Project from damage.

C. Provide protection from the elements for that portion of the Project that may be exposed by cutting and patching work.

3.3 PERFORMANCE

A. General:
   1. Execute cutting and demolition by methods that will prevent damage to other work and will provide proper surfaces to receive installation of repairs.
   2. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.
   3. Restore work that has been cut or removed; install new products to provide completed work in accordance with requirements of Contract Documents.
   4. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

B. Cutting:
   1. Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.
   2. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping.
   3. Cut holes and slots neatly to size required with minimum disturbance of adjacent work.
   4. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces whenever possible.

C. Patching:
   1. Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work.
   2. Patch with durable seams that are as invisible as possible.
   3. Provide materials and comply with installation requirements specified in other Sections.

D. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.
   1. For continuous surfaces refinish to nearest intersection.

END OF SECTION

SECTION 01 7419

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

1.1 SUMMARY

A. Section Includes: Requirements for diversion of non-hazardous construction and demolition waste from landfill.

B. Related Requirements:
1. Submittal Procedures: Section 01 3300; general requirements for submittals.
2. Temporary Facilities and Controls: Section 01 5000.
3. Selective Demolition: Section 02 4119.

1.2 GENERAL

A. Contra Costa County adopted an ordinance that creates a mandatory program to maximize the recovery of all construction and demolition debris material.
1. The ordinance requires that mixed construction and demolition debris material be transported off-site by a Registered Transporter and taken to a Registered Facility that can process and divert from landfill the material generated from construction, demolition or remodeling projects.
2. Material source separated at the job site should be taken to a facility that reuses or recycles such material.
3. This ordinance prohibits any construction and demolition debris from being placed in trash or sent to a landfill.

B. It is a requirement for this Project to generate the least amount of waste possible and that processes which ensure the generation of as little waste as possible due to over-packaging, error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.
1. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled.
2. Waste disposal in landfills shall be minimized.

1.3 REFERENCES

A. Contra Costa County ordinance 2019-31 (Construction Waste Recycling Requirements) with effective date of January 1, 2020.

B. "Builders' Guide to Reuse and Recycling, A Directory for Construction and Demolition Materials."

1.4 DEFINITIONS

A. Alternative Daily Cover (ADC): Materials, other than soil, that have been approved by the California Department of Resources Recycling and Recovery ("CalRecycle") or a successor agency for use as a temporary overlay on an exposed landfill face.

B. Beneficial Reuse: The reuse of material at a landfill that does not include ADC but shall include, but not be limited to use of the material for or as the following: Alternative intermediate cover; final cover foundation layer; liner operations layer; leachate and landfill gas collection system; construction fill, road base, wet weather operations pads and access

roads, and soil amendments for erosion control and landscaping. "Beneficial reuse" does not include disposal of material at a landfill.

C. Conversion Rate: The rate set forth in the Conversion and Mixed Recycling Worksheet approved by the City of San Francisco for use in estimating the weight of materials identified in the Waste Reduction and Recycling Plan.

D. Disposal: The final deposition of material at a legally operating permitted landfill that does not include beneficial reuse or at a permitted transformation facility. A legally operating, permitted landfill includes Class III landfills and inert fills. Disposal of inert materials at inert fills or inert backfill sites does not constitute recycling.

E. Diversion: Use of material for any purpose other than disposal in a landfill or transformation facility, such as source reduction, reuse, recycling, and composting activities that do not result in material being disposed at permitted landfills and transformation facilities.

F. Inert Fill Facility: A facility that can legally accept inert waste such as asphalt and concrete exclusively for the purpose of disposal.

G. Landfill: A facility that (1) accepts for disposal in or on land non-hazardous waste such as household, commercial, and industrial waste, and waste generated during construction, remodeling, repair and demolition operations, and (2) has a valid current solid waste facilities permit from the California Department of Resources Recycling and Recovery (CalRecycle).

H. Net Cost: Means that the following have been subtracted from the cost of separating and recycling:
   1. Revenue from the sale of recycled or salvaged materials.
   2. Landfill tipping fees saved due to diversion of materials from the landfill.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.6 ACTION SUBMITTALS

A. Construction Waste Management Plan as required by ordinance 2019-31, Section 4.408.2.

1.7 INFORMATIONAL SUBMITTALS

A. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

B. Documentation and Records: Submit the following with the monthly Application for Payment, unless otherwise agreed.
   1. Documentation verifying compliance with the Plan at completion of demolition, and at 50 and 100 percent completion of the new construction work.
   2. Other records, including records of sales and donations, as applicable and required to substantiate conformance with waste management goals and as required by governing authorities.

1.8 CLOSEOUT SUBMITTALS

A. Waste Reduction Calculations: Before request for Substantial Completion, submit copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

1.9 WASTE MANAGEMENT GOALS

A. General:
1. Develop a Construction Waste Management Plan that results in end-of-Project rates for salvage/recycling of 75 percent by weight of total waste generated by the Work in accordance with the current requirements of Contra Costa County Construction Waste Recycling Requirements ordinance 2019-31.
2. See Section 02 4119, “Selective Demolition,” for a description of items to be salvaged for reuse on this Project or for turning over to Owner.

B. The Contractor shall take an active and responsible role in the management of construction waste, and shall require all subcontractors, vendors, and suppliers to participate in the effort.

C. The Contractor shall establish a construction waste management program for this Project that includes, but is not limited to, the following:
1. Salvage for resale.
2. Salvage and reuse.
3. Recycling.
4. Disposal.

D. Only trash or waste materials that cannot be practically or economically reused or recycled shall be transported to the landfill.

1.10 QUALITY ASSURANCE

A. Recycling Company Qualifications: Any of the following.
1. Certified as a mixed debris recycling facility by Contra Costa County.
2. A vendor that will certify in writing that accepted waste will be diverted from landfill, not dumped illegally, or dumped at sea.

B. Regulatory Requirements: Comply with referenced Contra Costa County construction and demolition waste recycling regulations.

C. Approval of Waste Reduction and Recycling Plan by the Architect, Owner, and City is required before beginning on-site mobilization.

1.11 WASTE REDUCTION AND RECYCLING PLAN

A. Plan Development: Develop a plan for diverting construction and the selective demolition debris from landfill. Include in Plan written and graphic information indicating how waste will be diverted from landfills as required by the City of Kensington Municipal Code and as follows:
1. Include in Plan both on-site recycling of construction debris and also off-site diversion from landfill.
2. Propose means and methods for collecting and separating each type of debris deemed reusable or recyclable.
3. Schedule each item, and list the off-site recycling service and hauler of each designated debris item who have agreed to accept and divert that item from landfill in

the proposed quantities anticipated. List the service and hauler companies' names, addresses, phone numbers, and persons contacted.

4. Include a good faith estimate of each type of construction waste that would be generated if no diversion methods were implemented. Submit with calculations based upon weight of each material. The following items are subject to the good faith estimate and diversion requirement:
   a. Asphalt concrete.
   b. Portland cement concrete.
   c. Aggregates.
   d. Concrete masonry, brick and clay products.
   e. Clean earth fill.
   f. Wood products, including clean dimensional wood, palette wood, plywood, formwork, OSB, and particleboard.
   g. Metals, including banding, ductwork, flashing, piping, rebar, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   h. Plant and tree trimmings (may be included in wood products if accepted by recycling service.)
   i. Cardboard, paper products, and packaging.
   j. Mixed waste, including, but not necessarily limited to the following:
      1) Beverage containers.
      2) Insulation.
      3) Roofing.
      4) Glass, excluding that used for containers.
      5) Gypsum board.
      6) Cement board.
      7) Plastics, including ABS, PVC, and piping.
      8) Latex paint.
      9) Other materials.
5. Calculate quantities and convert volume measurements to weights in accordance with the City's Conversion Rate Tables.

B. Plan shall be submitted for Owner's review sufficiently in advance of when submittal is required to be made to the City to allow for Owner's review and acceptance.

C. Plan Implementation:
   1. Maintain log of each load, of each category item diverted from landfill. Log in separately debris sent to a Class III landfill and materials sent to recycling facilities.
      a. Include in log the type of load, load weight, name of hauling service, recycling service or landfill, and date accepted by recycling service or by landfill.
      b. Owner reserves the right to audit the log at any time. Retain and make available all weight tickets, copies of receipts, and invoices.
      c. Units of Measure: Use same units as stated in the approved Plan good faith estimate of construction waste that would be generated if no remedial methods were implemented.
   2. Material Handling:
      a. Separation Facilities:
         1) Designate a specific area or areas on site to facilitate separation of materials for potential reuse, salvage, recycling, and return. Clearly mark bins for each category of waste.
         2) Keep waste bins and pile areas neat and clean. Do not contaminate non-recyclable waste with materials designated for reuse or recycling.

b. Environmental Controls during Handling, Storage, and Transport: Do not permit designated materials to become contaminated or to contaminate site or surrounding areas.

3. Training and Coordination:
   a. Furnish copies of the Waste Reduction and Recycling Plan to all on-site supervisors of each subcontractor.
   b. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage or reuse, and return methods to be used by all entities at the appropriate stages of the Project.
4. Meetings: Include construction waste reduction and recycling on the agenda of meetings. Meetings shall include all subcontractors affected by the Waste Reduction and Recycling Plan. At a minimum, discuss waste management goals and issues at the following meetings:
   a. Pre-construction meeting.
   b. Regularly scheduled jobsite meetings.
   c. Pre-installation meetings.

D. Hazardous Waste: Separate, store, and dispose of hazardous waste according to local regulations.

END OF SECTION

SECTION 01 7423

FINAL CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cleaning at completion of the Work.

B. Related requirements specified in other Sections include:
1. Temporary Facilities and Controls: Section 01 5000; cleaning and housekeeping requirements during construction.
2. Additional Cleaning Requirements: Review all Sections.

1.2 QUALITY CONTROL

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and antipollution laws including Proposition 65.

B. Do not discharge volatile, harmful, or dangerous materials into building drains.

C. Contractor shall engage the services of an independent, professional housecleaning service to perform final cleaning once Contractor’s final clean-up is completed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use only those cleaning materials that will neither create hazards to health or property nor damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer and in compliance with Proposition 65.

D. Use only environmentally acceptable “green” cleaning products.

PART 3 - EXECUTION

3.1 INTERIOR DUST CONTROL

A. Clean interior spaces prior to the start of finish painting, and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that no dust and other contaminants resulting from cleaning process will fall on wet or newly coated surfaces.

3.2 FINAL CLEANING

A. Interior and General:
   1. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces, including fixtures and equipment.
   2. Scars, stains, paint marks, tags, and labels (except required labels) shall be removed. Painted surfaces and equipment shall be cleaned and touched up as required.
   3. Clean and polish hardware and light fixtures.
   4. Glass, both interior and exterior, and mirrors shall be cleaned to the level expected by a professional window washer.
   5. Ventilating Systems:
      a. Clean permanent filters, and replace disposable filters if units have been operated during construction.
      b. Clean ductwork utilized during construction.
   6. Vacuum-clean all floors using vacuums having a high efficiency particulate arrester (HEPA) filter.
   7. Tile and polished concrete surfaces shall be cleaned as specified in the respective Specification Sections.

B. Exterior:
   1. Visually examine surfaces and remove traces of soil, waste materials, smudges, and other foreign matter.
   2. Remove traces of splashed materials from adjacent surfaces.
   3. Hose down hard surfaces where necessary.
   4. Where stubborn stains are not removable with water, the Architect may require use of other cleaning methods at no additional cost to Owner.

C. Immediately prior to final completion or Owner occupancy, conduct an inspection of sight-exposed interior and exterior surfaces, equipment, fixtures, and all work areas to verify that the entire Work is clean.

D. Final cleanup shall result in "move-in" condition.

END OF SECTION

SECTION 01 7700

CLOSEOUT PROCEDURES

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for Contract closeout.

B. These requirements supplement those included in the General Conditions and are subject to modification upon mutual agreement between the Architect, Owner, and Contractor.

1.2 QUALITY ASSURANCE

A. Contractor shall provide an orderly and efficient transfer of the completed Work to the Owner.

B. Prior to requesting inspection by the Architect and Owner, use adequate means to assure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection.

C. Closeout procedures shall be coordinated with the commissioning process.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting an inspection for certification of Substantial Completion, complete the following and note any exceptions:
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the work claimed as substantially complete.
      a. Include supporting documentation for completion as indicated and an accounting of changes to the Contract Sum.
      b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
   2. Advise the Owner of pending insurance changeover requirements.
   3. Changeover to permanent keying including advising Owner of changeover in security provisions.
   4. Submission of closeout submittals as specified below in Article 1.4.
   5. System startup and instructions to Owner’s personnel.
   6. Disconnection and removal of temporary facilities, mockups, and tools.
   7. Final cleanup.

B. The Contractor shall "pre-punch list" its own work and work of subcontractors. A “Zero Punchlist” approach is expected on this Project.
   1. Contractor shall plan to ensure work tasks are completed correctly and expeditiously the first time.
   2. Contractor shall recognize quality issues and correct defective work as soon as possible to minimize interference with other work ongoing and impact on the Construction Schedule.

C. When Contractor considers the Work or a designated portion of the Work is substantially complete, an inspection to determine acceptance of the Project will be performed by the Architect and Owner’s Representative.

D. From the information gathered during this inspection, the Architect will prepare a Certificate of Substantial Completion. If the Architect and Owner determine there are items to be performed, corrected, or completed before the Project will be accepted, the Architect will prepare and attach a "punch list" listing and describing these items.

E. The Architect's "Punch List" work shall be completed within thirty days, unless otherwise mutually agreed, and prior to acceptance of the Project by the Architect and Owner, subject to the following exceptions:
   1. Change Order work that is approved too late to be completed by the Contract completion date.
   2. Warranty work.

F. By acceptance of the Certificate of Substantial Completion, the Contractor agrees to pay the Owner's actual costs including, but not limited to, charges for engineering, repeat inspections, and administration incurred due to the failure to complete the punch list within the time period provided in the Certificate of Substantial Completion.

1.4 PROJECT CLOSEOUT SUBMITTALS

A. General: Upon acceptance of the Work by the Architect, and before Architect issues a Final Certificate for Payment, the following shall be submitted to the Architect or as otherwise directed.

B. Project Record Documents as specified in Section 01 7839, "Project Record Documents."

C. Spare parts and maintenance material (extra stock) where called for in the Specifications.

D. Guarantees and Warranties.
   1. Manufacturer's warranties, service or maintenance, and similar contracts with direct obligations running from the manufacturer to the Owner and, as applicable, approved by the Owner.
   2. Contractor warranties and guarantees required under respective Sections of the Specifications. These warranties and guarantees shall be procured by the Contractor who shall forward them in duplicate to the Architect together with a letter addressed to the Owner's Representative giving a summary of the guarantees being transmitted and stating the following:
      a. Character of work.
      b. Name of subcontractor.
      c. Period of guarantee or warranty.
      d. Condition of guarantee or warranty
   3. Guarantees and warranties shall cover the Work under this Contract, both by Contractor and its subcontractors, and with subcontractor guarantees and warranties countersigned by Contractor.

E. Evidence of Payment and Release of Liens.

F. Bonds and Service and Maintenance Contracts, as required by the Contract Documents, executed by Contractor, subcontractor, manufacturer, and supplier as applicable.

G. Operating and Maintenance Manuals: As specified.

H. Permanent keys in accordance with requirements of Section 08 7100, "Door Hardware."

I. Evidence of compliance with requirements of governmental agencies having jurisdiction including, but not necessarily limited to:
   1. Certificates of Inspection including Project Job Cards and proof of final sign-offs and approvals by all Project Field Inspectors including, but not limited to, Building, Fire, Plumbing and Electrical representatives.
   2. Certificates of Occupancy.

J. List of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.

K. Reports of final tests by the Contractor.

L. Reports on final adjustment of equipment.

M. Verification of operation and maintenance instruction given to appropriate personnel.

N. Service and maintenance contracts, directories and schedules.

1.5 OPERATING AND MAINTENANCE MANUALS

A. Furnish not less than two complete sets of manuals containing manufacturer's instructions for maintenance and operation of each item of equipment and apparatus provided under this Contract and any additional data specifically required under various Sections of the Specifications. Except as otherwise specified, Manuals shall comply with the following:
   1. Manuals shall be 8-1/2 inches x 11 inches in size, with over-sized charts and drawings properly folded, arranged in systematic order, indexed, and suitably bound in three-ring view binders with hard plastic covers.
   2. Provide slip-in sheet for cover of each manual, with name of Project, Owner, Architect, Contractor, subcontractor, and date of Substantial Completion.
   3. Assemble separate manuals for each Specification Section or Division as appropriate.
   4. Include names and addresses of manufacturers and their local representatives for each item.
   5. Check each manual for completeness, and deliver to the Architect, unless otherwise directed.

B. Manuals should be organized into the following separate and distinct volumes (binders):
   1. "Site Work and Site Utilities."
   2. "Buildings and Structures."
   3. "Elevators."
   4. "Mechanical, HVAC."
   5. "Mechanical, Plumbing."
   6. "Fire Sprinklers."
   7. "Electrical."
   8. "Communications."
   9. "Fire Alarm System."

1.6 SUBMITTAL AND DISTRIBUTION OF CLOSEOUTS

A. Keys, spare parts, materials, etc. shall be turned over to the Owner and a receipt shall be secured by the Contractor.

B. One paper copy of all other documents shall be properly bound and submitted to the Architect for review and Owner’s approval.

1. A corrected paper original of these documents shall then be delivered to the Owner.
2. A CD-Rom, flash drive, or other digital form of these documents acceptable to the Owner's Representative, shall be provided to the Owner.

1.7 TRAINING OF OPERATING AND MAINTENANCE PERSONNEL

A. Prior to final inspection, instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment and systems.

B. Use Operation and Maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

1.8 FINAL INSPECTION AND ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete and submit the following listing any exceptions. See additional requirements included in the General Conditions.
1. Insurance certificates for products and completed operations not previously submitted.
2. A certified copy of the Architect's Substantial Completion "punch list" of items to be completed or corrected stating that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect and the Owner.
3. Final meter readings for utilities and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
4. Evidence of final, continuing insurance coverage complying with insurance requirements.

B. Final Inspection: When Contractor considers that the Work is complete, including inspection list items from earlier inspections, except for items whose completion is delayed under circumstances acceptable to the Architect and Owner's Representative, it shall submit certified Contractor's "Notice of Completion" that:
1. Contract Documents have been reviewed.
2. Work has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents.
4. Equipment and systems have been tested in the presence of the Architect and are operational.
5. Work is completed and ready for final review.

C. Within 7 business days from receipt of the "Contractor's Notice of Completion," the Architect, Owner's Representative, and Contractor shall make a joint inspection of the Work.

D. If deficiencies, incomplete Work, or obligations that have not been fulfilled but required for final acceptance are observed, they will be listed by the Architect in a written memo to Contractor and Owner. Contractor shall complete all listed deficiencies in a timely manner until Work is in acceptable condition and so certify in writing.

E. If necessary, inspection will be repeated.

F. The Architect will notify the Contractor in writing when the Owner and Architect verify total completion of the Project. The Contractor shall then proceed with preparation of the final Application and Certificate for Payment.

1.9 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final Application for Payment to the Architect reflecting all adjustments to the Contract Sum as follows.
   1. The original Contract Sum.
   2. Additions and deductions resulting from:
      a. Previous Change Orders.
      b. Deductions for uncorrected Work.
      c. Other adjustments.
   3. Total Contract Sum, as adjusted.
   4. Previous payments.
   5. Sum remaining due.
   6. Receipts, if requested by Architect.

B. A final Change Order will reflect approved adjustments to the Contract Sum not previously made by Change Orders.

END OF SECTION

SECTION 01 7836

WARRANTIES

1.1 RELATED DOCUMENTS AND PROVISIONS

A. All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:
   1. General Conditions, including, without limitation, Warranty/Guarantee Information.
   2. Special Conditions.

1.2 FORMAT

A. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size.

B. Cover: Contractor shall identify each binder with typed or printed title "WARRANTIES" and shall list title of Project.

C. Table of Contents: Contractor shall provide title of Project; name, address, and telephone number of Contractor and equipment supplier; and name of responsible principal. Contractor shall identify each item with the number and title of the specific Specification, document, provision, or section in which the name of the product or work item is specified.

D. Contractor shall separate each warranty with index tab sheets keyed to the Table of Contents listing, providing full information and using separate typed sheets as necessary. Contractor shall list each applicable and/or responsible Subcontractor(s), supplier(s), and/or manufacturer(s), with name, address, and telephone number of each responsible principal(s).

1.3 PREPARATION:

A. Contractor shall obtain warranties, executed in duplicate by each applicable and/or responsible subcontractor(s), supplier(s), and manufacturer(s), within 10 days after completion of the applicable item or work. Except for items put into use with District's permission, Contractor shall leave date of beginning of time of warranty blank until the date of completion is determined.

B. Contractor shall verify that documents are in proper form, contain full information, and are notarized, when required.

C. Contractor shall co-execute submittals when required.

D. Contractor shall retain warranties until time specified for submittal.

1.4 TIME OF SUBMITTALS:

A. For equipment or component parts of equipment put into service during construction with District's permission, Contractor shall submit a draft warranty for that equipment or component within 10 days after acceptance of that equipment or component.

B. Contractor shall submit for District approval all warranties and related documents within 10 days after date of completion. Contractor must revise the warranties as required by the District prior to District's approval of Contractor’s final Application for Payment.

C. For items of work delayed beyond date of completion, Contractor shall provide an updated submittal within 10 days after acceptance, listing the date of acceptance as start of warranty period.

END OF DOCUMENT

SECTION 01 7839

PROJECT RECORD DOCUMENTS

1.1 SUMMARY

A. Section Includes: Requirements for preparing, maintaining, and submitting the Project Record documents.

1.2 DOCUMENT MAINTENANCE

A. Maintain one record copy of each of the following at the site for the Owner:
   1. Contract Drawings, Specifications, Addenda, Change Orders, RFIs and other modifications marked currently to record changes made during construction.
   2. Reviewed submittals.
   3. RFI log.
   4. Addenda log.
   5. Submittal log.
   6. Inspection reports and log.

B. Documents shall be kept in the field office and maintained in a clean, dry, legible condition.

C. The Contractor shall advise the Architect and Development Manager of changes and deviations made during construction.

D. Make documents available at all times for review by Architect, Development Manager, and Owner.

E. Comply with related requirements of the individual Specification Sections.

1.3 RECORDING

A. Label each document "PROJECT RECORD."

B. Do not permanently conceal any work until required information has been recorded.

C. Drawings:
   1. Make day-to-day changes and notations on a specially designated complete set of prints as the Work proceeds.
   2. Markings and notations shall be neatly and accurately made, using nonfading, clear, permanent markings. Use contrasting colors for different disciplines of work and where required for clarity.
   3. Drawings shall be marked to indicate:
      a. Measured depths of various elements of foundation in relation to survey or other approved datum.
      b. Measured horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.
      c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
      d. Variations in layout of buildings and improvements.
      e. Field changes of dimensions and detail.
      f. Changes made by Change Order or Construction Change Directive.
      g. Significant details not shown on the original Contract Drawings.

4. Upon completion of the Work and unless otherwise mutually agreed between Owner and Contractor, all changes and notations shall be neatly and accurately transferred by the Contractor to a complete set of Drawings as originally issued for construction. Coordinate with Architect and Development Manager on acceptable method and format for the Record Drawings.
    a. Where the Architect's Drawings are not of sufficient size and detail, the Contractor shall furnish its own drawings for incorporation of details and dimensions.
    b. Record drawings shall be signed and certified by the Contractor as to their correctness and turned over to the Architect, unless otherwise instructed.
5. Record drawings are specifically required for the following work:
    a. Electrical (include exterior lighting, sound, fire, communications, and all other related work).
    b. Plumbing.
    c. Storm, sanitary, and site drainage.
    d. Irrigation.
    e. Fire suppression system.
    f. HVAC.
    g. Fire detection and alarm.
    h. Security.

D. Specifications:
1. On a complete and designated copy of the Project Manual, legibly mark each Specification Section to record:
    a. Manufacturer, trade name, catalog number, color designation (if applicable), and supplier of each product and item of equipment actually installed.
    b. Changes made by Addendum, Change Order, or Construction Change Directive.
    c. Other matters not originally specified.
    d. Where selection of manufacturers is offered, indicate which manufacturer's product was installed.

E. Product Data: Maintain one copy of each product data submittal. Note related Change Orders and markup of Contract Drawings and Specifications.
1. Mark these documents to show significant variations in actual work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer’s installation instructions and recommendations.
2. Give particular attention to concealed products and portions of the Work that cannot be readily reviewed by direct observation.

F. Samples: Immediately prior to Substantial Completion, meet with Architect and Owner’s Representative at the Project site to determine which samples are to be transmitted to the Owner for record purposes. Comply with the instructions provided by the Owner regarding delivery to the Owner’s sample storage area.

G. Miscellaneous Record Submittals: As specified in other Specification Sections.
1. Immediately prior to Substantial Completion, complete these miscellaneous records and place in good order.
2. Identify miscellaneous records properly and bind or file, ready for continued use and reference.
3. Submit for the Owner’s records as directed.

1.4 INTERIM REVIEW

A. Project Record Documents are subject to review at time of review of payment request.

B. If Record Documents are not properly maintained, Owner may withhold all or a portion of payment to Contractor.

1.5 SUBMITTALS

A. At completion of work under the Contract, deliver Record Documents as directed.

B. Partial submittals are not acceptable, unless specifically acceptable by the Owner.

C. Submit documents specified and required by Section 01 7700, “Closeout Procedures,” and prior to claim for final Application and Certificate for Payment.

D. Accompany submittal with transmittal letter, in duplicate, containing:
   1. Date.
   2. Title of Work.
   3. Contractor's name and address.
   4. Title of each Record Document.
   5. Certification that each document, as submitted, is complete and accurate.
   6. Signature for Contractor or its authorized representative.

END OF SECTION

SECTION 01 8113

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: General requirements and procedures for the Project to obtain compliance with the District's sustainable design standards and the California Code of Regulations, Title 24, Part 11 California Green Building Standards Code (CALGreen), Chapter 5- Non-Residential Mandatory Measures for which the Contractor is responsible for actions, documentation, or both as applicable to the work under this Contract.

B. Related Requirements:
1. Construction Waste Management and Disposal: Section 01 5013; administrative and procedural requirements for salvaging, recycling, and disposing of demolition and construction waste.
2. Contract Closeout and Final Cleaning: Section 01 7700.
3. CALGreen Checklists with Mandatory and Tier requirements included on the Drawings.

1.2 DEFINITIONS

A. CALGreen: California Green Building Standards Code 2019, California Code of Regulations, Title 24, Part 11.

B. Sustainable Design Compliance shall mean compliance with CALGreen.

C. Additional words and terms used in this Section shall be as defined in CALGreen Chapter 2 and Chapter 5.

1.3 PROJECT GOAL

A. Mandatory and required CALGreen design elements bearing on the Contractor's scope of work as noted on the Project Checklist are intended to meet the District's goal of exceeding the CALGreen requirements by not less than 10 percent.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Contractor is responsible for responding to questions and requests from Architect, Owner, and the jurisdiction having authority regarding CALGreen compliance that depend on product selection or product qualities, or that depend on Contractor's procedures.

B. Responses will be considered Informational Submittals.

C. Substitutions:
1. Substitutions affecting CALGreen compliance shall be clearly stated as such.
2. The Contractor is responsible for re-submittal of calculations and documentation of products or material substitutions that affect the design elements on the Project Checklists.

1.5 SUBMITTALS

A. General:
1. Procedures: In accordance with Section 01 3300, “Submittals.”
2. CALGreen Submittals:
a. CALGreen submittals are in addition to other submittals.
b. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated CALGreen requirements.
c. Acceptable verification submittals are specified in the related Sections.
3. Refer to other Sections of the Specifications for any “Sustainable Design” submittal requirements.

B. Responses to questions and requests from Architect regarding CALGreen compliance requirements that are the responsibility of the Contractor, that depend on product selection or product qualities, and that depend on Contractor's procedures.

PART 2 - PRODUCTS

2.1 REQUIREMENTS - GENERAL

A. Provide products and procedures necessary to confirm sustainable design compliance required by the Specifications for this Project.

B. Although specific sustainable design requirements may be specified, the Contractor shall determine additional materials, techniques, means, methods and procedures necessary to comply with CALGreen.

C. Comply with requirements of CalGreen Sections and Tables specified below.

2.2 STORM WATER POLLUTION PREVENTION PLAN

A. CALGreen Section 5.106.1: Comply with requirements of this code section, District Design Standards, and related Sections specifying erosion control.

2.3 CONSTRUCTION WASTE REDUCTION

A. CALGreen Section 5.408 Construction Waste Reduction, Disposal and Recycling: Comply with requirements of this code section, District, and Section 01 5013, “Construction Waste Management and Disposal.”

2.4 BUILDING MAINTENANCE AND OPERATION

A. CALGreen Section 5.410.2.3 Commissioning Plan, and Section 5.410.2.4 Functional Performance Testing: Participate in Commissioning and provide functional performance testing as required by these code sections and as specified in Section 01 7700, “Commissioning and Contract Closeout.”

B. CALGreen Section 5.410.2.5 Documentation and Training: Provide Operations Training as required by these code sections and as specified in Section 01 7700, “Contract Closeout and Final Cleaning.”

2.5 POLLUTANT CONTROL

A. CALGreen Section 5.504.3 Covering of Duct Openings and Protection of Mechanical Equipment During Construction: Comply with requirements of this code section.

B. CALGreen Section 5.504.4 Finish Material Pollutant Control: Finish materials shall comply with requirements of this code section.
   1. Adhesives, Including Carpet and Cushion Adhesives: Comply with CALGreen Section 5.504 and Table 5.504.4.1.
      a. Evidence of Compliance: Acceptable types of evidence are:
         1) Report of laboratory testing performed in accordance with requirements.
         2) Published product data showing compliance with requirements.
         3) Certification by manufacturer that product complies with requirements.
      b. Aerosol Adhesives: Comply with CALGreen Table 5.504.4.1, and California Code of Regulations Title 17, Section 94507.
         1) Verification of Compliance: Acceptable types are:
            a) Current GreenSeal Certification.
            b) Report of laboratory testing performed in accordance with GreenSeal GS-36 requirements.
            c) Published product data showing compliance with requirements.
   2. Joint Sealants: Comply with CALGreen Table 5.504.4.2.
      a. Evidence of Compliance: Acceptable types of evidence are:
         1) Report of laboratory testing performed in accordance with requirements.
         2) Published product data showing compliance with requirements.
         3) Certification by manufacturer that product complies with requirements.
   3. Paints and Coatings: Comply with CALGreen Table 5.504.4.3.
      a. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
      b. Evidence of Compliance: Acceptable types of evidence are:
         1) Report of laboratory testing performed in accordance with requirements.
         2) Published product data showing compliance with requirements.
         3) Certification by manufacturer that product complies with requirements.
   4. Carpet:
      a. Carpets shall comply with CALGreen Section 5.504.4.4.
         1) Evidence of Compliance: Acceptable types of evidence are one of the following or the additional testing and product requirements included in code Section 5.504.4.4:
         2) Current Green Label Plus Certification.
         3) Report of laboratory testing performed in accordance with requirements.
   5. Carpet Cushion: Comply with CALGreen Section 5.504 and Table 5.504.4.1.
      a. Verification of Compliance:
         1) Meet requirements of Carpet & Rug Institute's "Green Label Program."
   6. Composite Wood Products: Provide products having no added urea-formaldehyde resins in compliance with CALGreen Section 5.504.4.5.
      a. Evidence of Compliance: Acceptable types of evidence are:
         1) Current SCS "No Added Urea Formaldehyde" certification; www.scscertified.com.
         2) Published product data showing compliance with requirements.
         3) Certification by manufacturer that product complies with requirements.
   7. Resilient Flooring Products: Comply with CALGreen Section 5.504.4.6.
      a. Provide documentation verifying that finish materials are certified to meet pollutant limits. Acceptable types of evidence are:

1) Published product data showing compliance with requirements.
2) Inclusion on one of the following lists:
   a) www.chps.net/dev/drupal/node/381
   b) www.rfci.com/int_FS-ProdCert.htm
   c) www.greenguard.org/default.aspx?tabid=135
3) Other method acceptable to enforcing agency.

8. Insulation: Comply with CALGreen Section 5.504.4.8.2 formaldehyde limits for insulation.
   a. Verification of Compliance: Documentation from manufacturer verifying thermal insulation materials meet the pollutant emission limits of one of the following.
      1) The VOC-emission limits defined in 2014 CACHPS criteria and listed on its High Performance Products Database.
      2) California Department of Public Health 2010 Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010 (also known as Specification 01350.)
9. Other Product Categories: Comply with limitations specified in related sections.

PART 3 - EXECUTION

3.1 GENERAL

A. Construction Waste Reduction: As specified in Section 01 7419, “Construction and Demolition Waste Management.”

B. Commissioning and Functional Performance Testing: Participate in Commissioning, including operations training, and provide functional performance testing as required by CALGreen and Owner.

C. Pollutant Control:
1. During storage, rough installation, and until final start-up of HVAC equipment, securely cover all ducts and air distribution component openings with plastic, tape, sheet metal or other methods acceptable to enforcing agency to reduce dust or debris collected in the system.
2. Finish materials shall comply with requirements of the Code Section referenced on the Checklists for each respective design element.

D. Comply with execution requirements of related Sections and CBC.

END OF SECTION

SECTION 02 4119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition of items indicated on the Drawings and required for completion of the Work.
   2. Disconnecting, capping or sealing, and removing of utilities.
   3. Contractor's Demolition Plan.

B. Related Requirements:
   1. Temporary Facilities and Controls: Section 01 5000; temporary construction, protection facilities, debris storage, and environmental-protection measures applicable to demolition operations.
   2. Construction Waste Management and Disposal: Section 01 5013.
   3. Structural, Mechanical, Electrical and Plumbing demolition Drawings for extent of demolition.
   4. Demolition Plan Drawings.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled, or to remain the Owner’s property.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner as directed. Salvage includes required protection, cataloging, documentation and tracking.
   1. Catalog and Documentation: Identification system including physically marking item, photography, written and/or drawn documentation which adequately describe an element or assembly for reinstallation, restoration and/or replication purposes.

C. Remove and Reinstall: Detach items from existing construction, store and protect against damage, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or recycled.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

B. Pre-Demolition Meeting: Conduct a pre-demolition meeting at project site before commencing demolition.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review demolition methods and procedures.
   3. Review protection measures for existing construction and building occupants.
   4. Report unresolved issues or conflicts to the Architect.
   5. Review and finalize Demolition Plan and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.

1.4 MATERIALS OWNERSHIP

A. Items of interest or of value to Owner will be removed prior to Contractor commencing demolition.

1.5 ACTION SUBMITTALS

A. Shop Drawings: Submit for any temporary shoring and bracing of the existing Building that may be required.
   1. Including analysis data and structural calculations for the shoring and bracing.
   2. Drawings and calculations shall be signed and sealed by the engineer in responsible charge retained by the Contractor. Engineer shall be a California licensed civil or structural engineer.
   3. Submittals will be reviewed by the Architect for general conformance with the design intent of the Contract Documents.

B. Demolition Plan as specified.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification data for demolition firm if a separate subcontractor will be used.

B. Photographs of Existing Conditions: Prior to commencement of selective salvage, and demolition work, submit photographs of existing damage on surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to selective salvage, and demolition operations.
   1. This does not, however, relieve the Contractor of the responsibility of restoring and replacing existing improvements to remain, determined by the Owner as damaged by work under this Contract, at no additional expense to Owner.

C. Inventory: After demolition is complete, submit a list of items that have been removed and salvaged, not previously removed by Owner, and that may be of value or of use to the Owner.

D. Reports: As required for demolition debris reporting as specified in Section 01 7419, “Construction and Demolition Waste Management.”

1.7 DEMOLITION PLAN

A. The Contractor shall submit a complete Demolition Plan detailing procedures and sequence for removing existing interior improvements and structural elements in a safe and controlled manner to insure stability of the structure at any given time.

B. Thoroughly investigate the condition of portions of the existing Building to be removed before proceeding with the Demolition Plan.

C. The Demolition Plan shall consist of the following:
   1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
   2. Interruption of utility services.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Details and locations of shields or other protective measures to ensure that occupants will not be endangered and improvements to remain will not be damaged.

D. Review by the Architect of the Demolition Plan, or field observations performed by the Architect, Owner, or their consultants, and Owner's Inspector will in no way relieve the Contractor of full responsibility for the Demolition Plan and procedure.

1.8 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

1.9 FIELD CONDITIONS

A. Special care shall be exercised to protect existing improvements and other items to remain.
   1. Damage or disturbance to existing facilities and items to remain shall be promptly restored, repaired, or replaced to match existing at no cost to the Owner.
   2. If the Contractor has any question as to the extent of demolition or items to remain, Contractor shall notify the Architect and request a clarification before proceeding.

B. Utility Services:
   1. Except where utilities are affected by demolition, maintain existing utilities and protect against damage during demolition operations.
   2. Utilities interfacing with demolition shall be disconnected and sealed before starting demolition operations.
   3. Coordinate interruptions with the Owner and provide temporary service as required where utilities are common to any occupants remaining in the Building.

C. Hazardous Materials: If hazardous materials are encountered, do not disturb and immediately notify Owner in accordance with the General Conditions. Materials determined by the Owner to be hazardous shall be removed by the Contractor in accordance with the provisions of the General Conditions.

PART 2 - PRODUCTS

2.1 STORAGE FACILITY

A. Salvaged materials and items shall be stored on site or off-site in storage area or facility acceptable to Owner's Representative, with dry, clean, ventilated spaces. Storage areas shall be isolated in order to prevent insect infestation of all woodwork items.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of additional demolition required.

B. Inventory and record the condition of items to be removed and salvaged.

3.2 DEMOLITION

A. Existing work to be removed shall, in general, be as indicated on the Drawings and shall include other existing materials and work necessary to install new work indicated and specified.

B. Surfaces to remain, when cut, shall be carefully restored and refinished to provide a continuous, even finish to nearest intersections.

3.3 SALVAGED ITEMS

A. Where required by the Drawings or specified and when so directed to be salvaged and/or reused or refurbished, existing materials shall be removed in the most careful manner possible to avoid damage; and, if damaged, such items shall be restored to conditions satisfactory to the Architect.

3.4 SITE RESTORATION

A. Completely fill voids resulting from demolition operations that will not be required by new construction in conformance with respective Specification Sections and as required to maintain existing Building assembly fire ratings.

3.5 REPAIRS

A. Promptly repair damage to existing improvements to remain.

B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Except for items or materials indicated to be recycled, salvaged, or otherwise indicated to remain Owner's property, promptly remove demolished materials from Project site and legally recycle or dispose of them in accordance with requirements specified in Section 01 7419, “Construction and Demolition Waste Management.”
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage outside of the Contract work area and into other Building areas.

END OFSECTION

SECTION 03 0100

CONCRETE SPALL REPAIR AND CRACK INJECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide all labor, materials, formwork, equipment and services to complete removal of damaged concrete and repair/patching of concrete to be reconstructed.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19 Concrete.

B. American Concrete Institute (ACI) PRC-224.1 “Causes, Evaluation, and Repair of Cracks in Concrete Structures”.

C. ACI RAP Bulletin 1 “Field Guide to Concrete Repair Application Procedures – Structural Crack Repair by Epoxy Injection”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve submittals prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review. Submit for review prior to installation.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturers' data on manufactured products and other concrete related materials. Demonstrate compliance with specified characteristics. Provide samples of items upon request.

D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.

1.4 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI RAP Bulletin 1.

B. Perform tests specified below in article FIELD QUALITY CONTROL.

C. Contractor shall bear the entire cost of remediation, removal, and/or replacement of concrete repairs determined defective or non-conforming, including Architect/Engineer fees for redesign.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials specified by brand name shall be delivered in undamaged packages bearing manufacturer's label and shall be brand specified or a previously submitted and approved equal.

B. Delivery, handling and storage of other materials shall conform to the applicable sections of the current editions of the various reference standards listed in this Section.

C. Protect materials from weather, temperature variations, or other damage. Sort to prevent inclusion of foreign materials.

1.6 MOCK-UP

A. Perform spall repair and/or crack injection on an inconspicuous location for review prior to commencing work

B. Provide 2 inch diameter concrete core at injected location to ensure adequate penetration and bond of epoxy. Notify Engineer for location of core. Patch core with repair mortar.

C. If determined to be acceptable mock-up may remain as part of the Work.

1.7 SCHEDULING AND SEQUENCING

A. Perform Work in existing facilities during such hours and by methods as are approved by Owner. Owner reserves the right to modify proposed schedules to eliminate conflicts and ensure use of existing facilities during the Work. Follow exactly the schedule as finally approved by Owner.

B. Organize the work and employ shop and field crew(s) of sufficient size to minimize impact on the Owner/Tenant.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Bonding Agent: Sika “Sikadur 32 Hi-Mod”, Simpson Strong-Tie “FX-752”.

B. Steel Corrosion Inhibitor: Sika “Armatec 110 EpoCem”, Simpson Strong-Tie “FX-406”.

C. Crack Injection:
1. Epoxy Surface Seal Compound: When required furnish Sika “Sikadur 31 High Mod Gel”, Simpson Strong-Tie “CIP-F” paste-over. The surface seal material shall have adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection.
2. Injection ports: per epoxy manufacturer’s recommendations.
3. Pressure Injected Epoxy:
   a. For installations above 60 degrees Fahrenheit: Sika “Sikadur 35 Hi-Mod LV” adhesive, Simpson Strong-Tie “CI-LV”. The epoxy resin adhesive shall conform to ASTM C881, Type I and IV, Grade 1, Class C, with a minimum 14-day bond strength per ASTM C882 of 2,750 psi.
   b. For cold weather installations (40 to 60 degrees Fahrenheit): Sika “Sikadur 35 Hi-Mod LV” adhesive, Simpson Strong-Tie “CI-LV FS”. The epoxy resin

adhesive shall conform to ASTM C881, Type I and IV, Grade 1, Class B, with a minimum 14-day bond strength per ASTM C882 of 2,750 psi.

D. Spall Repairs:
1. Horizontal or formed surfaces: Sika “Sikacrete 211 SCC”, Simpson Strong-Tie “FX-Rapid Setting Mortar”.

2. Vertical or overhead surfaces: Sika “SikaQuick VOH”, Simpson Strong-Tie “FX-263”.

PART 3 - EXECUTION

3.1 GENERAL CONCRETE WORK

A. Work must be performed by a contractor having not less than 5 years successful experience with comparable concrete repair projects employing personnel skilled in the restoration process and operations indicated

B. Protect finished surfaces not to be repaired from work to be done in this section.

C. Provide formwork, shoring, and bracing as required to complete work.

3.2 CRACK INJECTION WITH EPOXY

A. Equipment for Injection: Provide the type of equipment necessary to meter and mix the two injection adhesive components and inject the mixed adhesive into the crack. Follow manufacturer’s recommendations.

B. Surface Preparation: The cracks and surface adjacent to cracks or other areas of application shall be cleaned of dirt, dust, grease, oil, efflorescence or other foreign matter detrimental to bond of epoxy injection surface seal system. Use wire brushing, sandblasting, high pressure water blasting, etc per manufacturer’s instructions. Acid and other corrosives shall not be permitted. Repair area must be dry prior to product application. Manufacturer’s recommended minimum application and minimum/maximum curing temperature for substrate shall be verified.

C. Epoxy Application or Injection: In accordance with accepted procedures overseen by an experienced contractor, inject or apply epoxy compounds in strict accordance with the manufacturer's specifications and recommendations for each intended type of use. Entry ports shall be provided along the crack at intervals no greater than the thickness of the concrete (8 inch maximum spacing). Do not proceed until injected or pasted over material has gained adequate strength to continue with injection process. Perform epoxy adhesive injection continuously until all pressure-injected cracks are completely filled. The epoxy injection process should not, under any circumstances, result in any damage to the steel in the concrete.

D. Finishing and Cleaning: Excess materials, gel sealants and pastes, and plastic ports shall be removed after epoxy resin has cured. Exposed surfaces to be restored to original condition.

3.3 SPALL REPAIR OF CONCRETE

A. Remove loose/damaged concrete, sawcut straight edges with a minimum of 1/4" depth, chip and/or sand blast to assure competent concrete surfaces, expose clean aggregate surface to

1/4" minimum amplitude (ICRI CSP 9 or higher), and clean/remove rust from existing reinforcing. Remove concrete to minimum ¾ inch clear all around exposed reinforcing bars.

B. Notify Engineer for review of cleaned reinforcing.

C. If existing reinforcing steel is deemed acceptable by Engineer, coat prepared reinforcing steel with corrosion inhibitor per manufacturer's requirements. Coat prepared concrete surfaces with bonding agent per manufacturer's requirements.

D. Set formwork as required.

E. Mix and place grout per manufacturer's recommendations. Surfaces to be saturated surface dry (SSD) with no standing water unless noted otherwise. Scrub mortar into substrate, filling all pores and voids. Force grout against edge of repair, working toward the center.

F. Finishes: All finishes to match original finishes. Float, hand trowel, and edge (as for slab on grade). Remove formed edges if used (when grout has achieved sufficient set), float and hand trowel. Provide light broom, hand trowel, or other finish as required to match existing surfaces.

G. Apply curing compound or cover with water retaining materials and keep wet for 4 days minimum. Use of curing compound is limited to locations and/or conditions for which discoloration due to cure is acceptable and locations where other finishes will not be affected.

3.4 FIELD QUALITY CONTROL

A. A 2 inch diameter concrete core shall be taken for every 50 feet of injected crack (minimum 2 cores total) to verify adequate penetration and bond. Notify Engineer for location of cores. Patch core holes with repair mortar.

3.5 CLEANING

A. Remove all debris created by the work of this section.

END OF SECTION

SECTION 03 1000

CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials and equipment and all operations required to complete all formwork as indicated on the drawings; to produce shapes and configurations as shown, as required; and as specified herein, including:
   1. Forms, shores, bracing, removal and other operations as necessary for all cast-in-place concrete and masonry placed.
   2. Setting and securing anchor bolts and other metal items embedded in concrete into formwork, using materials and layouts furnished and delivered to jobsite as specified under other sections.

B. Related Sections:
   1. Pertinent Sections of Division 03 specifying concrete construction.
   2. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete foundations and formwork.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19 Concrete.

B. American Concrete Institute (ACI) PRC-347 "Guide to Formwork for Concrete".

C. American Plywood Association (APA) “Concrete Forming Guide”.

D. West Coast Lumberman Inspection Bureau (WCLIB) “Standard Grading Rules for West Coast Lumber”.

E. ACI MNL-066 “ACI Detailing Manual”.

F. ACI SPEC-301 “Specifications for Concrete Construction”.

G. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice”.

1.3 DESIGN REQUIREMENTS

A. Design, engineer, and construct formwork, shoring and bracing to conform to design and code requirements, resist imposed loads; resultant concrete to conform to required shape, line and dimension.

1.4 SUBMITTALS

A. Limitation of review: Structural Engineer's review will be required only where specifically requested for general architectural applications and features only. Contractor is responsible for structural stability, load-resisting characteristics and sufficiency of form work design.

1.5 QUALITY ASSURANCE

A. General: All form materials shall be new at start of work. Produce high quality concrete construction. Minimize defects due to joints, deflection of forms, roughness of forms, nonconforming materials, concrete or workmanship.

B. Reuse of Forms: Plywood forms may be reused, if thoroughly cleaned of all dirt, mortar, and foreign materials, and undamaged at edges and contact face. Reuse shall be subject to permission from the Architect without exception, and issued in writing. Reuse of any panel which will produce a blemish on exposed concrete, will not be permitted.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Form Materials:
   1. Non-Exposed Surface Formwork Facing: Forms for concrete which is not exposed to view, may be of plywood as specified for exposed surfaces, or square edge 1x nominal Douglas Fir, Construction Grade, S4S.
   2. Exposed Surface Formwork Facing:
      a. Forms for all exterior and interior concrete flat surfaces unless otherwise specified as board formed shall be new Douglas Fir Plywood (APA) ply, 5/8-inch, B-B Plyform, Class 1, Exterior Type, oiled and edged and edge-sealed conforming to U.S. Product Standard PS 1 in large sheet sizes to achieve joint patterns shown.
      b. All exposed concrete edges shall be chamfered 3/4" minimum or as noted on the drawings.
   3. Exposed Surface Formwork - Special Pattern Form Liner:
      a. Forms for all exterior and interior concrete flat surfaces indicated shall be as designated by Architect.

B. Earth Forms: Allowed, subject to soil standing in excavations without ravel or caving.

C. Form Release Agent: Spray-on compound, not affecting color, bond or subsequent treatment of concrete surfaces. Maximum VOC content shall comply with local requirements and California Green Building Code.

D. Accessories: Types recommended by manufacturers or referenced standards to suit conditions indicated;
   1. Anchors, spacers, void in-fill materials: sized to resist imposed loads.
   2. Form Ties: Prefabricated rod, flat band, or wire snap ties with 1" break-back or threaded internal disconnecting type with external holding devices of adequate bearing area. Ties shall permit tightening and spreading of forms and leave no metal closer than 1" to surface.

E. Corner Chamfers and Rustications: Filleted, wood strip or foam type; sizes and shapes as detailed, or 3/4 x 3/4 inch size minimum if not detailed; maximum possible lengths.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

G. Foam Block Formwork: For use only where specified on drawings to create void space under or within concrete. ASTM D6817. 1 pound per cubic foot maximum density. 10 pounds per square inch minimum compressive strength at 10% deformation. 3.5 pounds

per square inch minimum compressive resistance at 1% deformation. 8 pounds per square inch minimum compressive resistance at 5% deformation. InsulFoam Geofoam EPS15, or equivalent.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect the substrate and the conditions under which concrete formwork is to be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates and conditions.

B. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. If natural soil or compacted fill can be accurately cut and maintained, foundations and grade beams may be poured against earth without forming. Provide positive protection of trench top corners.

B. Maintain earth forms free of water and foreign materials.

3.3 ERECTION – FORMWORK

A. General: Construct formwork in accordance with calculations, and recommendations of ACI PRC-347. Construct forms to the sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in finished structure. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.
   1. Construct cambers specified in concrete members and slabs in the formwork.
   2. Schedule the work and notify other trades in ample time so that provisions for their work in the formwork can be made without delaying progress of the project. Install all sleeves, pipes, etc. for building services systems, or other work. Secure information about and provide for all openings, offsets, recessed nailing blocks, channel chases, anchors, ties, inserts, etc. in the formwork before concrete placement.
   3. Deflection: Formwork and concrete with excessive deflection after concrete placement will be rejected. Excessive deflection is that which will produce visible and noticeable waves in the finished concrete.
   4. Measure formwork for elevated structural slabs, columns, wall elevations points of maximum camber and submit in writing to the Architect/Engineer prior to placing concrete.

B. Formwork Construction: Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301. Uniform, substantial and sufficiently tight to prevent leakage of concrete paste, readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Tie, brace, shore, and support to insure stability against pressures from any source, without failure of any component part and without excessive deflection. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

C. Provide all openings, offsets, inserts, anchorages, blocking, and other features of the work as shown or required. See INSERTS, EMBEDDED PARTS, AND OPENINGS for detailed requirements.

D. Warped, checked, or scuffed forms will be rejected.

E. Maintain membranes, reinforcing and other work free of damage; protect with plywood runway boards or other positive, durable means.

F. Align joints and make watertight. Keep form joints to a minimum.

G. Provide fillet and chamfer strips on external corners of exposed locations and as indicated to form patterns in finished work. Extend patterns around corners and into alcoves, on backs of columns and similar locations not otherwise shown.
   1. Produce beveled, smooth, solid, unbroken lines, except as otherwise indicated to conform to patterns.
   2. Form corners and chamfers with 3/4 inch x 3/4 inch strips, unless otherwise indicated, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer at changes in direction

H. Unexposed corners may be formed either square or chamfered.

I. Ties and Spreaders: Arrange in a pattern acceptable to the Architect when exposed. Snap-ties may be used except at joints between pours where threaded internal disconnecting type shall be used.

J. Coordinate this section with other sections of work that require attachment of components to formwork.

K. Reglets and Rebates: Accurately locate, size, and form all reglets and rebates required to receive work of other trades, including flashing, frames, and equipment.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not allow excess form coating material to accumulate in the forms or to come into contact with reinforcement or surfaces which will be bonded to fresh concrete.

D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork will be rejected.

E. Leave no residue or stain on the face of the concrete, nor affect bonding of subsequent finishes or work specified in other sections.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.
   1. Provide openings in concrete formwork to accommodate work of other sections including those under separate contracts (if any). Size and location of openings, recesses and chases shall be in accordance with the section requiring such items. Accurately place and securely support items to be built into forms.

B. Construction Joints: Construct and locate generally as indicated on Drawings and only at locations approved by Structural Engineer, so as not to impair the strength of the structure. Form keys in all cold joints shown or required.

C. Locate and set in place items that will be cast directly into concrete.

D. Rough Hardware and Miscellaneous Metal: Set inserts, sleeves, bolts, anchors, angles, and other items to be embedded in concrete. Set embedded bolts and sleeves for equipment to template and approved shop drawings prepared by trades supplying equipment.

E. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

F. Wood Inserts and Nailers: Provide approved preservative-treated lumber. Set all required nailing blocks, grounds, and other inserts as required to produce results shown. Wood plugs shall not be used.

G. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

H. Piping: Do not embed piping in structural concrete unless locations specifically approved by Structural Engineer.

I. Conduit: Place conduit below slabs-on-grade and only as specifically detailed on structural drawings. Minimum clear distance between conduits shall be 3 diameters. Location shall be subject to Engineer's written approval and shall not impair the strength of the structure.

J. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
   1. Provide openings for the introduction of vibrators at intervals necessary for proper placement.
   2. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

K. Install Form Liner inserts in accordance with manufacturer's recommendations, to produce patterns and textures indicated.

L. Install waterstops in accordance with manufacturer's recommendations to provide continuous waterproof barrier.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.
   1. Remove all dirt, chips, sawdust, rubbish, water and foreign materials detrimental to concrete.
   2. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.7 FOOTINGS

A. Verify elevations and provide final excavation required for footings prior to placing of concrete.

3.8 EQUIPMENT BASES

A. Form concrete bases for all mechanical and electrical equipment in accordance with approved shop details furnished by other sections.

B. Sizes and locations as indicated and as required to produce results shown.

C. Provide coved base for all equipment bases placed on concrete slabs.

3.9 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI SPEC-301.

3.10 FOAM BLOCK FORMWORK

A. Blocks shall be placed on prepared leveling course for level bearing. Place adjacent blocks in tight contact together. Where placed in multiple layers, orient long axis of upper layer at 90° to lower layer, and so forth for subsequent layers. Anchor blocks as required to prevent movement prior to and during concrete placement. Do not expose to hydrocarbons, solvents, or coal tar.

3.11 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

C. Clean and repair surfaces to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

D. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.12 FORM REMOVAL

A. Do not loosen or remove forms before minimum curing period has elapsed without employment of appropriate alternate curing methods, approved by the Architect in writing.

B. Remove forms without damage to the concrete using means to insure complete safety of the structure and without damage to exposed beams, columns, wall edges, chamfers and inserts. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Do not remove forms until the concrete has hardened sufficiently to permit safe removal and the concrete has attained sufficient strength to safely support imposed loads. The minimum elapsed time for removal of forms after concrete has been placed shall be as follows:
   1. Columns and Walls: 7 days, provided members are not subjected to overhead loads.
   2. Retaining Walls: 21 days minimum.
   3. Footings: 7 days minimum. If backfilled immediately, side forms may be removed 24 hours after concrete is placed.
   4. Beams, elevated slab, and similar overhead conditions: 28 days unless adequate shoring is provided.

D. Durations listed above are minimums and are subject to extension at the sole judgment of the Architect/Engineer.

E. Reshoring: Reshore members where and if required by Formwork Design Engineer.

F. Do not subject concrete to superimposed loads (structure or construction) until it has attained full specified design strength, nor for a period of at least 14 days after placing.

G. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.13 CLEANING

A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 2000

CONCRETE REINFORCING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforcing steel work for all concrete and masonry work as indicated on the drawings and specified herein.
   2. Coordinate this work with other work affected by these operations, such as forms, electrical work, mechanical work, structural steel, masonry and concrete.

B. Related Sections:
   1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
   2. Pertinent Sections of Divisions 03 specifying concrete construction.
   3. Pertinent Sections of Divisions 04 specifying masonry construction.
   4. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete work.

1.2 REFERENCE STANDARDS

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19 Concrete.

B. American Concrete Institute (ACI) SPEC-301 “Specifications for Concrete Construction”.

C. ACI CODE-318 “Building Code Requirements for Structural Concrete and Commentary”.

D. ACI MNL-066 “ACI Detailing Manual”.

E. ASTM International (ASTM) A1064 “Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete”.

F. ASTM A615 “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”.

G. ASTM A706 “Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement”.

H. American Welding Society (AWS) D1.4 – “Structural Welding Code - Steel Reinforcing Bars”.

I. Concrete Reinforcing Steel Institute (CRSI) - “Manual of Standard Practice”.

J. CRSI - “Placing Reinforcing Bars”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer.

C. Shop Drawings: Show complete fabrication and placing details of all reinforcing steel. Comply with requirements of ACI MNL-66. Include:
1. Bar sizes and schedules;
2. Shapes of bent bars, layout and spacing of bars, location of splices.
3. Stirrup spacing, arrangements and assemblies,
4. References to Contract Document detail numbers and designations.
5. Wall elevations corresponding to elevations shown in Contract Documents.

D. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.

E. Certificates: Submit all certifications of physical and chemical properties of steel for each heat number as manufactured, including location of material in structure as specified below in Article titled QUALITY ASSURANCE. All materials supplied shall be tagged with heat numbers matching submitted Mill Test Report analyses.

F. Samples: Provide to the Owner's Testing laboratory as specified in Article SOURCE QUALITY CONTROL.

1.4 QUALITY ASSURANCE

A. Perform work of this Section in accordance with the CRSI “Manual of Standard Practice”, CRSI “Placing Reinforcing Bars”, ACI SPEC-301, and ACI CODE-318.

B. Requirements of Regulatory Agencies, refer to pertinent Sections of Division 01 and CBC.

C. Certification and Identification of Materials and Uses: Provide Owner's Testing Agency with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.
1. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.
2. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each grade of reinforcing and/or heat number in the project (i.e. foundations, walls, etc.).
3. Unidentified Material Tests: Where identification of materials by heat number to mill tests cannot be made, Owner's Testing Agency shall test unidentified materials as described below.

D. Testing and Inspection: Tests and Inspections required by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent Sections of Division 01.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with pertinent requirements of Division 01.

B. Deliver reinforcement to project site in bundles marked with durable tags indicating heat number, mill, bar size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.

C. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel: Deformed billet steel bars, ASTM A706 Grade 60 or ASTM A615 Grade 60.
   1. Welded reinforcement shall be ASTM A706, or A615 meeting carbon requirements of AWS D1.4. Welding shall conform with AWS D1.4.
   2. All reinforcement to be unfinished.
   3. ASTM A615 reinforcement at special structural concrete walls, concrete coupling beams, and special concrete moment frames shall have maximum yield stress of 78,000 psi and the tensile strength shall be greater than 125% of the actual yield strength. Test ASTM A615 reinforcement for conformance to these criteria prior to fabrication and/or installation.

B. Welded Wire Reinforcement: ASTM A1064.

C. Tie Wire: No. 16 AWG or heavier, black annealed.

D. Concrete Blocks: On-grade conditions only, as required to support reinforcing bars in position.

E. Reinforcing Supports: Plastic or galvanized steel chairs, bolsters, bar supports, or spacers sized and shaped for adequate support of reinforcement and construction loads imposed during concrete placement, meeting ACI and CRSI standards.
   1. For use over formwork: Galvanized wire bar type supports complying with CRSI recommendations. Provide plastic tips where exposed to view or weather after removal of formwork. Do not use wood, brick, or other unacceptable materials.

F. Reinforcement Splice Couplers: For use only where specified on drawings. Submit other locations proposed for use to Engineer for review. "L-Series Bar Lock" Coupler Systems for Splicing Reinforcement Bars, UES ER-0319, by Dayton-Superior Corporation.

2.2 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4), unless specifically shown otherwise. Details not specifically shown or indicated shall conform to SP-066 and specified codes and standards.
   1. Accurately shop-fabricate to shapes, bends, sizes, gauges and lengths indicated or otherwise required.
   2. Bend bars once only. Discard bars improperly bent due to fabricating or other errors and provide new material; do not re-bend or straighten unless specifically indicated. Rebending of reinforcement in the field is not allowed.

3. Do not bend reinforcement in a manner that will injure or weaken the material or the embedding concrete.
4. Do not heat reinforcement for bending. Heat-bent materials will be rejected.

B. Unacceptable materials: Reinforcement with any of the following defects will not be permitted in the work.
1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
2. Bends or kinks not indicated on Drawings or final shop drawings.
3. Bars with reduced cross-section due to rusting or other cause.

C. Tag reinforcement with durable identification to facilitate sorting and placing.

D. Shop Fusion Welded Stirrup/Tie/Spiral Cages
1. Shop fusion welding of stirrup/tie/spiral cages is permitted to aid in fabrication and handling. The following requirements shall be met.
2. All reinforcing bars receiving weld shall be ASTM A706.
3. Longitudinal holding wires shall be ASTM A1064.
4. Shop welding shall be performed by machines under a continuous, controlled process.
5. Quality control tests shall be performed on shop-welded specimens and the test results shall be available, upon request, to the Architect/Engineer.
6. Tack welding of reinforcing steel is not permitted.
7. Welding of any type shall not occur at 90°, 135°, or 180° bends. Circular ties and spirals may be shop fusion welded outside of areas with 90°, 135°, or 180° hook bends.
8. Longitudinal bars shall not be welded to stirrups/ties/spirals.

2.3 SOURCE QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform the following:
1. Material Testing:
a. Identified Steel: When samples are taken from bundled steel identified by heat number, matched with accompanying mill analyses as delivered from the mill, supplemental testing of reinforcing steel is not required.
b. Unidentified Steel: When identification of materials by heat number matched to accompanying mill analyses cannot be made, perform one tensile test and one bend test per each two and one-half tons or fraction thereof for each required size of reinforcing steel. Tests of unidentified steel shall be performed by the Owner's Testing Agency and costs for these tests shall be paid by the Contractor by deductive change order.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Inspect the conditions under which concrete reinforcement is to be placed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Coordinate with work of other sections to avoid conflicts or interference. Bring conflicts between reinforcement and other elements to Architect's attention. Resolve conflicts before concrete is placed.

C. Notify Architect, Structural Engineer, and Authority Having Jurisdiction for review of steel placement not less than 48 hours before placing concrete.

3.2 PLACEMENT

A. General: Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean bars free of substances which are detrimental to bonding. Maintain reinforcement clean until embedded in concrete.

C. Place reinforcement to obtain the minimum coverages for concrete protection. Do not deviate from required position. Maintain required distance, spacing and clearance between bars, forms, and ground.

D. Location and Support: Provide metal chairs, runners, bolsters, spacers and hangers, as required.

E. Provide additional steel reinforcement as necessary or as directed, to act as spreaders or separators to maintain proper positioning.

F. Tying and Attachment: Securely tie at all intersections and supports with wire. Prevent dislocation or movement during placement of concrete. Direct twisted ends of wire ties away from exposed concrete surfaces.

G. Separate reinforcing from pipes or conduits with approved non-metallic separators. Do not use wood or steel form stakes or reinforcement used as stakes as support for reinforcement.

H. Accommodate placement of formed openings required by other sections.

I. Obstructions:
1. Where obstructions, block-outs, or penetrations (conduits, raceways, ductwork) prevent continuous placement of reinforcement as indicated, provide additional reinforcing as detailed and as directed by the Structural Engineer to supplement the indicated reinforcement around the obstruction.
2. Place additional trim bars, ties, stirrups, or other elements as detailed and as directed at all opening, sleeves, pipes or other penetrations through structural elements.

J. Welded Wire Reinforcement: Reinforce slabs with 6"x 6"-W1.4 x W1.4 welded wire reinforcement reinforcing, unless otherwise noted on drawings.
1. Provide flat sheets only, no rolls. Straighten, cut to required size, and lay out flat in place.
2. Securely wire-tie reinforcement to other reinforcement at frequent intervals.
3. Extend reinforcement over supporting beams and walls, and to within 1 inch of edge of slabs, construction joints, and expansion joints.
4. Support reinforcement in mid-depth of slab.
5. Lift reinforcement at intervals as slab concrete is placed, ensure proper embedment.

3.3 REINFORCING SPACING AND COVERAGE

A. Spacing: Do not space bars closer than four (4) diameters of the largest of two adjacent bars, except at bar laps, which shall be placed such that a minimum of 2 bar diameters is clear between bars.

B. Where reinforcing in members is placed in two layers, the distance between layers shall not be less than four bar diameters of the largest bar and the bars in the upper layers shall be placed directly above those in the bottom layer, unless otherwise detailed or dimensioned.

C. Coverage of bars (including stirrups and columns ties) shall be as follows, unless otherwise shown:
1. Footings and Mat Foundation: 3 inches to any soil face, 2 inches to top.
2. Slabs (on grade): 2 inches to grade face, 1-1/2 inches to top face.
3. Slabs (elevated): 1-1/2 inches top and bottom.
4. Beam & Column: 1-1/2inches to form.
5. Walls: 1-1/2 inches clear to form and 2 inches clear to form at soil face.

3.4 DOWELS, SPLICES, OFFSETS AND BENDS

A. Provide standard reinforcement splices at splices, corners, and intersections by lapping ends, placing bars in contact, and tightly tying with wire at each end. Comply with details shown on structural drawings and requirements of ACI CODE-318.

B. Provide minimum 1-1/2 inch clearance between sets of splices. Stagger splices in horizontal bars so that adjacent splices will be 4 feet apart.

C. Laps of welded wire reinforcement shall be at least two times the spacing of the members in the direction lapped but not less than twelve inches.

D. Splices of reinforcement shall not be made at points of maximum stress. Provide splice lengths as noted on the structural drawings, with sufficient lap to transfer the stress between bars by bond and shear.

E. Spacing:
1. Space bars minimum distance specified and all lapped bars 2 bar diameters (minimum) clear of the next bar.
2. Stagger splices of adjacent bars where possible and where required to maintain bar clearance.
3. Beam or slab top bars shall be spliced mid-span of column support and bottom bars spliced at column supports.
4. Request Architect/Engineer review prior to placement for all splices not shown on the drawings.

F. Reinforcement Couplers: Install at all locations indicated. Install couplers in accordance with manufacturer’s recommendations.

3.5 WELDING

A. No reinforcing shall be welded unless specifically indicated. No reinforcing shall be welded without prior approval of the Structural Engineer and the Authority Having Jurisdiction.

B. Only when so approved for use as noted above, all welding shall conform to AWS D1.4, ACI CODE-318, and the following;
1. All welding performed by certified welders.
2. All reinforcement requires preheat prior to welding. All preheat and welding shall be continuously inspected by the Testing Agency.

3.6 MISPLACED REINFORCEMENT

A. Notify Architect/Engineer immediately if reinforcing bars are known to be misplaced after concrete has been placed.

B. Perform no correction or cutting without specific direction. Do not bend or kink misplaced bars.

C. Correct misplaced reinforcing only as directed in writing by the Architect/Engineer. Bear all costs of redesign, new, or additional reinforcing required because of misplaced bars at Contractor's expense.

3.7 FIELD QUALITY CONTROL

A. The Testing Agency as specified in the Article QUALITY ASSURANCE, will inspect the work for conformance to contract documents before concrete placement.
   1. Inspection: Provide inspection and verification of installed reinforcement. Confirm that the surface of the rebar is free of form release oil or other coatings.
   2. Inspect all preheat and welding activities for steel reinforcement when these occur.
   3. Exception: Shallow foundations & non-structural slabs-on-grade supporting buildings of no greater than three stories and either of concrete design strength 2500psi (or greater) or supporting light-frame construction do not require special inspection. Non-structural patios, driveways, and sidewalks do not require special inspection.

3.8 CLEANING

A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Provide all labor, materials, equipment and services to complete all concrete work required, including, but not limited to, the following:
   1. Foundations, beams, columns, elevated slabs, slabs-on-ground, walls, and retaining walls.
   2. Installation of all bolts, inserts, sleeves, connections, etc. in the concrete.
   3. Joint devices associated with concrete work.
   4. Miscellaneous concrete elements, including, but not limited to: equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.
   5. Concrete curing.
   6. Coordination with other sections:
      a. Make all preparations and do all work necessary to receive or adjoin other work. Install all bolts and anchors, including those furnished by other sections, into formwork and provide all required blocking.
      b. Install all accessories embedded in the concrete and provide all holes, blockouts and similar provisions necessary for the work of other sections. Provide all patching or cutting made necessary by failure or delay in complying with this requirement at the Contractor's expense.
      c. Coordinate with other sections for the accurate location of embedded accessories.

B. Related Sections:
   1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
   2. Pertinent Sections of Division 03 specifying concrete construction.
   3. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete.
   4. Pertinent sections of other Divisions specifying floor finishes and sealants applied to concrete substrates.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19 Concrete.

B. American Concrete Institute (ACI) PRC-211.1 “Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete”

C. ACI PRC-213 “Guide for Structural Lightweight-Aggregate Concrete”.

D. ACI SPEC-301 “Specifications for Concrete Construction”.

E. ACI PRC-302.1 “Guide for Concrete Floor and Slab Construction”.

F. ACI PRC-304 “Guide for Measuring, Mixing, Transporting, and Placing Concrete”.

G. ACI SPEC-305.1 “Specification for Hot Weather Concreting”.

H. ACI SPEC-306.1 “Standard Specification for Cold Weather Concreting”.

I. ACI SPEC-308.1 “Specification for Curing Concrete”.

J. ACI CODE-318 “Building Code Requirements for Structural Concrete and Commentary”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review. Submit for review prior to fabrication.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturers' data on manufactured products and other concrete related materials such as bond breakers, cure/sealer, admixtures, etc. Demonstrate compliance with specified characteristics. Provide samples of items upon request.

D. Mix Designs: Submit Mix Designs for each structural concrete type required for work per requirements of articles CONCRETE MIXES and QUALITY ASSURANCE. Resubmit revised designs for review if original designs are adjusted or changed for any reason. Non-Structural mixes need not be submitted for review by Structural Engineer.

E. Shop Drawings: Proposed location of construction and cold joints. Proposed location of all slab construction/dowel joints, control joints, and blockouts.

F. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.

G. Batch Plant Certificates: Include with delivery of each load of concrete. Provide Certificates to the Testing Agency and the Architect/Engineer as separate submittals. Concrete delivered to the site without such certificate shall be rejected and returned to the plant. Each certificate shall include all information specified in Article SOURCE QUALITY CONTROL below.

H. Engineering Analysis: Prepared by a California-licensed Civil or Structural Engineer, justifying construction-imposed loads on slabs, beams, and walls which exceed those allowed by CBC for the specified use.
   1. 2000 lbs maximum allowable construction load without analysis.
   2. 10,000 lbs maximum allowable construction load with analysis.

I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.4 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

B. Concrete construction verification and inspection to conform to CBC 1705.3.

C. Common Sourcing: Provide each of the following materials from consistent sources for entire project.

1. Cement.
2. Fly ash.
3. Aggregate.
4. Slag Cement.

D. Follow requirements of ACI SPEC-305.1 when concreting during hot weather. Follow requirements of ACI SPEC-306.1 when concreting during cold weather.

E. Services by the Independent Testing Agency (includes "Special" Inspections) as specified in this Section and as follows:
1. Perform tests and inspections specified below in articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and reports to be in conformance with pertinent Sections of Division 01.

F. Contractor shall bear the entire cost of remediation, removal, and/or replacement of concrete determined defective or non-conforming, including Architect/Engineer fees for redesign.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials specified by brand name shall be delivered in unbroken packages bearing manufacturer's label and shall be brand specified or an approved equal.

B. Delivery, Handling and Storage of other materials shall conform to the applicable sections of the current editions of the various reference standards listed in this Section.

C. Protect materials from weather or other damage. Sort to prevent inclusion of foreign materials.

D. Specific Requirements:
1. Cement: Protect against dampness, contamination, and warehouse set. Store in weather tight enclosures.
2. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregates. Use only one supply source for each aggregate stock pile.
3. Admixtures:
a. Store to prevent contamination, evaporation, or damage.
b. Protect liquid admixtures from freezing and extreme temperature ranges.
c. Agitate emulsions prior to use.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather (Freezing or near-freezing temperatures) per ACI SPEC-306.1:
1. Heat concrete materials before mixing, as necessary to deposit concrete at a temperature of at least 50°F but not more than 90°F.
2. Do not place concrete during freezing, near-freezing weather, snow, rain or sleet unless protection from moisture and/or cold is provided.
3. Protect from freezing and maintain at a temperature of at least 50°F for not less than seven days after placing. Take special precautions to protect transit-mixed concrete.
4. No salts, chemical protection or admixture are permitted without written approval of Architect/Engineer.
5. Contractor shall maintain an air temperature log for the first 7 days after placement with entry intervals not to exceed 8 hours.

B. Hot Weather per ACI SPEC-305.1:

1. Cool concrete materials before mixing, or add ice in lieu of mix water as necessary to deposit concrete at a temperature below 85°F.
2. Do not place concrete in hot/windy weather without Architect/ Engineer review of procedures.
3. Provide sunshades and/or wind breakers to protect concrete during finishing and immediate curing operations. Do not place slab concrete at air temperature exceeding 90°F.
4. Provide modified mix designs, adding retarders to improve initial set times and applying evaporation reducers during hot/windy weather for review by Independent Testing Agency prior to use.

1.7 MOCK-UP

A. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish, as result of formwork.
   1. Panel Size: Sufficient to illustrate full range of treatment.
   2. Number of Panels: 2.
   3. Locate as indicated on drawings.

B. If requested by Architect / Engineer, cast concrete against mock-up panel. Obtain acceptance of resulting surface finish prior to erecting formwork.

C. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.

D. Mock-up may remain as part of the Work.

1.8 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 – PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 03 1000.

2.2 REINFORCEMENT

A. Comply with requirements of Section 03 2000.

2.3 MATERIALS

A. General Requirements: All materials shall be new and best of their class or kind. All materials found defective, unsuitable, or not as specified, will be condemned and promptly removed from the premises.

B. Cementitious Materials:
   1. Portland Cement: ASTM C150, Type II, low alkali conforming to CBC 1903.1.
   2. Fly Ash (Pozzolan): ASTM C618, Class F.

3. Slag Cement: ASTM C989, Grade 100 or 120.

C. Concrete Aggregates:
1. Coarse and Fine Aggregates: ASTM C33; Stone aggregate and sand. Specific source aggregate and/or sand or shrinkage characteristics as required for class of concrete specified.
2. Lightweight aggregate: ASTM C330 and C332.
3. Source shall remain constant throughout the duration of the job. The exact portions of the fine aggregates and coarse aggregates to be used in the mix shall be determined by the mix design.

D. Water: ASTM C1602. Potable, clean, from domestic source.

E. Admixtures: All admixtures shall be used in strict accordance with the manufacturer's recommendations. Admixtures containing calcium chlorides or other accelerators shall not be used without the approval of the Architect/Engineer and the Owner's Testing Laboratory.
1. Normal or Mid-Range Water Reducing Admixtures: ASTM C494 Type A, “MasterPozzolith” series or "MasterPolyheed" series by Master Builders Solutions, "WRDA" series by W.R. Grace, or equal.
2. Water Reducing Admixture and Retarder: ASTM C494 Type B or D, "MasterSet R” series or “MasterSet DELVO” series by Master Builders Solutions, "Plastiflow-R" by Nox-crete, or equal.
3. High Range Water-Reducing Admixtures: ASTM C494 Type F, "MasterRheoBuild 1000" or “MasterGlenium” series by Master Builders Solutions or equal.
4. Air Entraining Admixtures: ASTM C260, “MasterAir” series by Master Builders Solutions or equal.
5. Viscosity Modifiers: ASTM C494 Type S, “MasterMatrix VMA” series by Master Builders Solutions or equal..

F. Slurry: Same proportion of cement to fine aggregates used in the regular concrete mix (i.e. only coarse aggregate omitted); well mixed with water to produce a thick consistency.

G. High Strength Grout: See section 05 1200 or 05 1100 for requirements.

H. Dry Pack: Dry pack (used only for cosmetic concrete repairs) shall consist of:
1. One part cement to 2-1/2 parts fine aggregate (screen out all materials retained on No.4 sieve), mixed with a minimum amount of water, added in small amounts.
2. Mix to consistency such that a ball of the mixture compressed in the hand will retain its shape, showing finger marks, but without showing any surface water.

2.4 ACCESSORIES

A. Bonding Agent: ASTM C881, Type II Grade 2 Class B or C. Do not allow epoxy to set before placing fresh concrete.
1. “MasterEmaco ADH 326” by Master Builders Solutions;
2. “Rezi-Weld 1000” by W.R. Meadows.

B. Chemical Hardener: Fluorosilicate solution designed for densification of cured concrete slabs. “MasterKure HD 300 WB” by Master Builders Solutions, "LIQUI-HARD" W.R. Meadows Co, or equal.

C. Moisture-Retaining Cover: ASTM C171, type 1, one of the following;
1. Regular Curing Paper, Type I, reinforced waterproof: Fortifiber Corporation "Orange Label Sisalkraft", "Pabcotite" paper, or equal.
2. Polyethylene Film: ASTM D 2103, 4 mil thick, clear or white color.
3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd.

D. Liquid Curing Compound: ASTM C 309, Type 1, Class B, clear or translucent, 25% minimum solids, water base acrylic cure/sealer which will not discolor concrete and compatible with bonding of finishes specified in related sections. W.R. Meadows Co. “Vocomp 25” or equal. Maximum VOC content shall comply with local requirements and California Green Building Code.

E. Under Slab Water Vapor Retarder: Vapor retarder sheet to be ASTM E1745 Class A; 15 mil, single ply extruded polyolefin; permeance no greater than 0.01 U.S. Perms per ASTM E154, ASTM E96 procedure B or ASTM F1249.
1. “Stego Wrap Vapor Barrier (15mil)” by Stego Industries LLC.
2. “Vaporguard” by Reef Industries.
3. Approved Equal.

F. Evaporation Reducer: "MasterKure ER 50”, by Master Builders Solutions.

G. Permeability Reducer: Use only where specifically referred to.
1. ASTMC494 Type S.
2. Admixture Type: Xypex Chemical Corporation "XYPEX Admix C-500", Master Builders Solutions “MasterLife 300” series. Dosage: per manufacturer.
3. Surface-Applied Type: Xypex Chemical Corporation "XYPEX Concentrate. Brush application: 1.25-1.50lb/sq. yd., 5 parts powder to 2 parts water. Master Builders Solutions “MasterSeal 500”. Slurry coat: one part water to 2.25-2.5 parts powder by volume.
4. Approved equal.

2.5 JOINT DEVICES AND MATERIALS

A. Waterstops: Resilient type, meeting Corps of Engineers CRD-C 572. Consult manufacturer for appropriate product for specific use. Submit for review. Install per manufacturers recommendation. Provide W. R. Meadows “Seal Tight” PVC waterstop, Sika “Greenstreak” PVC waterstop, or approved equal.

B. Expansion Joint Filler: ASTM D1751, Nonextruding, resilient asphalt impregnated fiberboard or felt, 3/8 inch thick and 4 inches deep; tongue and groove profile.
1. Products: "Serviced Products", W.R. Meadows, Inc., "National Expansion Joint Company", "Celotex Corporation", or equal.

C. Joint Filler: ASTM D944, Compressible asphalt mastic with felt facers, 1/4 inch thick and 4 inches deep.

D. Sealant and Primer: As specified in Section 07 9000.

E. Slab Joint Sealant: Compatible with floor finishes specified in related sections.

2.6 CONCRETE MIXES

A. General requirements for mix design and submittal of structural class concrete:
1. Provide Contractor submittals to Architect/Engineer not less than 15 days before placing concrete.
2. Contractor shall review mix designs and proposed placing requirements prior to submittal for compatibility to ensure that the concrete as designed can be placed in accordance with the drawings and specifications.

3. Changes or revisions require re-submittal: All variations to approved mix designs, including changing type and/or quantity of admixtures shall be resubmitted to the Architect/Engineer for review prior to use.
4. Mix design(s) for all structural classes of concrete to be prepared by qualified person experienced in mix design. Allow for time necessary to do trial batch testing when required.
5. Preparer to provide backup data and certify in writing that mix design meets:
   a. Requirements of the specifications for concrete durability and quality;
   b. Requirements of the California Building Code and ACI CODE-318, including break histories, trial batching test results, and/or a mix designed by a California Registered Civil Engineer per ACI CODE-318 and bearing the Engineer's seal & signature.
6. Clearly note on mix designs with specified maximum W/CM if design permits addition of water on site, or clearly identify in the mix design that no water is to be added on site.
7. Deviations: Clearly indicate proposed deviations, and provide written explanation explaining how the deviating mix design(s) will provide equivalent or better concrete product(s) than those specified.
8. Include adjustments to reviewed mix designs to account for weather conditions and similar factors.

B. Proportioning - General: The following provisions apply to all mix designs:
1. Proportion concrete mixes to produce concrete of required average strength (as defined by ACI CODE-318). Select slump, aggregate sizes, shrinkage, and consistency that will allow thorough compaction without excessive puddling, spading, or vibration, and without permitting the materials to segregate, or allow free water to collect on the surface.
2. Select aggregate size and type to produce dense, uniform concrete with low to moderate shrinkage, free from rock pockets, honeycomb and other irregularities.
3. Mix designs may include water reducing and retarding admixtures to meet or exceed minimum set times (time required to place and finish) and to minimize Water-Cementitious Materials (W/CM). Minimum and maximum criteria presented in this section are guidelines and do not represent a specific mix design.
4. Cement Content: Minimum cement content indicates minimum sacks of cementitious material. Increasing cement content to increase early strengths or to achieve specified W/CM while maintaining water content is discouraged in order to minimize effects of shrinkage.
   a. Substitution of fly ash for Portland cement on an equivalent weight basis up to 25% replacement is permitted, except at high early strength concrete. Replacement in excess of 25% is not permitted unless part of a specified mix design that has been submitted for review.
   b. Substitution of slag cement for Portland cement on an equivalent weight basis up to 45% replacement is permitted, except at high early strength concrete. Replacement in excess of 45% is not permitted unless part of a specified mix design that has been submitted for review.
   c. Such substitution requests may be denied by the Engineer.
5. Water Content: Mix designs with a specified maximum W/CM may be designed with a lower WCR than specified in order to allow addition of water at the site.
6. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301 and this section.
   a. For trial mixtures method, employ independent testing agency acceptable to Architect/Engineer for preparing and reporting proposed mix designs.
7. Placement Options: Mix designs may, at the Contractor's option, be designed for either pump or conventional placement with aggregate size, slumps, etc. to be maintained as specified in this section.

C. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations and this section.

D. Special mix design requirements for interior concrete floor slabs-on-ground:
   1. Proportion concrete mixes per this specification, ACI PRC-211.1, and the requirements below:
   2. Fly Ash, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a minimum replacement of 25% and a maximum of 35%. Alternatively, slag cement, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a minimum replacement of 30% and a maximum of 45%.
   3. 200 lbs. of 3/8(-) aggregate shall be added to reduce total sand.
   4. Reduce total sand to minimum practical.
   5. Admixture dosage shall be per manufacturer's recommendations. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.

E. Special mix design requirements for high volume fly ash concrete:
   1. Proportion concrete mixes per this specification, ACI PRC-211.1, and the requirements below:
   2. Fly Ash shall be substituted for cement on a 1 lb. per 1 lb. basis, with a replacement of 50%.
   3. Minimum strength at 28 days to be 2500 psi; minimum strength at 56 days to be 3000 psi.
   4. Add 200-300 pounds 3/8" aggregate to replace portion of fine aggregate.
   5. Admixture dosage shall be per manufacturer's recommendations. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.
   6. Concrete shall be wet cured per CONCRETE CURING.

Mix Design Minimum Requirements:

Concrete Class	Coarse Aggregate Size (Inches) & Fine Aggregate[3]	Maximum W/CM or Maximum Nominal Slump & Tolerance (Inches)[1,2]	Minimum 28-Day Design Strength	Minimum Cement Sacks/per yd[4]
NON-STRUCTURAL				
1) Lean Concrete (use only where specified)	---	---	---	3.0
2) Slab on Ground Exterior (Walks & Patios)	1" x #4	W/CM = .55	2,500	4.5
STRUCTURAL				
3) Interior Slab on Ground[5]	1" x #4	W/CM = .45	3,000	6.1
4) Foundation (including stem walls)	1" x #4	W/CM = .53	3,000	5.0
5) Drilled Pier	3/4" x #4	W/CM = .53	3,000	5.0
6) High Volume Fly Ash Concrete[6]	1" x #4	W/CM = .45	See footnote 6	6.0

7. The tolerance is the maximum deviation allowable without rejection. The mix design shall be based on the nominal value specified and is without water reducing mixtures. Slump to be measured at the end of the hose.
8. The maximum W/CM is limited at time of placement as noted. No water is to be added on site such that the specified W/CM or maximum slump is exceeded without approval of the testing laboratory and the Architect/Engineer. Workability is to be achieved utilizing an acceptable mid-range to high range water reducing admixture.
9. Gradation of aggregate is per ACI CODE-318 and ASTM C33.
10. Minimum cement content includes all cementitious materials.
11. See Article 2.6E for additional requirements at interior slabs on ground.
12. See article 2.6F for additional requirements at high volume fly ash concrete.

2.7 MIXING CONCRETE

A. Batch final proportions in accordance with approved mix designs. All adjustments to approved proportions, for whatever reason, shall be reviewed by the Architect/Engineer prior to use.

B. Batch and mix concrete in accordance with ASTM C94, at an established plant. Site mixed concrete will be rejected.

C. Provide batch and transit equipment adequate for the work. Operate as necessary to provide concrete complying with specified requirements.

D. Place mixed concrete in forms within 1-1/2 hours from the time of introduction of cement and water into mixer or 300 revolutions of the drum whichever comes first. Use of, re-mixing, and/or tempering mixed concrete older than 1 hour will not be permitted.

E. Do not add water at the site to concrete mixes with a maximum specified W/CM unless the water content at batch time provides for a W/CM less than specified and this provision, including the quantity of water which may be added at the site, is specifically noted on the mix design and certification by the mix preparer. See ASTM C94 for additional requirements.

2.8 SOURCE QUALITY CONTROL

A. Services by independent Testing Agency:
1. Batch Plant Certificates: Obtain the weighmaster's Batch Plant Certificate at arrival of truck at the site. If no batch plant certificate is provided, recommend to the General Contractor that the truckload of concrete be rejected. So note in daily log, along with the location of the load of concrete in the structure if the load is not rejected.
a. Laboratory's inspector shall obtain for each transit mixer Batch Plant Certificates to verify mix design quantities and condition upon delivery to the site.
b. Certificates to include: Date, time, ingredient quantities, water added at plant and on job, total mixer revolutions at time of placement, and time of departure.
c. Concrete with specified water cement ratio: Add no water on site unless mix design and batch records each show additional water may be added. See ASTM C94 for additional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

B. Verify work of other sections is complete and tested as required before proceeding.

3.2 PREPARATION

A. Observation, Inspection and Testing:
1. Architect/Engineer: Notify not less than 2 working days before each concrete placement, for observation and review of reinforcing, forms, and other work prior to placement of concrete.
2. Testing Agency: Notify not less than 24 hours before each placement for inspection and testing.

B. Placement Records: Contractor shall maintain records of time, temperature and date of concrete placement including mix design and location in the structure. Retain records until completion of the contract. Make available for review by Testing Agency and Architect/Engineer

C. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

D. Verify location, position and inclusion of all embedded and concealed items.

E. Verify installation of vapor retarder under interior slabs on ground, as specified in related section, is complete.

F. Cleaning and Preparation:
1. Remove loose dirt, mud, standing water, and foreign matter from excavations and cavities.
2. Close cleanout and inspection ports securely.
3. Thoroughly clean reinforcement and other embedded items free from loose rust and foreign matter. Maintain reinforcing securely in place. Do not place concrete on hot reinforcing.

4. Dampen form materials and substrates on which concrete is to be placed at least 1 hour in advance of placing concrete; repeat wetting as necessary to keep surfaces damp. Do not saturate. Do not place concrete on saturated material.
   a. Thoroughly wet wood forms (except coated plywood), bottom and sides of trenches, adjacent concrete or masonry and reinforcement.
   b. Concrete slabs on base rock, dampen rock.
   c. Concrete slabs on vapor retarder, do not wet vapor retarder.
5. Verify that metal forms are clean and free of rust before applying release agent.
6. Thoroughly clean metal decking. Do not place concrete on wet deck surface.
7. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

G. Drill holes in existing concrete at locations where new concrete is doweled to existing work. Insert steel dowels and prepare connections as detailed.

H. Do not overcut at existing concrete work to remain. Contractor is responsible for repair/replacement of overcut concrete to the Owner’s satisfaction.

3.3 PIPES AND CONDUITS IN CONCRETE

A. Slabs-on-Ground:
   1. No pipe or conduit exceeding 1 inch outside diameter shall be embedded within the specified slab thickness except as specifically detailed.
   2. Do not stack or abut pipes, maintain 3 inches minimum clearance.

B. Sleeving and Wrapping:
   1. Foundations: Sleeve or wrap all individual pipe penetrations, minimum 1-1/2 inches clear to reinforcing all around.
      a. Sleeves: PVC. Provide 1 inch minimum clear all around O.D. pipe to I.D sleeve, UNO at ends, fill void space with mastic or plastic bituminous cement.
      b. Wrapped Vertical Pipes: Provide 1/8 inch nominal sheet foam with three wraps minimum, UNO.
      c. Wrapped Horizontal Pipes: Provide 1/8 inch nominal sheet foam with eight wraps minimum, UNO.
      d. Underground Fire Lines 4” and Larger: At sleeves provide 2 inch minimum clear all around O.D. pipe to I.D sleeve. At wrapped pipes, provide 1/8 inch nominal sheet foam with sixteen wraps minimum.
   2. Slabs or Curbs: Wrap pipes as described above.

C. Space groups of pipes/conduits at least 3 sleeve diameters apart, do not interrupt specified concrete and reinforcement.
   1. Provide block-outs as detailed when grouping of pipes/conduits in foundation or other structural member prevents spacing as described. Notify Architect/Engineer for review of any conditions not conforming to details.
   2. Center pipe/conduit penetrations in the depth and/or thickness of foundations.
   3. Maximum size of pipe/conduit penetrations shall not exceed the least dimension of concrete divided by 3.

D. Do not embed pipes/conduits in concrete slabs on metal deck.

E. Provide the following at pipes/conduits detailed to be embedded in a concrete beam, wall or column:
   1. Place as near as possible to center of member with reinforcing as specified on each side.
   2. Where reinforcing is located near or at center of member, place pipe or conduit 1 inch minimum clear from reinforcing and provide #3 at 12 inches on center perpendicular

to the pipe/conduit. Reinforcing to extend 12 inches minimum past pipe/conduit each side.

3. Maintain ¾ inch clear minimum from added reinforcing to face of concrete where not exposed to weather and 1-1/2 inches clear where exposed to weather.
4. Space embedded items (groups of pipe/conduit, junction boxes or other elements) minimum 3 inches apart.
5. Provide reinforcing in walls, beams, columns as detailed for groups of pipe/conduit. Provide minimum replacement reinforcement of same size and number for interrupted or displaced reinforcement for the full height, length, width of the wall, beam, and/or column on each side of the “effective opening.”

3.4 CONCRETE PLACEMENT

A. Transporting:
1. Provide clean, well-maintained equipment of sufficient quantity and capacity to execute the work and produce concrete of quality specified.
2. Handle and transport concrete from mixer to final deposit location as rapidly as practicable. Prevent separation or loss of ingredients.

B. Perform concrete placement by methods which will not puncture, damage or disturb vapor retarder membrane. Repair all damage to vapor retarder membrane before covering.

C. Placement - General: Placement, once started, shall be carried on as a continuous operation until section of approved size and shape is completed. Provide construction joints as detailed on the drawings. Engineer's written approval required for all deviations.
1. Deposition:
   a. Deposit concrete to maintain an approximately horizontal plastic surface until the completion of the unit placement.
   b. Deposit as neatly as practicable in final position, minimize re-handling or flow.
   c. Do not drop concrete freely where reinforcing bars, embeds, or obstructions occur that may cause segregation. Provide spouts, elephant trunks, or other means to prevent segregation during placement.
2. Depth: Layered placement in columns and walls shall not exceed ten feet vertical depth.
   a. Place concrete in minimum 32 inch horizontal lifts.
   b. Schedule placement to ensure that concrete will not take initial set before placement of next lift.
   c. No horizontal cold joints are allowed in columns or walls.
3. Progress Cleaning: Remove all concrete spilled on forms or reinforcing steel in portions of structure not immediately concreted. Remove completely before concrete sets.
4. Interruptions: Shut down placement operations and dispose of all remaining mixed concrete and concrete in hoppers or mixers following all interruption in placement longer than 60 minutes.
   a. If such interruption occurs, provide new or relocate existing construction joints as directed by Engineer.
   b. Cut concrete back to the designated line, cleaning forms and reinforcing as herein specified.
   c. Prepare for resumption of placement as for new unit when reason for interruption is resolved.

D. Placement - Elevated Structural Systems: Place as noted for "General" above and as follows:
1. Metal Decking and Structural Steel Beam Systems that are not to be shored: Locate screed lines on primary structural members. Review proposed screed line locations

and expected structural deflections with the Architect/Engineer prior to placement of concrete.

2. Place screed lines to match camber of primary girders made of material other than concrete. Locate screeds to provide the minimum specified thickness of concrete at all locations.
3. Compensate for deflection of intermediate structural members and decking by placement of additional concrete.
4. Adjust embedded items to compensate for camber and deflection. Maintain locations within specified tolerances.

E. Consolidation:
1. Consolidate all concrete thoroughly during placement with high-speed mechanical vibrators and other suitable tools. Perform manual spading and tamping to work around reinforcement, embedded fixtures, and into corners of formwork as required to obtain thorough compaction.
   a. Provide vibrators with sufficient amplitude for adequate consolidation.
   b. Use mechanical vibrators at each point of concrete placement.
   c. Keep additional spare vibrators, in addition to those required for use, at the site for standby service in case of equipment failure.
2. Consolidate each layer of concrete as placed.
   a. Insert vibrators vertically at points 18 to 30 inches apart; work into top area of previously placed layer to reconsolidate, slowly withdraw vibrator to surface.
   b. Avoid contact of vibrator heads with formwork surfaces.
   c. Systematically double back and reconsolidate wherever possible. Consolidate as required to provide concrete of maximum density with minimized honeycomb

F. Unacceptable Materials:
1. Do not place concrete that has started to set or stiffen. Dispose of these materials.
2. Do not add water on site to concrete except as specified in the approved mix design, see PART 2 above.

G. Protection of installed work:
1. Do not introduce any foreign material into any specified drainage, piping or duct systems.
2. Contractor shall bear all costs of work required to repair or clean affected work as a result of failure to comply with this requirement.

3.5 CONCRETE JOINTS

A. Structural Joints (Construction/Cold Joints):
1. Locate joints only where shown, or as approved.
2. Review Required: Joints not indicated on the plans shall be located to meet the minimum requirements below, shall not impair the strength of the structure and shall be submitted to Architect/Engineer for review prior to placement of concrete.
   a. Indicate proposed location(s) of construction/cold/expansion joints on shop drawing submittals for review prior to placing concrete.
3. Clean and roughen all surfaces of previously placed concrete at construction joints by washing and sandblasting to expose aggregate to 1/4 inch amplitude.
4. Slabs-On-Ground: Maximum Length of continuous placement shall not exceed 60 feet without special review by the Architect/Engineer. Alternate or stagger placement sections.
5. Foundations, Beams, Elevated Slabs and Joists: Maximum Length of continuous placement shall not exceed 200 foot increments. Provide “keyed” shut-off locations made up with form boards. Extend reinforcing one lap length or more through shut-off.

a. All reinforcement shall be continuous through construction/cold joint, lapping to adjacent reinforcing in future placement.
b. Construction Joints in Elevated Slabs: Review all proposed locations with Architect/Engineer.
c. Construction Joints in Slabs on Metal Decking: Review all proposed locations with Architect/Engineer. Do not locate closer than 48 inches of centerline of beam.

6. Horizontal Construction Joints: Place 2 inch slurry (specified concrete mix less coarse aggregate) at beginning of pour at the bottom of walls unless a prior review of a mock-up section demonstrates that segregation of aggregate will not occur.

B. Expansion/Construction Joints (Dowel Joints and Control Joints):
1. Interior and Exterior Slabs-on-Ground:
a. Expansion/Construction Joints: Provide dowel joints or control joints at a maximum dimension (in feet) of three times the slab thickness (in inches) in each direction unless noted otherwise (15'-0" maximum). Install joints to match slab level and in straight lines. Locate joints at all reentrant corners including blockouts.
b. Proportions: Install joints to divide slab into rectangular areas with long dimensions less than 1.5 times short dimension.
2. Exterior Concrete Slabs-on-Ground (walkways, patios):
a. Expansion/ construction joints: Provide a 2 inch deep troweled groove or asphalt impregnated joint material embedded 50 percent of the slab depth at 12 feet on center, maximum.
b. Proportions: Place no section with a length larger than two times width. Additionally, place joints at all inside corners and at all intersections with other work.

C. Joint Types:
1. Dowel Joint: A keyed joint with smooth dowels passing through to allow unrestricted movement due to contraction and expansion. Joints are as specified on the drawings.
2. Control Joint(s): Shrinkage crack control joints may be of the following types when shown on the drawings. Install joints in a straight line between end points with edges finished appropriate to type. Depth shall be 25% of the slab thickness, unless noted otherwise. Fill joints with sealant as shown on the drawings or as required by related sections.
a. 1/4 inch wide troweled joint.
b. Keyed joint: Only at locations where concealed by other finishes.
c. Masonite Strip, 1/8 inch: Only at locations where concealed by other finishes.
d. Saw Cut, 1/8 inch: Must be performed within eight hours of completion of finishing. Do not make saw cuts if aggregate separates from cement paste during cutting operation. Prevent marring of surface finish. Fill with flexible sealant.

3.6 VAPOR RETARDER

A. Vapor Retarder Installation: Install as specified in PART 2, ASTM E1643, and per manufacturer's recommendations including taping and lapping of seams, sealing of penetrations, and repair of damage. Do not extend vapor retarder below footings.

3.7 FLATWORK

A. General Requirements for All Concrete Formed & Finished Flat:
1. Edge Forms and Screeds: Set accurately to produce indicated design elevations and contours in the finished surface, edge forms sufficiently strong to support screed type proposed.

2. Jointing: Located and detailed as indicated.
3. Consolidation: Concrete in slabs shall be thoroughly consolidated.

B. Flatwork Schedule:
1. Exterior Slabs-On- Ground: Place concrete directly over sub-base as indicated.
a. Sub-Base: Clean free-draining, crushed base rock, 4 inch minimum thickness, thoroughly compacted.
2. Interior Concrete Slabs-On- Ground:
a. Sub-Base: Clean free-draining, crushed base rock, 4 inch minimum thickness, thoroughly compacted.
b. Vapor Retarder: Install over sub-base.

3.8 FORMED SURFACES

A. Form all concrete members level and plumb, except as specifically indicated. Comply with tolerances specified in ACI CODE-318, ACI SPEC-301, and this specification, except that maximum permissible deviation is 1/4 inch end-to-end for any single member.

B. Cambers: Provide all cambers indicated in the formwork construction. Set screeds to produce specified cambers in the finished concrete.

3.9 CONCRETE FINISHES

A. Flatwork Finishing:
1. Perform with experienced operators.
2. Finish surfaces monolithically. Establish uniform slopes or level grades as indicated. Maintain full design thickness.
3. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains as indicated on drawings.
4. Flatwork Finish Types:
a. Wood Float Finish: Surfaces to receive quarry tile, ceramic tile, or cementitious terrazzo with full bed setting system, or wood frame for raised finished floors.
b. Steel Trowel Finish: Surfaces to receive carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set tile or similar finishes specified in related sections. Trowel twice, minimum.
c. Broom Texture Finish: Exterior surfaces as indicated or for which no other finish is indicated. Finish as for steel trowel finish, except immediately following first troweling, (depending on conditions of concrete and nature of finish required) provide uniform surfaces texture using a medium or coarse fiber broom.

B. Other Concrete: Provide as required to achieve appearance indicated on structural and architectural drawings and related sections.
1. Repair surface defects, including tie holes, immediately after removing formwork.
2. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
3. Exposed Form Finish: Finish concrete to match forms. Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
a. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
b. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
c. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.

4. Intermediate joint and score marks and edges: Tool smooth and flush unless otherwise indicated or as directed by the Architect.
5. Use steel tools of standard patterns and as required to achieve details shown or specified. All exposed corners not specified to be chamfered shall have radiused edges.

3.10 TOLERANCES

A. Minimum Flatwork Tolerances: Measure flatness of slabs with in 48 hours after slab installation in accordance with ACI PRC-302.1 and ASTM E1155 and to achieve the following FF and FL tolerances:
   1. Exterior surfaces: 1/8 inch minimum per foot where sloped to drain. Level otherwise. FF20 and FL15.
   2. Interior surfaces not otherwise shown or required: Level throughout. FF25 and FL20
   3. Interior surfaces required to be sloped for drainage: 1/8 inch in 10 ft.
   4. Finish concrete to achieve the following tolerances:
      a. Under Glazed Tile on Setting Bed: FF30 and FL20.
      b. Under Resilient Finishes: FF35 and FL25.
      c. Flooring manufactureer and pertainent section of Division 9.

B. Formed Surface Tolerances:
   1. Permanently Exposed Joints and Surfaces: Provide maximum differential height within two feet of, and across construction joints of 1/16 inch.
   2. Vertical Elevations: Elevation of surfaces shall be as shown or approved.

3.11 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.

E. Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels not to exceed 20 feet in either direction.

F. Screed toppings level, maintaining surface tolerances per above.

3.12 CONCRETE CURING

A. Curing - General: Cure in accordance with ACI SPEC-308.1. Maintain concrete water content for proper hydration and minimize temperature variations. Begin curing immediately following finishing.

B. Protection During Curing: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. The General Contractor is responsible for the protection of the finished slab from damage.
   1. Avoid foot traffic on concrete for minimum of 24-hours after placement.
   2. Protect concrete from sun and rain.
   3. Maintain concrete temperature at or above 50 degrees F. during the first 7 days after placement. See Article ENVIRONMENTAL REQUIREMENTS.

4. Do not subject concrete to design loads until concrete is completely cured, and until concrete has attained its full specified 28-day compressive strength or until 21 days after placement, whichever is longer.
5. Protect concrete during and after curing from damage during subsequent building construction operations. See Article PROTECTION.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
1. Normal concrete: Not less than 7 days.
2. High early strength concrete: Not less than 4 days.

D. Begin curing immediately following finishing.

E. Surfaces Not in Contact with Forms:
1. Start initial curing as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than 3 days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
2. Begin final curing after initial curing but before surface is dry.
a. Moisture-retaining cover: Seal in place with waterproof tape or adhesive.
b. Curing compound: Apply in two coats at right angles, using application rate recommended by manufacturer.
3. In addition, see specific conditions noted below.

F. Slabs on Ground: Cure by one of the following methods:
1. Water Cure (Ponding): Maintain 100 percent coverage of water over floor slab areas, continuously for minimum 7 calendar days.
2. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
3. Moisture-Retaining Film or Paper: Lap strips not less than 6 inches and seal with waterproof tape or adhesive; extend beyond slab or paving perimeters minimum 6 inches and secure at edges; maintain in place for minimum 7 days.
4. Absorptive Moisture-Retaining Covering: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides and extend beyond slab or paving perimeters 6 inches minimum; maintain in place for minimum 7 days.
5. Liquid Membrane-forming Curing Compound: Provide only when subsequent concrete treatments or finish flooring specified in related sections will not be affected by cure/sealer. Apply curing compound in accordance with manufacturer's instructions at the maximum recommended application rate in two coats, with second coat applied at right angles to first.

G. Foundations: Apply curing compound immediately after floating.

3.13 CONCRETE HARDENER

A. Apply hardener to all floor slabs not receiving other finishes after 30 days minimum curing. Clean slabs of non-compatible cure/sealers or other foreign material(s) and apply in strict accordance with the manufacturer's directions.

3.14 GROUTING AND DRY PACK

A. Set steel plates on concrete or masonry with high strength grout bed, completely fill all voids; thoroughly compact in place. See Section 05 1200 or 05 1100.

B. Bolts or inserts dry packed or grouted in place shall cure for minimum 7 days before tensioning.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspections by Independent Testing Agency: Provided verification and inspection of concrete per CBC Table 1705.3. Provide written reports for to Engineer, Architect, Contractor and Building Official for the following tests and inspections:

B. Testing & Inspection: Provide periodic inspection of reinforcing steel. Provide continuous inspection during placement of structural class concrete, 3000 psi or more. Non-structural class concrete with a design strength of 2500 psi or less to have periodic inspection on a 150 cubic yard basis as required to assure conformance.
   1. Provide periodic inspection of bolts in concrete prior to and during placement where so noted on the construction documents.
   2. Structural Concrete Cylinder Tests: Form in accordance with ASTM C31.
      a. Take four standard 6 inch x 12 inch (or five 4 inch x 8 inch) cylinder specimens on the site, of each class of concrete as specified in PART 2, not less than once a day or for each 150 cubic yards or 5000 sq ft or fraction thereof placed each day.
      b. Record the location of each concrete batch in the building in a log and also note on each specimen.
      c. Perform standard compression test of cylinders in accordance with ASTM C39, one at 7 days and two (three for 4x8 cylinders) at 28 days.
      d. Hold fourth (fifth) cylinder untested until specified concrete strengths are attained.
   3. Structural Concrete Slump Test and Air Tests: Perform slump in accordance with ASTM C143 and air content in accordance with C231 or C173 at the time of taking test cylinders, and/or at one-hour intervals during concrete placing.
   4. Measure and record concrete temperature in accordance with ASTM C1064 upon arrival of transit mixers and when taking specimens. Note weather conditions and temperature.
   5. Determine concrete density in accordance with ASTM C138 at the time of forming test cylinders.
   6. Propose adjustments to reviewed mix designs for Architect / Engineer review to account for variations in site or weather conditions, or other factors as appropriate.
   7. Water Vapor Transmission Tests: Floors receiving floor finishes specified in related sections will be tested prior to installation of flooring systems. Refer to sections specifying floor finishes for related requirements.

C. Services by Contractor:
   1. Rejection of Concrete Materials: Do not use the following without prior written approval of the Architect/Engineer;
      a. Materials without batch plant certificates.
      b. Materials not conforming to the requirements of these specifications.

3.16 ADJUSTING

A. Inspect all concrete surfaces immediately upon formwork removal. Notify Architect/Engineer of identified minor defects. Repair all minor defects as directed.

B. Surface and Finish Defects: Repair as directed by the Architect/Engineer, at no added expense to the Owner. Repairs include all necessary materials; reinforcement grouts, dry pack, admixtures, epoxy and aggregates to perform required repair.
   1. Repair minor defective surface defects by use of drypack and surface grinding. Specific written approval of Architect/Engineer is required. Submit proposed patching mixture and methods for approval prior to commencing work.

2. Slabs-on- Ground, Elevated Slabs and on Slabs on Metal Deck: Review for "curled" slab edges and shrinkage cracks prior to installation of other floor finishes. Grind curled edges flush, fill cracks of 1/16 inch and greater with cementitious grout.
3. Grind high spots, fins or protrusions caused by formwork; Fill-in pour joints, voids, rock pockets, tie holes and other void not impairing structural strength. Provide surfaces flush with surrounding concrete.

3.17 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required compressive strength, lines, details, dimensions, tolerances, finishes or specified requirements; as determined by the Architect/Engineer

B. Repair or replacement of defective concrete will be determined by the Architect/Engineer who may order additional testing and inspection at his option. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Specific Defects:
1. "Low-Strength"; Concrete Not Meeting Specified Compressive Strength after 28 days:
   a. Concrete with less than 25% Fly Ash or 35% Slag as cementitious material: Test remaining cylinder(s) at 56 days. If strength requirements are met, concrete strength is acceptable.
   b. Concrete with 25% or more Fly Ash or 35% or more Slag as cementitious material: Test remaining cylinder(s) at 70 days. If strength requirements are met, concrete strength is acceptable.
2. Excessive Shrinkage, Cracking, Crazing or Curling; Defective Finish: Remove and replace if repair to acceptable condition is not feasible.
3. Lines, Details, Dimensions, Tolerances: Remove and replace if repair to acceptable condition is not feasible.
4. Slab sections not meeting specified tolerances for trueness/flatness or lines/levels: Remove and replace unless otherwise directed by the Architect/Engineer. Minimum area for removal: Fifteen square feet area unless directed otherwise by the Architect/Engineer.
5. Defective work affecting the strength of the structure or the appearance: Complete removal and replacement of defective concrete, as directed by the Architect/Engineer.

3.18 CLEANING

A. Maintain site free of debris and rubbish. Remove all materials and apparatus from the premises and streets at completion of work. Remove all drippings; leave the entire work clean and free of debris.

B. Slabs to Receive Floor Finishes Specified in other sections: Remove non-compatible cure/sealers or other foreign material(s) which may affect bonding of subsequent finishes. Leave in condition to receive work of related sections.

3.19 PROTECTION

A. Protect completed work from damage until project is complete and accepted by Owner.

B. Construction Loads: Submit engineering analysis for equipment loads (including all carried loads) specified in article submittals.

C. Keep finished areas free from all equipment traffic for a minimum of 4 additional days following attainment of design strength and completion of curing.

D. Protection of Drainage Systems:
   1. Care shall be taken not to introduce any foreign material into any specified drainage, piping or duct system.
   2. Cost of work to repair or clean drainage system as a result of failure to comply with this requirement will be back charged to the contractor.

E. Cover traffic areas with plywood sheets or other protective devices; maintain protection in place and in good repair for as long as necessary to protect against damage by subsequent construction operations.

END OF SECTION

SECTION 03 3543

POLISHED CONCRETE FLOOR FINISH

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Honed surface treatment for concrete floors.
   2. Liquid-applied sealer and finisher.

B. Related Requirements:
   1. Cast-In-Place Concrete: Section 03 3000.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Pre-Installation Meeting: Prior to polishing floors and preparing a mockup area, conduct meeting at Project to be attended by Architect, Contractor, Owner’s Project Manager, and concrete polisher.
   1. At meeting, polisher shall demonstrate understanding of work required by reviewing and discussing procedures for preparing concrete surface, sequence of polishing operation, and sealing.
   2. Additional Agenda Items:
      a. Protecting concrete floor surfaces until polishing work begins.
      b. Protecting polished concrete floors after polishing work is completed and during remainder of construction period.
      c. Confirm location and size of mockup area.
      d. Issues with condition of existing concrete slab that will affect achieving the desired final appearance of the polished and sealed concrete.
   3. Contractor shall record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

C. Coordination: The following shall be coordinated with cast-in-place concrete work:
   1. Structural concrete with manufactured materials and methods suitable to achieve polished concrete floor system. Coordinate with polished concrete floor system manufacturer.
   2. Materials for polished concrete shall come from a single source, and shall not be changed throughout Project. Job-site mixing of materials not acceptable.
   3. Cement: ASTM C150/C150M; Type II cement; uniform color; use only one brand and type of cement.
   4. Aggregates: ASTM C33/C33M, normal weight aggregates consisting of sand or crushed stone screenings, gravel or crushed stone, clean, hard, free of deleterious matter.
      a. Aggregates: Size, type and color to match approved sample and mockup; washed; from single source and of same color for entire job.

1.3 ACTION SUBMITTALS

A. Product Data:
1. Manufacturer's published data on each finishing product proposed to be used including information on compatibility of different products and limitations.
2. Concrete Polishing Council aggregate exposure and appearance charts.

1.4 INFORMATIONAL SUBMITTALS

A. Qualifications of polisher.

B. Process and procedures used to achieve appearance of accepted mockup if at variance with this Specification.

C. Minutes of pre-installation meeting.

D. Results of field slip-resistance testing.

1.5 CLOSEOUT SUBMITTALS

A. Data on maintenance and renewal of applied finishes.

1.6 QUALITY ASSURANCE

A. Mockup: Construct mockup area under conditions and lighting similar to those that will be expected during Owner occupancy, with densifier coatings applied.
1. Notify Architect 5 business days in advance of dates and times when mockup area will be prepared.
2. Mockup Size: Approximately 10 feet by 10 feet.
3. Location: Area scheduled to receive an applied floor covering or, if not available, a Utility Room area. Coordinate location with Architect if not previously determined during the pre-installation meeting.
4. Prepare surface and apply sealer to test panel area using specified and proposed procedures and products.
5. Contractor shall allow for up to 3 mockups for initial evaluation and final approval of appearance.
6. Comply with additional requirements of Section 01 4339, “Mockup Requirements.”

1.7 FIELD CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent additional damage and staining of existing concrete surfaces to be polished. Comply with procedures and methods reviewed at the pre-installation meeting.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 - PRODUCTS

2.1 POLISHED CONCRETE FLOORING

A. Systems and Manufacturers (“PC-1”): “The RetroPlate System” by Advanced Floor Products, 888-942-3144, as specified, "Induroshine PDS-2” System by W.R. Meadows, or accepted equal.

2.2 DESIGN AND PERFORMANCE CRITERIA

A. Dry or Wet Slip Resistance:
1. After completion of final polishing and cleaning, floor shall be tested using ASTM E303 Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
a. Pendulum Test Value (PTV) shall be 45 or greater under dry and wet conditions.
b. Test results shall be reported in writing.
2. Alternative test method, such as use of a BOT-3000E digital tribometer, if proposed, shall provide results for both wet and dry conditions.

2.3 COATINGS

A. Liquid Densifier: Odorless, non-hazardous, silicate or colloidal silica that penetrates concrete to react with free lime and calcium hydroxide to produce permanent chemical reaction that hardens and densifies concrete surface; “Retro Plate 99,” or equal by system manufacturer.

B. Sealer: Water and stain repellent; “RetroPel” or equal by system manufacturer.

2.4 ACCESSORIES

A. Patching Compound: Compound composed of 40 percent portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms a paste that hardens when surface imperfections are filled.

B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.

C. Floor Protection: Flexible, heavy-duty, non-staining, vapor permeable, and FSC Certified; “Ram Board,” or equal.

2.5 POLISHING EQUIPMENT

A. Field Grinding and Polishing Equipment:
1. Variable speed, multiple head, counter-rotating, walk-behind machine with not less than 775 pounds of down pressure on grinding or diamond polishing pads.
2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.

B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.

C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Metal Bonded Pads: Grinding pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

E. Resin Bonded Pads: Polishing pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

F. Burnishing Pads: Maintenance pads for use with high speed burnishing equipment.

PART 3 - EXECUTION

3.1 POLISHING CONCRETE FLOORS

A. Decorative ground concrete shall be produced by grinding and finishing in accordance with recommendations of polished concrete materials manufacturer to achieve the following Concrete Polishing Association of America (CPAA) finish.
   1. Finish Texture, Unless Otherwise Required to Match Accepted Samples: Class B – fine aggregate.
   2. Low Gloss Appearance - Level 2, Satin Honed, with a medium sheen and Image Clarity value of 10 to 39 and a Haze Index of less than 10.
   3. Procedure: Not less than 4 step process with full refinement of each diamond pad up to 800 grit resin bonded pad with one application of densifier.

B. Initial Grinding:
   1. Use grinding equipment with metal bonded grinding pads.
   2. Begin grinding in one direction using sufficient size grit pad.
   3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 150 grit.
   4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
   5. Vacuum floor using squeegee vacuum attachment after each pass.
   6. Continue grinding until aggregate exposure matches approved field mockup.

C. Treating Surface Imperfections:
   1. Mix patching compound and grout material with dust created by grinding operations to match color of adjacent concrete surface.
   2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids.
   3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

D. Liquid Densifier Application:
   1. Apply undiluted to point of rejection, remove excess liquid, and allow to cure in accordance with manufacturer’s instructions.
   2. Verify that the floor is dry and clear of debris prior to continuation of polishing procedure.

E. Finish Grinding and Polishing:
   1. Follow manufacturer recommendations for finishing including grinding and polishing.

2. Equipment: Use equipment recommended by system manufacturer and as required to achieve finish matching approved samples and mockup.

F. Apply sealer to polished floor in accordance with manufacturer recommendations and application instructions.
1. If sealer is absorbed within 10 minutes, apply a second coat “wet-on-wet” prior to the first coating drying.
2. Treat floor with low speed buffing if any sealer residue remains on surface after application.
3. Prohibit walking on surface until sealer is completely dry.
4. Appearance of sealed floor shall match accepted mockup.

3.2 CLOSEOUT ACTIVITIES

A. Maintenance Training: A CPAA Master Craftsman or qualified representative of the polished concrete applicator shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

3.3 PROTECTION AND ADJUSTMENT

A. Comply with system manufacturer recommendations. Keep surface dry for minimum 48 hours after application.

B. Do not permit traffic on polished concrete floors for at least 72 hours.

C. Repair or replace flooring system damaged prior to acceptance by Owner.

END OF SECTION

SECTION 05 1100

STRUCTURAL AND MISCELLANEOUS STEEL

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials, equipment and operations required to complete structural and miscellaneous metals in shapes and configurations indicated; including:
   1. Structural steel columns, beams, bracing, base plates, bolts, joist hangers, and stud bolts welded to structural steel.
   2. Miscellaneous structural steel and connections; fabricated connectors and hangers installed by related sections.
   3. Anchor bolts and steel inserts embedded in concrete or masonry, installed by related sections.
   4. Fabricated steel items embedded in concrete or masonry installed by related sections.
   5. Supervision of anchor bolt setting, leveling and elevations to ensure required fit of steel work.
   6. Shop priming and field touch-up, galvanizing.
   7. Bracing, Shoring, Fabrication and Erection.

B. Related Sections:
   1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.
   2. Pertinent Sections of other Divisions specifying concrete reinforcement, formwork, concrete, structural and miscellaneous metal fabrications, steel joists, metal decking, cold-formed metal framing, rough carpentry.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 22 Steel.

B. American Institute of Steel Construction (AISC) 303 “Code of Standard Practice for Steel Buildings and Bridges”.

C. AISC 360 “Specification for Structural Steel Buildings”.

D. American Welding Society (AWS) D1.1 “Structural Welding Code - Steel”.

E. Underwriters Laboratories (UL) FRD “Fire Resistance Directory”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.

D. Shop drawings: Submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following;
   1. Profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Fabrication tolerances for all steel.
   3. Connections: All, including type and location of shop and field connections.
   4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths, type, size, and sequence. Designate demand critical welds.
   5. Cross-reference all shop drawing detail references to contract document detail references.
   6. Secure all field measurements as necessary to complete this work prior to submitting shop drawings for review.
   7. Provide holes, welded studs, etc. as necessary to secure work of other sections.
   8. Provide the following as separate submittals for each building or unit of work:
      a. Bolt and anchor setting plans.
      b. Layout, fabrication and erection drawings.

E. Certifications:
   1. Steel Materials: Submit the following for identified materials.
      a. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
      b. Mill Test Reports: Indicate structural strength, destructive test analysis, and non-destructive test analysis.
      c. Contractor's affidavit certifying that all identified steel materials provided are of the grades specified and match the certificates supplied.
   2. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification per AWS D1.1.

F. Samples: Provide samples to the Testing Agency as specified in Article SOURCE QUALITY CONTROL, at no additional costs.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies, refer to pertinent sections of Division 01 and CBC Chapter 17.

B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.

C. Certification and Identification of Materials and Uses: Provide Testing Agency with access to fabrication plant to facilitate inspection of steel. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.
   1. Test all steel as required by ASTM A6.
   2. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.
   3. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each material type and/or heat number in the project (i.e. walls, braced frames etc.).
   4. Unidentified Material Tests: Where identification of materials by heat number or mill tests cannot be made, Owner's Testing Agency shall test unidentified materials.

5. Provide all certification, verifications, and other test data required to substantiate specified material properties at no additional cost to the Owner.

D. Testing and Inspection: Tests and Inspections performed by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent sections of Division 01.

E. The following standards are the minimum level of quality required. Provide higher quality work as specifically indicated in the Contract Documents.
1. Workmanship and details of structural steel work shall conform to the CBC and AISC 360.
2. The quality of materials and the fabrication of all welded connections shall conform to AWS D1.1.
3. Comply with Section 10 of AISC 303 for architecturally exposed structural steel.

F. The Testing Agency will review all submittals and testing of materials.

G. All re-inspections made necessary by non-conforming work shall be at the Contractor's expense.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in bundles marked with durable tags indicating heat number, mill, member size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.

B. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

1.6 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel Plates: ASTM A36 or ASTM A572 Gr. 50 or ASTM A529 Gr. 50

B. Structural Steel Channels, Angles: ASTM A36 or ASTM A572 Gr. 50.

C. HSS (Hollow Structural Sections):
1. Round: ASTM A500, Gr. C.
2. Rectangular or Square: ASTM A500, Gr. C.

D. Bolts, Nuts, and Washers: ASTM A307 Grade A machine bolts with ASTM A563 Grade A nuts and ASTM F844 washers to match. See FINISHES section for galvanization, where required.

E. Anchor Bolts/Rods, Nuts, and Washers: ASTM F1554 Gr. 36 or 55 with ASTM A563 Grade A nuts and ASTM F436 Type 1 washers. Grade DH nuts where Grade 105 rod is specified. No upset thread allowed.

F. Arc-Welding Electrodes: AWS Standards E70 or equivalent, except no E70T-4 allowed.

G. Other Welding Materials: AWS D1.1; type required for materials being welded.

H. Welded Headed/Threaded Studs: ASTM A108 and AWS D1.1 Section 7. Minimum yield strength is 51,000 pounds per square inch.

I. Deformed Bar Anchors: ASTM A496.

2.2 ACCESSORIES

A. High Strength Grout: ASTM C1107, non-shrink, premixed compound consisting of aggregate, cement, and water reducing plasticizing agents. Minimum compressive strength f'c = 7000 psi at 28 days. Non-metallic where exposed to view. BASF "MasterFlow 928" or equivalent.

B. Building Structural Steel Primers: Comply with local VOC limitations of authorities having jurisdiction and the California Green Building Code. Verify compatibility with finish coats specified in other sections. Follow manufacturers printed instructions. Apply one coat unless otherwise directed.
   1. Type A: Self-Crosslinking Hydrophobic Acrylic passing 2000 hours ASTM D4585 and 7000 hours ASTM D5894. "Series 115 Uni-Bond DF" by Tnemec (2.0 to 4.0 mils DFT).
   2. Type B: Organic Zinc-Rich Urethane passing 50,000 hours ASTM B117 and 15000 hours ASTM G85. "Series 90-97 Tneme-Zinc" by Tnemec (2.5 to 3.5 mils DFT) or "Series 94-H20 Hydro-Zinc" by Tnemec (2.5 to 3.5 mils DFT).
   3. Type C: MIO-Zinc Filled Urethane passing 10,000 hours ASTM B117 and 5000 hours ASTM D4585. "Series 394 PerimePrime" by Tnemec (2.5 to 3.5 mils DFT).

C. Galvanizing: ASTM A153 and A123.

D. Touch-Up Primer for Galvanized Surfaces: Type B primer.

2.3 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal built up members by continuous welds where exposed to weather.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Protect all materials, before and after fabrication, from rust, corrosion, dirt, grease, and other foreign matter.

E. Fabricate framing members free from twists or bends. Form holes, cut and sheared edges neatly without kinks, burrs, or warped edges.

F. Exposed Steel: Straight, smooth, free of nicks, scars or dents.

G. Gas Cutting: Gas cutting of holes in a member shall not be permitted.

H. Splicing of members: Members requiring splicing due to length requirements may be spliced using full penetration butt welds when such welds and procedures are inspected and certified by the Testing Agency, in conformance with AWS and AISC standards. The location of splices shall be approved by the Architect/Engineer in writing prior to fabrication.

I. Welding: Welding of structural steel connections shall be performed by qualified welders in accordance with AWS Standards. All weld sizes shall match those shown on the drawings.
   1. Preparation: Clean all surfaces free of rust, paint and all foreign matter. Remove paint or scale by brushing, chipping or hammering as required. Chip clean and wire brush burned or flame cut edges before welding. Space and alternate welds, clamping as necessary to prevent warp or misalignment.
   2. Sequence Welding: When welds enclose, or partially enclose, the perimeter or portion of the surface of a member, make weld bead in sequence, or staggered. Minimize internal stresses. Weld groups of members occurring in a single line in staggered sequence to minimize distortion of the structural frame.
   3. Faulty and Defective Welding: Welds failing to meet AWS standards and the Contract Documents shall be rejected and remade at Contractor expense. All welds showing cracks, slag inclusion, lack of fusion, bad undercut or other defects, ascertained by visual or other means of inspection shall be removed and replaced with conforming work.
   4. Minimum Weld Strengths: All welds shall match the minimum weld sizes recommended by AISC. Details of fabrication not specifically shown shall match similar details which are specifically shown. All bevel and groove welds shall be full penetration unless size is noted otherwise.
   5. Threaded studs, headed studs, and deformed bar anchors shall be full-fusion welded conforming to ASW D1.1.

J. Camber: Fabricate all beams cambered as indicated on the drawings.
   1. Fabricate beams without camber for installation with any "natural" crown up.
   2. Exception: Fabricate cantilever beams with "crown" down.

K. Grinding: Grind smooth the following structural steel and connections;
   1. Exposed cut ends of structural and fabricated shapes.
   2. All welds exposed to view.
   3. Mitered and fit-up corners and intersections.

L. Back-Up Bars: Required for all complete penetration welds.

M. Bolt Holes: Edge, end distances and spacing shall conform to dimensions shown on the drawings, and as follows;
   1. Round: Size indicated and 1/16 inch maximum oversize, except 1 inch and larger bolts may have 1/8 inch maximum oversize.
   2. Slotted: At locations specifically noted on the drawings, provide size indicated and 1/16 inch by 1/4 inch oversize slotted in direction perpendicular to applied loads.
   3. Holes in base plates for anchor bolts may be 1/8 inch oversize.

N. Comply with Section 10 of AISC 303 for architecturally exposed structural steel (AESS). See architectural & structural drawings for locations of AESS.

2.4 FINISHES

A. Steel exposed to inclement atmospheric conditions or weather (such as coastal moisture or seasonal rain) shall be sufficiently primed or otherwise protected against corrosion. If condition of steel is suspect due to weathering/corrosion, Contractor shall bear cost of inspection to determine if excessive corrosion is present and if steel member(s) requires repair or replacement. Contractor shall bear cost of repair or replacement.

B. Prepare and finish structural and miscellaneous steel component surfaces as follows, unless a higher standard-of-care is determined necessary per item A:
   1. Unpainted, interior, dry exposure surfaces need not be primed.
   2. Finished painted, interior, dry exposure surfaces:
      a. Surface Preparation: SSPC-SP2 Hand-Tool and/or SP3 Power-Tool Cleaning. Apply Primer Type A. Field touchup with same primer.
      b. Where jobsite exposure is expected to exceed 6 months, SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning is required. Apply Primer Type B or C. Field touchup with same primer.
   3. Finish painted surfaces with exterior exposure, interior exposure subject to wet conditions or fumes, or surfaces to receive high performance finish coatings (for example epoxy or urethane coatings.
      a. Surface Preparation: SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning to create a dense, uniform angular surface profile of 2.0 mils minimum. For severe (immersion) exposure, SSPC-SP10 / NACE No. 2 Near-White Blast-Cleaning is required.
      b. Apply Primer Type B. Field touchup with same primer.
   4. Surfaces to be fire proofed need not be primed unless required by the fireproofing manufacturer or if jobsite exposure is expected to be inclement per item A. Where unprimed steel is to receive fireproofing, prepare steel surface as required by fireproofing manufacturer. If fireproofed surfaces are to be primed, provide primer as follows:
      a. Surface Preparation: SSPC-SP3 Power-Tool Cleaning.
      b. Apply Primer Type C. Field touchup with same primer.
   5. Exterior exposed (unpainted) surfaces and as otherwise indicated to receive galvanizing:
      a. Galvanize per ASTM A123 Class 55 minimum. Passivation agents are not permitted on galvanized metal that is to be painted. Provide vent holes per ASTM A385 at closed sections (such as HSS). Submit proposed location of vent holes for review by Engineer.
      b. Connection hardware shall be hot-dip galvanized per ASTM A153 or F2329. Mating bolts and nuts shall receive the same zinc-coating process.
      c. Repair all uncoated, damaged, or altered galvanized surfaces per ASTM A780.

C. Do not prime the following surfaces unless otherwise indicated:
   1. Connections to be field welded.
   2. Steel in contact with concrete.
   3. Surfaces to receive welded metal decking.

D. Do not cover up work with finish materials until inspection is complete and work is approved by the Testing Agency.

2.5 SOURCE QUALITY CONTROL

A. An independent Testing Agency will perform source quality control tests and submit reports, as specified in pertinent sections of Division 01.

B. Steel Materials Testing:
   1. No testing is required for materials identified in accordance with CBC 2202.1 (heat number, grade stencil, etc.).
   2. Unidentified steel- General: Test all structural shapes. In addition, test to verify Fy and Fu values when engineering requirements exceed Fy = 25 ksi for design.

C. Shop Welding Inspection:

1. Testing Agency shall inspect and certify all structural welds unless the fabricating shop has been accredited in conformance with CBC requirements. Submit certification to the Architect/Engineer for review and the Building Official for approval.
2. Welder Qualifications: Welding inspector shall verify that all the welders are properly qualified prior to steel fabrication and state the qualifications of each welder in the welding inspection report.
3. Welding Inspection: Continuous inspection required unless otherwise noted below. Comply with requirements of AWS D1.1.
   a. Welding Inspector shall check all welds, materials, equipment and procedures.
   b. Welding Inspector shall provide reports certifying the welding is as required and has been done in conformity with the plans, specifications and codes.
   c. Welding Inspector shall use radiographic, ultrasonic, magnetic particle, or any other necessary aid to visual inspection to assure adequacy of welds.
4. Periodic Inspection Acceptable:
   a. Single pass fillet welds not exceeding 5/16 inch.

D. Bolts, Nuts, and Washers: Provide samples to Testing Agency for required testing, at no additional cost.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Framing:
1. Erect all structural steel true and plumb.
2. Verify proper final alignment prior to making final connections.

C. Field Connections:
1. Workmanship of field bolted and welded connections shall conform in all respects to methods and tolerances specified for fabrication.
2. Field weld components indicated on shop drawings. Sequence field welds to minimize built-up stress and distortion of the structural frame. Verify sequence with Engineer. Coordinate field welding schedule with Testing Laboratory.
3. Welded Studs: Install in accordance with manufacturer's instructions and structural welding code AWS D1.1.

D. Templates: Provide bolt setting templates for all anchor bolts. Provide instructions for the setting of anchors and bearing plates, verify these items are set correctly as work progresses.

E. Column base plates: Set level to correct elevations, support temporarily on steel wedges, shims, or leveling nuts where shown, until the supported members are plumbed and base plate is grouted.
1. Grout solid the full bearing area under base plates prior to installation of floor and/or roof decks.
2. Comply with manufacturer's instructions for high strength grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

F. Bolting:
1. Inspect mating surfaces to ensure that bolt head and nut will have full bearing and that metal plies will mate flush between bolts.
2. Install bolts in matching holes. Do not distort metal or enlarge holes by drifting during assembly. Remake mismatched components to achieve tolerances indicated.
3. Holes mismatched in excess of 1/8 inch will be rejected.
4. Holes mismatched less than 1/8 inch may be reamed to the next larger size bolt.
5. Do not enlarge holes by flame cutting or air/arc (“plasma“) cutting.
6. Provide flat washer(s) at over-size holes.
7. Provide washer at bolt head and nut where connected part is less than ¼ inch thick.
8. Provide ASTM F436 beveled washers when the slope of the surfaces of parts in contact with the bolt head or nut is greater than 1:20.
9. Do not install bolts with damaged threads.
10. Threads shall commence outside of the shear plane.
11. Machine Bolts (MB): Install and tighten to a snug condition (ST) such that laminated surfaces bear fully on one another, using an impact wrench or “full effort” of an installer using a standard spud wrench.

G. Supports, Shoring and Bracing: Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing. Conform to requirements of all applicable laws and governing safety regulations. Resist imposed loads, including those of stored materials and equipment.
1. Provide all temporary supports, shoring and bracing necessary to achieve work of tolerances indicated.
2. Provide all necessary temporary flooring, planking and scaffolding required for erection of steel, and support of erection machinery.
3. Construction Loading: Do not overload the structure or temporary supports with stored materials, equipment or other loads.
4. Maintain temporary bracing and shoring until work is complete, and longer as required to ensure stability and safety of structure.

H. Do not make final connections until structure is aligned to meet specified tolerances.

3.3 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. The independent Testing Agency will perform field quality control tests, as specified in pertinent sections of Division 01.

B. Field Welding Inspection: Conform to all requirements of section SOURCE QUALITY CONTROL.
1. Inspect mating surfaces.
2. Test all materials prior to use. Use only materials meeting specified requirements.

3.5 ADJUSTING

A. Touch-up damaged finishes with compatible specified primer.

B. Replace defective or damaged work with conforming work. Replace all defective work at Contractor's expense.

C. Straighten materials by means that will not injure the materials.

D. Replace defective or damaged work which cannot be corrected in the field with new work, or return defective items to the shop for repair.

E. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.

F. Pay expenses incurred by Owner for Architect/Engineer's costs for (re-)design and obtaining approvals of Authorities Having Jurisdiction (AHJ) necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

G. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

3.6 CLEANING AND PROTECTION

A. Clean all surfaces upon completion of erection; leave free of grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave surfaces broomed clean.

B. Protect work from damage by subsequent operations.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The following metal specialties and utilitarian fabrications:
      a. Frames for overhead doors.
      b. Concealed support system for countertops and other concealed steel supports not included under other Sections.
      c. Miscellaneous framing and supports for mechanical and electrical equipment, and applications not specified in other Sections.
   2. The following decorative metal fabrications:
      a. Stainless steel backsplashes.
      b. Handrails.
   3. Shop priming.
   4. Hot-dip galvanizing.

B. Related Requirements:
   1. Delegated Design: Section 01 3573.
   2. Structural and Miscellaneous Steel: Section 05 1100.
   3. Painting and Coating: Section 09 9000; field-applied coatings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

B. Coordination:
   1. Furnish setting drawings, diagrams, templates, and directions for installing anchorages, including sleeves, inserts, anchor bolts, and items with integral anchors, to be embedded in concrete.
   2. Coordinate fabrication schedule with construction progress to avoid construction delays.
   3. Coordinate with other construction in order to ensure that actual dimensions correspond to established dimensions.

1.3 ACTION SUBMITTALS

A. Shop Drawings:
   1. Large-scale drawings for fabrication and erection of assemblies not completely shown by manufacturer's product data including, but not necessarily limited to, railings, and countertop support brackets.
      a. Include, as appropriate, plans, elevations, complete details, thicknesses, sizes, types, grades, classes of metal, connecting and joining methods, anchorages.
      b. Show required field measurements and interface with work of other Sections.
      c. Welds, both shop and field, shall be indicated by AWS "Symbols for Welding, Brazing and Nondestructive Examination," A2.4.
   2. Setting drawings, templates, instructions, and directions for installation of anchorage devices.

B. Product Data: Manufacturer's specifications for manufactured products to be used in the fabrication of work, including paint products, bolts, and other exposed hardware.

C. Delegated Design: Calculations prepared by the design engineer in responsible charge retained by the Contractor for elements requiring structural framing, support or bracing not shown on the Drawings or provided by the Project Structural Engineer to demonstrate compliance with governing code and specified performance requirements.

D. Samples:
1. Each type of exposed fastener or hardware.
2. Provide 12-inch long sample of handrail as specified.

1.4 INFORMATIONAL SUBMITTALS

A. Certification for each welder.

B. Completed “Procedure Qualification Record” (PQR) and “Welding Procedures Specification” (WPS) forms for the welds to be performed under this Specification for delegated design components.

1.5 QUALITY ASSURANCE

A. Design Engineer in Responsible Charge: A professional engineer with experience in providing engineering services of the kind required and lawfully eligible in the State of California to seal the design in accordance with state law.

B. Welding:
1. Qualifications: Certified and qualified in accordance with AWS D1.1/D.1M.
2. Procedures and operations shall comply with AWS "Standard for Welding Procedure and Performance Qualifications," B2.1.
3. Comply with AWS publication "Welding Zinc Coated Steel" for galvanized products.
4. Welding inspector's qualifications shall be in accordance with AWS D1.1/D1.1M.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel from corrosion.

B. Store packaged materials in original unbroken package or container.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.7 FIELD CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings.
1. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabrication without field measurements.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Fabrications designated as decorative metal shall conform to the recommended practices of the Architectural Products Division (AMP) of the National Association of Architectural Metal Manufacturers (NAAMM), Section 10 of the AISC Code of Standard Practice, and the additional requirements of this Section.

B. Design exterior items to be watertight and to drain properly.

C. Allow for thermal movement resulting from 100 degrees F change (range) in ambient temperatures, to prevent buckling, opening up of joints and overstressing of welds and fasteners.

D. If modifications to designs indicated are proposed in order to meet code requirements, indicate them as such on shop drawing submittals. Work with Architect to arrive at an acceptable design that is sufficiently similar to the design indicated.

E. Structural Performance of Handrails:
1. General: In engineering railing components to withstand structural loads indicated, determine allowable design working stresses of railing materials based on 60 percent of minimum yield strength.
2. Handrails:
a. Uniform load of 50 pounds per foot applied in any direction.
b. Concentrated load of 200 pounds applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

F. Industry Standards:
1. Comply with "Metal Rail Manual" of National Ornamental and Miscellaneous Metals Association (NOMMA).
2. Comply with "Pipe Railing Manual" of National Association of Architectural Metal Manufacturers (NAAMM).

G. Regulatory Requirements:
1. Comply with the Americans with Disabilities Act (ADA).
2. Comply with CBC.

2.2 METAL MATERIALS

A. General: Metal surfaces exposed to view shall not exhibit pitting, seam marks, roller marks, splice marks, mill identification markings, stains, discolorations, or other blemishes and imperfections.

B. Standard Structural Steel Shapes, Bars and Plates: ASTM A36/A36M.

C. Architectural and Miscellaneous Steel Items: ASTM A283/A283M, grade optional.

D. Steel Tubing: ASTM A500/A500M welded or seamless, grade as required for proper strength except where used structurally tubing shall have a strength of not less than Fy = 46 ksi.

E. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B for structural pipe; Grade A or Type F for railings where bending is required.

F. Stainless Steel:
1. Alloy: Type 304 at interior, unless otherwise indicated or specified.
2. Sheet and Plate: ASTM A240/A240M.
3. Bars: ASTM A276/A276M.
4. Tubing for Railings and Guardrails: ASTM A554.
5. Finish: No. 4 directional satin.

2.3 ADDITIONAL MATERIALS, COMPONENTS, AND MANUFACURED ITEMS

A. Fasteners: Provide type, grade, and class required for the particular use. Use fasteners of same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
1. Provide zinc-coated fasteners with galvanizing complying with ASTM A153/A153M for exterior use or where built into exterior walls.
2. Provide concealed fasteners for interconnecting decorative metal components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method. Exposed fasteners shall be indicated on required submittals.

B. Wood Components Associated with Decorative Metalwork: As shown and conforming to requirements specified in Section 06 4023, "Interior Architectural Woodwork."

C. Welding:
1. Electrodes: In accordance with AWS Code.
2. Welding Filler Metal for Carbon Steel: AWS A5.1 or A5.5 E70XX for SMAW welding process, AWS A5.18 ER70S-X for GMAW welding process, AWS A5.17 or A5.23 F7X-EXXX for SAW welding process, and AWS A5.20 E7XT-X for FCAW welding process.

D. Non-Metallic, Non-Shrink Grout: Premixed, conforming to ASTM C1107/C1107M, with minimum compressive strength of 5000-psi at 28-days.

E. Anchoring Cement: Erosion-resistant hydraulic expansion cement with an aged compressive strength of not less than 8,000 psi at 7 days; “Rockite,” or accepted equal.

2.4 FABRICATED AND MANUFACTURED METAL ITEMS

A. Form decorative metal to required shapes and sizes, with true lines and angles. Provide components in sizes and profiles indicated.

B. Use special care so as to avoid bending, twisting, or otherwise distorting individual members.

C. Provide rebates, lugs, and brackets as required to assemble units and to attach to other work. Drill and tap for required fasteners, unless otherwise indicated. Use concealed fasteners, unless otherwise indicated on reviewed shop drawings.

D. Joints and Connections:
1. Shop-assemble items to greatest extent possible so as to minimize field splicing and assembly. Disassemble only as necessary for shipping and handling limitations. Clearly mark items for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.
3. Detail connections to facilitate fabrication and erection in accordance with the referenced AISC code.

4. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather so as to exclude water penetration.
5. Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, and other connectors as required.
6. Fabricate and space anchoring devices as shown and required to provide adequate support for intended use.

E. Welding and Brazing: Comply with AWS-recommended practices.
1. Welds shall be continuous unless otherwise approved for a specified fabrication by Architect during submittal review.
2. Weld and braze behind finished surfaces without distorting or discoloring exposed side.
3. Remove flux from exposed welded and brazed joints. Dress exposed and contact surfaces.

F. Miscellaneous Framing and Supports: Provide as required to complete the Work.
1. Fabricate to sizes, shapes, and profiles shown or required.
2. Except as otherwise shown, fabricate from structural steel shapes, plates, and steel bars, of all-welded construction, using mitered corners, welded brackets and splice plates, and a minimum number of joints for field connection.
3. Cut, drill, and tap units to receive items anchored to the Work.

2.5 GALVANIZING

A. Provide zinc coating for ferrous metal items exposed to exterior atmosphere, shown on the Drawings, or specified to be galvanized using the hot-dip process after fabrication in accordance with ASTM A385/A385M.

B. Newly galvanized items shall not be water quenched or chromate quenched after galvanizing if they are scheduled to receive a paint coating.

C. Exterior standard bolts, cast-in-place anchor bolts, and nuts, not indicated to be stainless steel, shall be galvanized.

2.6 PROTECTIVE COATINGS

A. General:
1. Comply with manufacturer’s preparation and application instructions for each coating and NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Manufacturer’s instructions shall govern in event of conflict.
2. Coatings shall be shop-applied to the greatest extent possible, including galvanized items, except surfaces and edges to be field welded.
   a. Acrylic coating systems specified for galvanized steel products and specified in Section 09 9000 “Painting and Coating,” may be totally shop-applied, have primer applied in shop with topcoats applied in field, or be totally field-applied at Contractor’s option. Specified waterborne epoxy primer is UV stable and may be left exposed in field prior to application of finish coats.
   b. Interior non-galvanized steel shall be shop-primed and either shop or field finish painted.
3. Corrosion Control: Prevent galvanic action and other forms of corrosion by insulating metals from direct contact with incompatible materials.

4. Steel members shall be protected and be free of corrosion when ready to receive field-applied finish coatings. Apply coatings before rusting occurs.
5. Metal shall be degreased.
6. Apply air-dried primer after cleaning and pretreatment, to provide a minimum dry film thickness.
7. Finish Painting: Where not shop finished, field finish painting shall conform to requirements specified in Section 09 9000 "Painting and Coating."
8. Finish exposed fasteners to match adjacent metal.

B. Products:
1. Galvanizing-Repair Paint: Minimum 82 percent zinc-dust-content paint for regalvanizing welds in galvanized steel; Z.R.C. Cold Galvanizing Compound by ZRC Worldwide, "Drygalv" by American Solder and Flux, “Cold Galv Primer” by Valspar, or equal.
2. Shop Primers for Ferrous Metal:
   a. Interior: Modified alkyd; Tnemec Series "FD88 Azeron" or equal, 1.5 to 2.5 mils DFT.
   b. Exterior - Galvanized: Low VOC polyamidoamine epoxy, Tnemec “L69,” or equal applied at 2.0 to 3 mils DFT.
3. Field-Applied Finish Paints: As specified in Section 09 9000, “Painting and Coating.”

C. Repair galvanized coating damaged after fabrication during handling, installation, or welding. Use specified repair paint in accordance with ASTM A780/A780M, AGA publication "Recommended Practice for Touch-up of Damaged Galvanized Coatings," and manufacturer’s recommendations for application of repair paint.

D. Preparation of Galvanized Surfaces for Priming: SSPC No. 1 and additional recommendations included in the AGA document “Suggested Specification for Preparing Hot Dip Galvanized Surfaces for Painting.”

E. Shop Priming: In accordance with the following surface preparation and SSPC PA1, “Shop, Field, and Maintenance Painting.”
1. Galvanized Surfaces: As specified.
2. Concealed Items: SSPC-SP No 3, “Power Tool Cleaning.”
3. Exposed Items: SSPC-SP No. 6/NCACE No. 3 “Commercial Blast Cleaning.”

F. Powder Coating on Exterior Galvanized Steel:
1. Surface Preparation: In accordance with coating manufacturer’s requirements.
2. Finish: Polyester. High-performance powder coat; “Series 38 Super Durable” by Tiger Drylac USA, Inc., or equal in color as indicated on the Drawings or, where not indicated, as selected by Architect.

G. Field Finish Painting: As specified in Section 09 9000, “Painting and Coating.”

2.7 FABRICATION METHODS

A. General:
1. Use materials of size and thicknesses shown or required to produce adequate strength and durability in finished product for intended use.
2. Work to dimensions shown on the Drawings or accepted on shop drawings within the allowable tolerances as defined in referenced AISC Code.
3. Use type of materials shown or specified for various items of work.
4. Castings shall be sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance.

5. Form exposed work true to line and level with accurate angles and surfaces and straight, sharp edges. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
6. Weld in accordance with recommendations of AWS.
7. Provide anchorage devices and fixings where necessary for securing metal fabrications to in-place construction, including threaded fasteners for concrete and masonry inserts, through bolts, lag bolts, and other connectors as required.
8. Fabricate and space anchoring devices as shown and required to provide adequate support for intended use of work.
9. Metal fabrications shall be fabricated completely in the shop except as otherwise specified or shown on the Drawings.
10. Bent plate shall be in accordance with AISC minimum radius for bending.

B. Additional Requirements for Decorative Metal Items:
1. Form decorative metal to required shapes and sizes, with true lines and angles. Provide components in sizes and profiles indicated.
2. Use special care so as to avoid bending, twisting, or otherwise distorting individual members.
3. Use concealed fasteners, unless otherwise indicated on reviewed shop drawings.
4. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather so as to exclude water penetration.
5. Welds shall be continuous.
   a. Weld and braze behind finished surfaces without distorting or discoloring exposed side.
   b. Remove flux from exposed welded and brazed joints. Dress exposed and contact surfaces.
6. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
   a. Welds, burrs, roller marks, seams, and rough surfaces shall be ground neat and smooth.
   b. Mill markings shall be completely removed.
   c. Gouges, dents, and other surface abuse shall be filled and ground smooth.

PART 3 - EXECUTION

3.1 PREPARATION

A. At the time of connecting, bearing surfaces shall be free from loose or non-adherent rust, loose mill scale, oil, grease, dirt, mud, and any foreign matter, coating, or defect that adversely affects the connection.

B. Surface preparation for welding shall be in accordance AWS D1.1/D1.1M, except loose or non-adherent rust, loose mill scale, and paint shall be removed by wire brushing.

3.2 INSTALLATION - GENERAL

A. Install metal fabrications as shown on the Drawings in accordance with reviewed submittals and referenced standards including allowable tolerances as defined in the AISC “Code of Standard Practice for Steel Buildings and Bridges.”

B. Provide temporary bracing or anchors in formwork for items that are to be built into concrete.

C. Cut, drill, and fit as required for installation.

D. Set work accurately in location, alignment, and elevation; plumb, level, true, and free of rack; measured from established lines and levels.

E. Adjust items prior to securing in place so as to ensure proper matching of components and correct alignment.

F. Field Welding:
1. Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds and for methods used in correcting welding work.
2. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
3. Grind exposed welded joints smooth, unless otherwise specified, and restore finish to match finish of adjacent surfaces.

G. Erection Tolerances:
1. Variation from Level: Maximum 1/4 inch in any 20-foot run, noncumulative.
2. Offsets in End-to-End or Edge-to-Edge Alignment of Consecutive Members: 1/16 inch.

3.3 RAILING INSTALLATION

A. Cope neatly to fit.

B. Longitudinal members shall be parallel to each other, to floor surface, or to slope of stairs as shown.

C. Center line of members within each railing run shall be in same vertical plane.

D. Secure wall railing brackets to stud wall construction with bolts into solid backing.
1. Space brackets as shown. If not shown, then space at maximum 60 inches on center and 9 inches from end of rails.
2. Return rails to walls at ends.

E. Protect against galvanic action wherever dissimilar metals are in contact, using zinc-chromate primer on contact surfaces.

F. Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Plumb posts in each direction. Remove any burrs or protrusions that might snag fingers or clothing, grind smooth and polish.

3.4 FIELD QUALITY CONTROL

A. Wedge and expansion nut-type concrete anchor and resin/adhesive anchor installation shall be inspected in accordance with special inspection requirements of the CBC.

B. Inspection of welding shall be in accordance with AWS D1.1/D1.1M the special inspection requirements of the CBC with all welds visually inspected. Acceptance of welding inspection results shall be in accordance with AWS D1.1/D1.1M.

3.5 ADJUSTMENT AND TOUCH-UP

A. After erection, touch up abraded areas of shop paint and paint exposed areas with same material as used for shop painting.
   1. Apply by brush or spray.
   2. Touch-up shall not be noticeable.

B. Touch up galvanized surfaces as specified.

C. Return items that cannot be refinished or corrected in the field to the shop. Make required alterations and refinish entire unit, or provide new units.

3.6 PROTECTION

A. Protect finishes of decorative metal from damage during construction period as required.

END OF SECTION

SECTION 06 1000

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials and equipment and all operations required to complete all rough carpentry and structural framing as indicated on the drawings; to produce shapes and configurations as shown, as required; and as specified herein, including:
   1. Structural floor, wall, and roof framing.
   2. Floor, wall, and roof sheathing.
   3. Rough hardware, framing connectors and fasteners.
   4. Treatment of wood.
   5. Concealed wood blocking for support of toilet and bath accessories, wall cabinets, wood trim, and other work requiring supporting blocking.
   6. Miscellaneous wood nailers and furring strips, including roof applications, other wood framing, furring, shims or blocking as required to complete the work.

B. Related Sections:
   1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.
   2. Pertinent sections of Division 01 specifying Structural Product Requirements: Structural Product Options, Substitution procedures and limitations, transportation, handling and storage.
   3. Pertinent sections of Division 03 specifying wood formwork construction and/or setting anchors in concrete.
   4. Pertinent section of Division 06 specifying wood construction and materials.
   5. Pertinent sections of other divisions specifying steel or concrete construction.

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 23 Wood.

B. American National Standards Institute (ANSI) / American Wood Council (AWC) “NDS - National Design Specification for Wood Construction”.

C. National Institute of Standards and Technology (NIST) / Engineered Wood Association (APA) “PS 1 - Voluntary Product Standard for Structural Plywood”.

D. NIST / APA “PS 2 - Performance Standard for Wood-Based Structural-Use Panels”.

E. NIST “PS 20 - American Softwood Lumber Standard”.

F. Redwood Inspection Bureau (RIS) “Standard Specifications for Grades of California Redwood Lumber”.

G. West Coast Lumber Inspection Bureau (WCLIB) “Standard Grading Rules for West Coast Lumber No. 17”.

H. Western Wood Products Association (WWPA) “Western Lumber Grading Rules”.

I. American Wood Preservers Association (AWPA) “Book of Standards”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. Submit for review prior to fabrication. Submittals that do not meet these requirements will be returned for correction without review.
   1. Substitutions for products specified require conformance to substitution requirements in Division 01.
   2. Review of materials and hardware for substitution to products specified is at the additional expense of the Contractor.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer.

C. Product Data:
   1. Submit manufacturer's product data, specifications, and installation instructions for & location of framing connectors, wood preservative materials, application instructions, and fasteners. Include complete, accurate equivalence data when submitting alternate products to those specified. Provide samples of these items upon request.
   2. Submit product data and current ICC-ES report for machine-driven nails, fasteners, and equipment, including dimensions of all fasteners, including head, shank diameter and length.

D. Shop drawings: For manufactured wood products, submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following;
   1. Indicate profiles, sizes, and spacing locations of structural members.
   2. Cross-reference all shop drawing detail references to contract document detail references.
   3. Secure all field measurements as necessary to complete this work.

E. Manufacturer's Certificate: Submit all certifications of physical and chemical properties of materials as specified below in Article titled QUALITY ASSURANCE.
   1. Certify that wood products supplied for rough carpentry meet or exceed specified requirements, including specified moisture content.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies, refer to pertinent sections of Division 01 and CBC Chapter 17.

B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.

C. Inspection of fabricators is required per CBC 1704.2 unless fabricator is registered and approved by the building official. Wood product quality standards:
   1. All wood products to comply with article REFERENCES.
   2. Factory-mark each piece of lumber and sheathing with type, grade, mill, and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.
   3. Sheathing panels to be marked by APA (The Engineered Wood Association).

D. End-Jointed lumber shall not be used.

E. Hardware and engineered wood products shall have current ICC ES Evaluation/research reports that are equivalent to products specified.

F. Employ competent workers experienced in work of the types specified and required.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with pertinent requirements of Division 01.

B. Delivery: Time delivery and installation of carpentry products to avoid delaying other trades whose work is dependent on or affected by this section and to comply with moisture content, protection and storage requirements.

C. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and sheathing panels to prevent deformation and provide air circulation within stacks.
   1. Store materials for which a maximum moisture content is specified only in areas where relative humidity has been reduced to a level where specified moisture content can be maintained.
   2. Handle and store materials above ground to prevent damage, contamination, or accumulation of dirt or foreign materials.
   3. Provide special protection for horizontal sheathing panels. Deformation of panels due to moisture is not acceptable.

1.6 PROJECT/SITE CONDITIONS

A. Verify all conditions at project site affecting the work; work to field dimensions as required. Coordinate carpentry installation with size, location, and installation of service utilities.

B. Sequence rough carpentry installation activities to allow sufficient time for:
   1. Review of all submittals.
   2. Indicate submittal review, procurement, and testing activities in the project schedule prior to the start of installation. Installation durations shall be based on hand-nailed installation methods specified.
   3. Attainment of specified maximum lumber moisture content.

PART 2 - PRODUCTS

2.1 DIMENSIONED LUMBER

A. General
   1. Size per industry standards for nominal sizes shown; S4S (sanded four sides).
   2. Warped/twisted and excessively checked members shall not be used regardless of grade marks.
   3. At the Contractor’s option, engineered lumber of equivalent size and material properties may be substituted for solid sawn lumber where material is difficult to source due to length, availability, etc. Submit proposed substitution to Engineer for review prior to purchasing materials.

B. Moisture content of framing:
   1. All lumber to be maximum 19% at time of fastener installation, except 3x and 4x studs may be 25% at time of sheathing panel nailing. All lumber to be maximum 19% at time of close-in, unless noted otherwise.
   2. The Owner's Testing Laboratory will test for moisture content prior to commencement of close-in.
   3. The Contractor shall recognize that excessive shrinkage of lumber results from excess moisture content at the time of installation. The Contractor will compensate for use of such lumber by waiting for acceptable moisture content before close in and/or by replacing/repairing lumber that has sagged, twisted, or warped prior to close in.
   4. Deviation from this specification would require structural redesign of connections and fasteners.

C. Sills/ledgers on concrete or masonry: No. 2 pressure treated Douglas Fir and as called for on the drawings.

D. Interior structural framing shall be Douglas Fir (D.F.) with grades as noted below, unless otherwise specified on the drawings. All grades are per WCLIB standard grading rules.
   1. All permanently exposed (interior or protected from weather) framing shall be select structural grade with no box heart.
   2. Except per 1 above, unless noted otherwise, minimum grades are:
      a. Floor/roof joists/rafters (2x) and 2x8 & larger studs: D.F. No. 2
      b. 2x4 and 2x6 studs and plates: D.F. No. 2
      c. 4x and larger: D.F. No. 1
      d. Blocking: D.F. No. 2
      e. 6x8 and larger posts and beams may be SGL/CGL per below unless noted otherwise on the drawings.

E. Exterior structural framing (exposed to weather) shall be redwood select structural grade or pressure treated D.F. No. 1, unless noted otherwise.

F. Structural decking shall be D.F. select decking or White Pine select where not exposed to moisture. Where directly exposed to moisture or high humidity for prolonged periods of time, decking shall be Alaskan Yellow Cedar or Port Orford Cedar. Moisture content at time of installation to be less than 12%.

G. Framing not otherwise shown or specified: Douglas Fir construction grade per WCLIB paragraphs applicable to uses and sizes required.

2.2 MANUFACTURED LUMBER

A. Structural (Certified) Glued Lumber (SGL): SGL shall be manufactured following the American Lumber Standards Committee (ALSC) "Glued Lumber Policy" and meet the requirements of Voluntary Product Standard PS 20 "American Softwood Lumber Standard". Grading shall be per the West Coast Lumber Inspection Bureau (WCLIB) or Western Wood Products Association (WWPA). SGL shall be manufactured with waterproof adhesive. "Stud use only" SGL is not permitted.
   1. Acceptable products:
      a. "RMT" by Rosboro.
      b. Approved equal.
   2. Where specified for use on plan, SGL shall be entirely Douglas Fir lumber. SGL shall be grademarked to match the grade as would be specified for solid sawn lumber in the same location/use.

3. At the contractor's option, SGL may be substituted for solid sawn lumber. SGL species and grade shall match that for the solid sawn member. SGL shall not be substituted for glued-laminated (glulam) members.

B. Laminated Veneer Lumber (LVL): for use as joists, beams, blocking, or studs when so noted on the drawings. Conform to ICC AC 47. Minimum F_b = 2,600 PSI. Minimum E=2,000,000 PSI. Acceptable products:
1. “Microllam LVL” by Trus Joist, ICC ESR-1387
2. “Redlam LVL” by RedBuilt, ICC ESR-2993
3. Approved equal

2.3 STRUCTURAL SHEATHING PANELS

A. Plywood: Structural sheathing shall conform to product standard PS-1 or PS-2. All panels shall have a minimum bond classification of “Exposure 1” and bear the trademark of the Engineered Wood Association (APA) or other qualified agency. Grades shall be “Rated Sheathing” or “Structural 1” as required on the drawings.

B. Oriented Strand Board (OSB): All structural OSB shall be grade marked by a qualified agency for conformance with Product Standard PS-2 and shall be fabricated with exterior glue. Grades shall be as required on the drawings.

2.4 TREATED WOOD:

A. Treated Lumber and Plywood: Comply with requirements of AWPA Standard U1. See Standard U1 for “Use Category” designations. Do not provide higher Use Category lumber than that specified. Maximum moisture content shall be the same as required for “dimensioned lumber” as specified above.

B. Preservative Treated Lumber
1. General
   a. Preservatives shall be waterborne. Preservative retention rate shall be as required per AWPA Standards U1 & T1. Lumber shall be Douglas Fir No. 2 (or better). Cut faces of treated wood shall be brush treated (two complete applications) prior to installation.
   b. Lumber less than 8 inches above grade and lumber less than 6 inches above exterior hard-surface flatwork shall be treated.
   c. Each piece of wood shall be stamped by the wood preservative applicator to identify its treatment and preservative retention.
2. Lumber at interior, non-weather exposed locations installed adjacent to concrete or masonry shall be Use Category UC2. Examples include sill plates & ledgers and lumber in contact with roofing, flashing, or water proofing. Borate treated lumber meeting AWPA UC2 is acceptable in this application.
3. Lumber at exterior locations, not in contact with soil/ground, shall be Use Category UC3B. Examples include Douglas Fir decking and deck framing.
4. Lumber in contact with soil/ground shall be Use Category UC4A. Examples include timber retaining walls.
5. Poles, posts, and sheathing panels shall be treated as recommended by AWPA Standard U1 per use and exposure.
6. Maximum Volatile Organic Compound (VOC) content of field-applied preservative shall meet local air quality standards and the California Green Building Code. Provide either of the following:
   a. Copper Azole (CA-B) per ICC-ES AC326.
   b. Alkaline/Copper/Quaternary (ACQ).

C. Fire Retardant Treatment: Product and application process must be recommended by manufacturer of treatment as being suitable for painting. Application shall be by a California State Fire Marshal approved licensed contractor.
   1. Exterior Type: Use Category UCFB, chemically treated, and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Treat exposed exterior rough carpentry items, including stairways, balconies, and covered walkways.
      b. Do not use treated wood in direct contact with the ground.

   2. Interior Type: Use Category UCFA, low temperature (low hygroscopic) type, chemically treated, and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Treat rough carpentry items as indicated.
      b. Do not use treated wood in applications exposed to weather or where the wood may become wet.

2.5 FASTENERS AND ACCESSORIES

A. General requirements for fasteners:
   1. Fasteners shall be of adequate size, spacing, and number to resist design loads under intended use, and types shall be appropriate for the materials or conditions for which used.
   2. Provide washers, pre-drilling, etc. as required for proper installation and to prevent damage to framing.
   3. Fasteners shall be hot-dip galvanized (ASTM A153), mechanically galvanized (ASTM B695 class 55 minimum), stainless steel (type 303, 304, 305, or 316), silicon bronze, or copper by approved methods for the following applications:
      a. Exterior, exposed use.
      b. In contact with preservative or fire-retardant treated wood.
      c. Nails in contact with preservative treated wood containing ammonia shall be stainless steel.
   4. Fasteners in moist corrosive atmosphere to be of stainless steel (type 303, 304, 305, or 316).
   5. Where the retention level of ACQ or MCQ preservative is greater than 0.40 pcf, CBA-A preservative is greater than 0.41 pcf, or CA-B preservative is greater than 0.21 pcf, provide stainless steel fasteners (type 303, 304, 305, or 316).
   6. All fasteners specified by manufacturer shall be installed in framing hardware, unless noted otherwise.
   7. At borate treated lumber a clear zinc coating per ASTM F1941 is acceptable.

B. Nails and nailing not otherwise shown or specified:
   1. Comply with requirements of governing building code.
   2. For securing materials to hardened concrete or masonry provide hardened steel masonry nails or Simpson Strong-Tie “Titen” screws.
   3. For framing and general woodwork: Common bright wire nails (not box nails) with centered full-round heads per ASTM F1667 including Supplement S1. 16d cement coated sinker nails may be used in lieu of common nails for framing, where noted on the drawings. Unless otherwise noted on drawings, nail sizes shall be as follows
      a. 8d Common: 0.131”ø x 2-1/2” long with 0.281”ø head.
      b. 10d Common: 0.148”ø x 3” long with 0.312”ø head.

c. 16d Common: 0.162”ø x 3-1/2” long with 0.344”ø head.

4. Nails for sheathing panels shall be of common wire with full round heads and shall be of sufficient length to fully develop the nails.
5. Machine-driven nails of all types must comply with the requirements of this section. All proposed nails shall match diameter and penetration of specified nails.
6. Staples shall conform to length and gauges specified and shall be installed to match specified patterns and spacing.
7. Power Actuated Fasteners (PAF): Use only as approved by the Architect/Engineer; operators shall be qualified.

C. Bolts: Malleable iron washers or steel plate washers, unless otherwise shown, shall be provided under all bolt heads and nuts.
1. Machine Bolts: ASTM A307 and ANSI/ASME B18.2.1, standard semi-finished machine bolts as shown or required. Nuts shall be standard size unless noted otherwise and shall be per ASTM A563.
2. Anchor bolts or threaded rod anchors shall conform to ASTM F1554, ASTM A307, or ASTM A36. Anchor bolts shall be headed or end in two nuts tightened against one another, unless noted otherwise. Provide embedded plate washer as indicated on drawings. No upset threads allowed. No L or J bolts allowed.

D. Lag screws: Standard hex lag screws per ANSI/ASME B18.2.1.

E. Wood screws: Standard wood screws per ANSI/ASME B18.6.1

F. Power Actuated Fasteners (PAF): Hilti X-CP72, ICC ESR-2379; Simpson PDPAWL-300 MG, ICC ESR-2138.

G. Framing hardware: Fabricated sheet metal timber framing connectors shall be manufactured from painted or galvanized G90 steel by Simpson Strong-Tie (connectors specified on drawings are per Simpson Strong Tie, USP Lumber Connectors, or approved equivalent. Connectors shall be at least 16 gauge material, (1/8 inch plate materials where welded), unless otherwise noted, punched for nailing. All heavy hardware to be fabricated from A36 steel per Division 05, Metals. All hardware intended for exterior exposed use shall be galvanized per G185 ASTM A653 or stainless steel.

1. For contact with preservative or fire-retardant treated wood, provide minimum G185 galvanizing per ASTM A653.
2. Nails and nailing shall conform to the manufacturer’s instructions with a nail provided for each punched hole. Nails to be used with framing accessories are subject to the requirements specified in this Section for fasteners and anchors.

H. Subfloor Glue: Water proof, water base, air cure type, cartridge dispensed conforming to APA Standard AFG-01 or ASTM D3498. Maximum Volatile Organic Compound (VOC) shall meet local air quality standards and the California Green Building Code.

2.6 SOURCE QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform testing for moisture content of all lumber at time of fastener installation.

B. The Testing Agency will submit reports as specified in Division 01.

PART 3 - EXECUTION

3.1 REQUIREMENTS FOR STRUCTURAL FRAMING

A. General
1. Refer to drawings for layouts, notes and details, provide framing as required; comply with governing building code requirements.
2. Provide framing to achieve true alignments as surfaces receiving finish materials.
3. It shall be the responsibility of the Contractor to provide and install all wood blocking, furring strips, or grounds detailed or required to provide anchorage for all finishes, accessories, fixtures, etc. as required to complete all work. All blocking and/or backing shall be securely bolted or otherwise anchored in place.
4. Contractor shall be responsible for layout of anchor bolts, and other hardware embedded in concrete when placed by other trades.
5. Provide and install all structural framing, blocking, fasteners, brackets, clips, etc. as required to complete work specified in the Construction Documents.

B. Framing
1. Sill Plates and Ledgers:
a. Sill plates and ledgers on concrete shall be anchored with bolts, unless noted otherwise, shall have full bearing on concrete, and shall be placed for sheathing panel nailing as indicated. All bolt nuts shall be provided with a cut plate steel washer for bearing on wood.
b. Provide a minimum of two sill anchor bolts per sill piece with a bolt no less than 4 ½” and no more than 12” from the end of the sill. Bolts to be 5/8" diameter x 12" (18” at curb) long at 48” on centers, unless otherwise shown or noted. Provide additional anchor bolts each side of a notch or hole, as per a typical plate splice, where notch or hole is in excess of 1/3 the plate width. At shear walls, provide a plate washer 3” x 3” x 0.229” minimum between the sill and nut at anchor bolts. Plate washer to extend within ½ inch of the structural wall sheathing. Offset and/or stagger anchor bolts, or provide larger plate washer as required.
c. Anchor bolt holes in sill plates or ledgers shall be 1/16" maximum larger than anchor bolt.
2. Stud Walls and Framing:
a. Cut studs and posts with square ends, unless otherwise shown or noted. All posts and beams shall be "cut to bear" unless otherwise detailed.
b. All studs in walls shall be placed with the shortest dimension parallel to the run of the wall. Bearing studs shall extend full height to be the supporting framing as shown; non-bearing studs shall extend to the supporting framing.
c. Provide double studs on each side of all openings, unless shown or noted otherwise.
d. All openings in stud walls and partitions shall be framed with headers across the top, as shown, with a minimum size (6" nominal depth x stud width) resting on short cripple studs, and as shown on the drawings.
e. All stud partitions and walls shall have horizontal solid blocking not less than 2x and of the same width as the stud, fitted and nailed into the studs at mid-height of stud, for studs over 8 feet in height, except as otherwise shown or specified. This blocking shall be so spaced that there shall be no concealed air spaces greater than eight feet in any dimension.
f. Stud partitions containing plumbing, heating or other pipes shall be so framed as to give proper clearance for piping. Plumbing, heating and vent pipes exceeding 1-1/2" in inside diameter shall not be placed in partitions used as bearing or shear walls unless completely furred clear of the wall. No notching

shall be allowed. Pipes shall be placed in the center of the plate using a neat, bored hole and the plates shall be strapped on each side with 3" x 36" x 14 gauge steel punched for 10d nails 3" on center, staggered, or as shown on the drawings.

3. Top Plates
   a. Top plates shall be double, set single. Corners where stud wall or partitions meet shall be framed with studs on all surfaces and blocking to form a "rigid" corner with nailing for all corners. Double top plates shall be lapped at corners. Lap splices and nailing per the drawings.
4. Floor, Roof and Ceiling Framing
   a. Joists and beams shall be accurately aligned and the position and spacing of all joists and beams shall be as shown and be coordinated with other framing and to other trades prior to actual construction.
   b. Place all joists and beams with crown up. Cantilevered joists and beams shall be placed with the crown down.
   c. Cutting of wood girders, beams or joists for electrical and mechanical lines shall be limited to cuts and bored holes not deeper than 1/5 of the beam depth from the top and located not farther from the support than three times the beam depth and not less than the beam depth. Cuts in excess of this, or single bored holes with a diameter of more than 1" are not permitted without special provisions for framing the beams. Location of all cuts in framing shall receive the prior review of the Architect/Engineer.
   d. Provide vent holes in rafters and/or blocking as shown and/or directed by the Architect.

3.2 STRUCTURAL SHEATHING

A. General
   1. Sheathing nailing shall be as required on the drawings. Do not overdrive (Do not break skin of sheathing face sheet). Over driving will be cause for rejection.
   2. Form sheathing may be re-used for concealed sheathing provided the lumber at the time of re-use is approved by the Architect, meets with the framing grade requirements specified herein, is in good condition, and is thoroughly cleaned with all nails removed.
   3. Pneumatic nailing devices shall be adjustable so that nail heads do not penetrate skin of sheathing. Contractor shall submit equipment and nails for review prior to use. Refer to PART 2 for other nailing requirements.

B. Roof and Floor Sheathing: Except "Panelized Roofs", lay with face grain perpendicular to roof rafters, roof trusses or floor joists. Stagger sheets. Block all unsupported sheet edges with 2x material unless noted otherwise.

C. Wall Sheathing: Lay with face grain either parallel or perpendicular to studs. Exposed bottom edges shall be sealed as recommended by manufacturer. Block all unsupported sheet edges with 2x materials unless noted otherwise.

D. Panelized Roofs: Where sheathing is set @ 8'-0 1/8" spacing, cut every fourth sheet short by 1/2" to re-align structural framing that has been specified to be spaced at even units of 2, 4 or 8 feet.

3.3 ROUGH HARDWARE

A. General: Nails, spikes, screws, fabricated sheet metal anchors, ties, hangers and any other materials shown or required for the attachment of wood to concrete and wood to steel and wood to wood shall be furnished and installed as part of this work.

B. Framing Nailing: All framing nailing shall conform to minimum requirements of the Building Code, and with details shown on the drawing.

C. Bolts, Lag Screws and Washers:
   1. Bolts in wood shall be machine bolts unless otherwise noted and shall be of such length that the bearing length of the threads does not exceed ¼ of the full bearing length in the member holding the threads. Bolt holes in wood shall be 1/32" oversized. Bolt holes for sill plates may be 1/16" maximum oversize. Holes in steel shall be 1/16" oversize. See Section 3.1 for anchor bolts at sill plates and ledgers.
   2. Provide square plate or malleable iron washer and nut at head where bearing is against wood; cut washer under nut where it is against steel. Washer will not be required under head of carriage bolts. Provide malleable iron washers where exposed.
   3. All nuts shall be tightened when placed and retightened at completion of the job or immediately before closing with final construction.
   4. Lag screws shall be screwed (not driven) into place. Drill pilot hole to 70% of shank diameter. Drill clearance hole to full shank diameter and depth of unthreaded screw length.

D. Wood Screws: Minimum penetration is 10 diameters unless noted otherwise. Where fastening hardwood timber species or where wood tends to split, provide pilot hole 70% of screw shank diameter.

E. Proprietary Fasteners and Hardware: Install per manufacturer’s published installation instructions (MPII) and code approval report (e.g. ICC ESR, IAPMO ER, etc). Provide MAX quantity, size, and length of fastener at hardware (i.e. joist hangers, framing, clips, etc) unless otherwise noted per plan.

3.4 INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD

A. Coordinate installation of wood decking, metal-web wood joists, glued-laminated wood construction, shop-fabricated wood trusses, and wood I- joists.

B. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members. Fasten curbs corner-to-corner and to rafters with framing connectors configured for this application.

C. Blocking:
   1. Provide fire blocking at locations and spacing’s as required by CBC Chapter 7. Locate other blocking, supplementary framing, backing plates and bracing to facilitate installation of finish materials, fixtures, equipment, services, accessories, and trim requiring attachment and support.
   2. Solid block joists and rafters over all supports with blocking of the same size and material as the joist or rafter.

D. Furring:
   1. Nominal 1 inch x 3 inch minimum, continuous and spaced at 16 inches on center, maximum.

2. Install plumb, rigid, and level. Shim where necessary to provide a true, even plane suitable to receive the finish required.
3. Attach to concrete and masonry as shown in the contract drawings.

E. Bridging: Use 2 inch solid cross bridging. Nail bottom ends of bridging only after sheathing has been nailed.

F. Stair Framing: Provide with 3 stair stringers for each set of stairs, unless otherwise shown. Cut notches to receive exact size of treads and risers (if any) shown, with no change in dimensions between landings. Provide stringers of size shown, or if not shown, of a size to allow not less than 3-1/2 inch of effective depth, measured perpendicular to the rake of the stringer, after notching.

G. Install miscellaneous metal angles, bolts, and other items; secure into formwork where embedded in concrete.

H. Install accessory items not otherwise set under other sections; after completion of painting and other finishing work; in locations shown or directed by the Architect. Set items plumb, level, and secure using appropriate fastening as applicable.

3.5 FIELD APPLIED WOOD TREATMENT

A. Field treat all end cuts and holes in preservative treated materials per PART 2.

B. Apply two brush coats; or full-immersion dip not less than 15 minutes; or as required to thoroughly saturate all surfaces after cutting.

C. Air dry 2-hours minimum before installation.

3.6 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum. Provide framed substrates meeting requirements for application of finishes specified in other sections.

D. Exposed surfaces shall be free from dents and tool marks, unsanded rough or torn faces and corners, and other defects.

3.7 FIELD QUALITY CONTROL

A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform the following tests and submit reports as specified in Division 01:
1. Moisture content of all lumber at time of close-in.
2. Periodic special inspection of nailing, bolting, and other fastening within the seismic-force-resisting system including shear walls, wood diaphragms, etc. per CBC Section 1705.12.2, excluding systems with sheathing nailing spacing greater than 4” on center.
3. Special inspection of high load diaphragms per CBC Section 1705.5.1 where designated on documents.

3.8 ADJUSTING

A. Replace all defective work at Contractor's expense.

B. Replace defective or damaged work with conforming work.

C. Correct defects using means that will not injure the materials.

D. Replace defective or damaged work which cannot be corrected in the field with new work, or return defective items to the shop for repair.

E. Repair or replace framing lumber sagged, twisted or warped due to shrinkage from excessive moisture content at time of installation, or from other causes.

F. Adjust to meet specified tolerances.

G. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.

H. Pay expenses incurred by Owner for Architect/Engineer's costs for (re-)design and obtaining approvals of Authorities Having Jurisdiction (AHJ) necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work.

I. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work.

3.9 CLEANING AND PROTECTION

A. Clean all surfaces upon completion of erection, leave free of grime and dirt. Remove unused materials, tools, equipment, and debris from the premises and leave surfaces broomed clean.

B. Waste Disposal: Comply with the requirements of pertinent sections of Division 01 specifying cleaning and disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

C. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

D. Prevent sawdust and wood shavings from entering the storm drainage system.

E. Protect work from damage by subsequent operations.

END OF SECTION

SECTION 06 1643

GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Non-structural gypsum wall sheathing.

B. Related Requirements:
   1. Gypsum Board: Section 09 2900.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's product data for each product.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Immediately upon delivery to jobsite, place materials in area protected from weather.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Non-Structural Gypsum Sheathing: ASTM C1177/C1177M, Type X, fiberglass-faced, silicone-impregnated core; Georgia Pacific "DensGlass Fireguard," “Securerock” Firecode Core by United States Gypsum, or accepted equal.
   1. Thickness: 5/8-inch.
   2. Size: 4 feet x maximum lengths possible; 8 feet minimum.
   3. Edge: Square.

2.2 ACCESSORIES

A. Fasteners: Corrosion-resistant, conforming to ASTM C954 and the requirements of CBC Section 1403.3; USG “Sheathing Type SF,” or equal.
   1. Length as recommended by manufacturer for board thickness and substrate.
   2. Provide Type specifically designed for attachment to heavy steel gage metal framing.

PART 3 - EXECUTION

3.1 INSTALLATION – NON-STRUCTURAL WALL SHEATHING

A. Install sheathing vertically or horizontally using specified fasteners in accordance with board manufacturer’s installation instructions and recommendations.

B. Fit boards tightly against each other and around openings.
1. If applied vertically, edges shall be parallel to and centered over studs.
2. Stagger end joints.

C. Provide back blocking or supplemental framing where recommended by board manufacturer and wherever end joints do not bear against framing.

D. Secure to framing using specified fasteners.
1. Secure to supports in accordance with manufacturer's recommended spacing, but space fasteners not more than 4 inches on center around perimeter at edge and end supports and 8 inches on center at intermediate supports.
2. Install flush with face of board; do not countersink.
3. Keep perimeter fasteners 3/8-inch from edges and ends of board units.

END OF SECTION

SECTION 06 1800

GLUED LAMINATED CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: All labor, materials and equipment for glued laminated timber necessary to complete work shown, implied, specified and required.

B. Related Sections:
   1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.
   2. 06 1000 Rough Carpentry

1.2 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 23 Wood.

B. American National Standards Institute (ANSI) A190.1 “Standard for Wood Products - Structural Glued Laminated Timber”.

C. ANSI 117 “Standard Specification for Structural Glued Laminated Timber of Softwood Species”.

D. American Society for Testing and Materials (ASTM) D3737 “Standard Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)”.

1.3 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review.

B. Limitation of Review: Structural Engineer’s review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Shop Drawings: Submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following:
   1. Indicate profiles, sizes, lengths, appearance grade, and locations of structural members. Indicate adhesive type and sealer application area(s).
   2. Cross-reference all shop drawing detail references to contract document detail references.
   3. Secure all field measurements as necessary to complete this work, prior to submittal.

D. Certifications:
   1. ANSI/AITC Certificate of Conformance.
   2. Special Inspection Certification.

E. Warranty:
1. Two copies of a five-year warranty, signed by an officer of the manufacturer, shall be submitted to the Architect/Engineer stating that the workmanship shall be corrected to the satisfaction of the Architect/Engineer at no cost to the Owner.

1.4 QUALITY ASSURANCE

A. Each glued laminated member shall bear the ANSI/AITC Quality Mark to indicate conformance to ANSI A190.1.

B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.

C. Certification and Identification of Materials and Uses: Provide Testing Agency with access to fabrication plant to facilitate inspection of fabrication. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification.

D. Testing and Inspection: Tests and Inspections performed by Independent Testing Agency are specified below in Article SOURCE QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs, and test reports to be in conformance with pertinent sections of Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber
1. Conform to ANSI/AITC 117.
2. Laminations shall be 2 inch nominal thickness unless otherwise noted.
3. 16% maximum moisture content (MC) at time of manufacture.

B. Adhesive: Shall be exterior grade for wet surface condition above 16% and shall meet requirements of ANSI 405.

C. Interior use glue laminated members shall be manufactured entirely from Douglas Fir.
1. Simple span beams shall be combination 24F-V4-1.8E.
2. Beams with intermediate supports and/or cantilevers shall be combination 24F-V8-1.8E.
3. Posts and truss members shall be combination 3-1.9E.

D. Glue laminated members that are protected from weather by a roof, eave, or similar covering may be Douglas Fir. The ends shall be flashed and treated with approved wood preservative to prevent decay.

E. Glue laminated members with exterior exposure shall be fabricated entirely from Alaskan Yellow Cedar (AYC). No sap wood permitted.
1. Simple span beams shall be combination 20F-V12-1.5E.
2. Beams with intermediate supports and/or cantilevers shall be combination 20F-V13-1.5E.
3. Posts and truss members shall be combination 20F-V13-1.5E.

F. Radial Tension Reinforcement: ANSI/AITC 404.

2.2 CAMBER

A. All beams shall be cambered as noted on the drawing. Where no camber is noted, provide 5,000 ft radius camber at simple span beams.

B. Cambers specified shall be provided within tolerances per ANSI A190.1. The Contractor shall verify all beam cambers prior to the erection and report his findings in writing to the engineer for review and comment.

2.3 APPEARANCE

A. Glued laminated members shall be Industrial Appearance Grade when not exposed to permanent view and Architectural Appearance Grade otherwise. Appearance to meet the requirements of ANSI A190.1.

2.4 PROTECTION

A. Protection during shipping and field handling to meet requirements of AITC 111, including protective wrapping and proper storage of members to prevent increased moisture content and damage. Individually wrap members with Architectural Appearance Grade.

B. Ends shall be sealed after end trimming and entire surface of members shall be factory sealed with a penetrating sealer that has been approved by the Architect. Field cuts, notches, and daps shall receive one coat of the same sealer prior to erection.

2.5 SOURCE QUALITY CONTROL

A. Members shall be continuously inspected during fabrication by a glue fabrication inspector specifically approved for that purpose. The Inspection shall conform to CBC requirements. An ANSI/AITC Certificate will not meet this requirement.
   1. An independent Testing Agency will perform source quality control tests and submit reports, as specified in pertinent sections of Division 01 and CBC Chapter 17.
   2. The inspector shall issue four copies of certificates to the Architect/Engineer certifying that materials, manufacture and fabrication are in accordance with these Specifications and the Drawings and shall specify the following:
      a. Species, grade and slope of grain of lumber. Lumber grading inspection shall be done by lumber graders authorized under the provisions of the American Lumber Standards Committee and verified by the special independent inspector.
      b. Glue quality specified.
      c. Glue bond over entire surface.
      d. Continuous inspection of gluing operation.
      e. Moisture content of laminations during manufacture.
      f. Finger joint locations.
      g. All requirements of ANSI A190.1 are met.
   3. Each inspected member shall be stamped by the special inspector with an identification mark.

PART 3 - EXECUTION

3.1 ERECTION

A. Members shall be seat cut to bear, dapped, etc. as detailed on the drawings prior to erection.

B. Members shall be erected with suitable equipment and secured in place as detailed on the drawings.

C. Glued laminated members shall be aligned and braced until all secondary members or other framing is secured. Contractor shall verify all beam cambers in the field prior to erection.

3.2 CLEANING

A. All debris resulting from this portion of the work shall be removed from the site upon completion.

B. Protect work from damage by subsequent operations.

END OF SECTION

SECTION 06 4023

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Miscellaneous millwork items as indicated and not provided under other Sections.
   2. Shop-applied coatings.
   3. Finish hardware for interior millwork.

B. Related Requirements:
   1. Architectural Wood Casework: Section 06 4100.
   2. Fiber-Reinforced Plastic (FRP) Paneling: 06 6420.
   3. Joint Sealants: Section 07 9200.
   4. Painting and Coating: Section 09 9000; field-applied finishes.

1.2 REFERENCES

A. Woodwork Institute (WI): "North American Architectural Woodwork Standards" (NAAWS) published jointly by WI and the Architectural Woodwork Manufacturers of Canada (AWMAC).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."

1.4 ACTION SUBMITTALS

A. Shop Drawings: Submit for custom fabricated items and millwork profiles not included as part of show drawings submitted under other Sections.
   1. Include to-scale, dimensioned layout and component profiles identifying materials used and indicating method of attachment.
   2. Prepare in accordance with the NAAWS Section 1 Article entitled "Submittals."

B. Product Data: Descriptive literature for manufactured products and shop-applied coatings.

C. Samples:
   1. Millwork: 12 inch lengths of each profile for each required wood species, Grade and finish.
   2. Paneling: Not less than 10 inches x 12 inches with specified veneer and finish.
      a. Sample shall receive specified finish applied in step fashion to clearly show unfinished veneer and each applied coat of finishing system.
   3. Samples shall receive specified finish applied in step fashion to clearly show unfinished veneer and each applied coat of finishing system.
   4. Provide additional or modified samples if requested by Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Statement of fabricator qualifications.

1.6 QUALITY ASSURANCE

A. Standard for Materials and Workmanship: Comply with applicable requirements of the referenced NAAWS publication (hereinafter referred to as "woodworking standard"). Where Contract Documents indicate requirements that conflict with or augment the woodworking standard, comply with the conflicting or augmenting requirements.

B. Mockups:
1. First installed area or example of each type or configuration of paneling and millwork, and each installation condition, shall serve as a mockup for review and approval by Architect of workmanship, visual effect, and interface with adjacent construction.
2. Accepted mockups may remain as part of the completed work and shall serve as a visual standard of quality and appearance of the work represented, including interface with adjacent materials and components.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver products until ambient conditions required can be and are maintained.

B. Do not deliver millwork until wet work, painting, grinding, and similar operations in storage and installation areas that could damage, soil, or deteriorate millwork have been completed.

C. Store products only in areas where required ambient conditions can be and are maintained.

D. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

1.8 FIELD CONDITIONS

A. Ambient Conditions: During and after installation, maintain the same temperature and humidity conditions in building spaces as will occur after occupancy.

B. Before fabricating, obtain field measurements, and verify that dimensions are as indicated on the shop drawings.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS

A. General:
1. Moisture Content at Time of Fabrication: As specified in woodworking standard.
2. Provide wood dressed on all exposed faces.
3. Do not use twisted, warped, bowed, or otherwise defective wood.
4. Sizes indicated on Drawings are net actual size, unless otherwise indicated.
5. Do not mark or color material, except where such marking will be concealed in finish work.
6. Wood is not required to be fire-retardant treated.
7. Lumber shall be free of sapwood, knots, pitch, or resin.

B. Wood Veneers at Transparent Finish, Stain or Clear:
1. Species: Clear White Oak.
a. Grade: NAAWS Premium.

C. Solid Stock at Transparent Finish:
   1. Species and Grade: To match wood veneer.
   2. Grade: NAAWS Premium.
   3. Cut: Rift.
   4. Finger Jointing: Not allowed.
   5. Face Surface: Surfaced four sides (S4S) (smooth).
   6. Gluing for Width: Allowed, if required and approved by Architect.
   7. Matching: Selected for compatible grain and color.

D. Solid Stock at Opaque Finish (Painted), if Required:
   1. Species: Poplar, or equal hardwood, kiln dried.
   2. Grade: Clear, A or Better (NAAWS Premium).
   3. Texture on Exposed Surfaces: Smooth, S4S.
   4. Finger Jointing: Allowed.

2.2 ACCESSORIES

A. Adhesives: VOC compliant, water and mold resistant of type, grade, and class best suited for intended use, compatible with laminating methods of fabricator, substrate, wood or metal type.

B. Rough Hardware: Furnish items required to complete the Work.

2.3 FABRICATION - GENERAL

A. Conform to NAAWS Custom Grade requirements, unless otherwise specified.

B. Provide millwork in maximum possible lengths so as to minimize joints.

2.4 FINISHING

A. General:
   1. Do not apply finishes until sample submittals are reviewed and approved by the Architect.
   2. Coatings shall comply with the Premium Grade requirements of NAAWS Section 5.
   3. Do not exceed manufacturer’s recommended film thickness for each coating and for total system.
   4. Use grit recommended by coating manufacturer for sanding. Remove sanding dust prior to application of subsequent coating.
   5. Finish shall match accepted sample.

B. Back Painting: Surfaces which are not exposed to view at any time shall be primed. Prime end grain edges at both exposed and butt joints prior to installation.

C. Opaque and field-applied coatings shall conform to Section 09 9123, “Interior Painting and Coating.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify mechanical, electrical and building items affecting woodwork are placed and ready to receive work.

3.2 PREPARATION

A. Condition millwork to humidity and temperature in installation area prior to installing.

B. Complete work specified in this Section to whatever extent not completed at factory or prior to installation.

3.3 INSTALLATION - GENERAL

A. Install work plumb, true, and in accordance with the Drawings and referenced NAAWS Standard.

B. Accurately scribe work abutting other components with maximum gaps of 1/16 inch.

C. Fastening: Secure with finishing nails or screws as required. Where other anchorage is indicated, use appropriate rough hardware.
1. Set all finished nails for putty stopping.
2. Hammer, tool marks, and marred surfaces and edges are not acceptable on exposed surfaces.
3. At exposed wood to receive transparent finish, use concealed fasteners wherever possible. Where not possible, use countersunk fasteners with plugs to match adjoining wood.

D. After installation, wipe finished surfaces in order to remove marks of handling and to prepare for finishing, if not previously shop-finished, as specified in Section 09 9000, “Painting and Coating.”

E. Field Finishing: Apply in accordance with Section 09 9123, “Interior Painting and Coating.”

3.4 ADJUSTING AND CLEANING

A. Adjust moving or operating parts to function smoothly and correctly.

B. After installation, wipe finished surfaces to remove marks of handling, and leave in clean condition.

C. Damaged, stained, scratched, or otherwise disfigured portions of the work shall be touched up, refinished, or replaced to satisfaction of the Architect.

END OF SECTION

SECTION 06 4100

ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic-laminate-faced architectural cabinets.
   2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:
   1. Metal Fabrications: Section 05 5000; miscellaneous steel supports and brackets.
   2. Rough Carpentry: Section 06 1000; wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
   3. Division 12: Furnishings; countertops.
   4. Woodwork Institute (WI) Certified Seismic Installation Program.

1.2 DEFINITIONS

A. Unless otherwise specified, exposed, semi-exposed, and concealed surfaces shall conform to the cabinet surface terminology in Section 10 - Casework of the “North American Architectural Woodwork Standards (NAAWS),” published jointly by WI and AWMAC.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

B. Coordination:
   1. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.
   2. Coordinate the work with plumbing and electrical rough-in.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Prepare for each casework layout following the recommendations for preparation of shop drawings in NAAWS Section 1 Article entitled “Submittals.”
   1. Indicate, as applicable, materials to be used, location of hardware, and finishes.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for electrical switches, outlets, and other items installed in architectural plastic-laminate cabinets.
   4. Apply WI Quality Certification Program label to shop drawings.

B. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, fire-retardant-treated materials and cabinet hardware and accessories.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Samples for Verification:
   1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish.
   2. Thermoset Decorative Panels: 12 by 12 inches, for each color, pattern, and surface finish.
   3. Hardware:
      a. Door and drawer pulls.
      b. Other hardware items as requested by Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Statement of fabricator qualifications.

B. Certification: Before delivery of casework to jobsite, submit WI Certified Compliance Program certificates.

C. Evaluation Reports for fire-retardant-treated materials from ICC-ES.

1.6 QUALITY ASSURANCE

A. Standard for Materials and Workmanship: Comply with applicable requirements of the NAAWS (referred to as the "woodworking standard"). Where Contract Documents Show requirements that conflict with or augment the woodworking standard, comply with the most stringent requirements.

B. Qualifications:
   1. Fabricator: Firm specializing in quality architectural cabinetwork and active member of WI or AWI. Fabricators not active members of WI or AWI will be considered upon submission of verifiable evidence of experience in successful completion of work similar to work of this Project. This provision does not waive compliance with specified WI Certification.
   2. Installer: Certified participant in WI's Quality Certification Program.

C. WI Certified Compliance Program:
   1. Casework and the installation thereof for this Project shall be certified by fabricator for compliance to the Contract Documents:
      a. WI licensees shall issue a Certified Compliance Certificate indicating the casework products being furnished and certifying that these products and their installation will fully meet all the requirement of the WI Grade specified. Certificate shall be submitted prior to delivery of casework to the jobsite.
      b. Non-licensees of the WI shall arrange to have a WI Inspector inspect the casework after completion of fabrication and installation and furnish a Certified Compliance Certificate. Contractor shall be responsible for all costs associated with corrections to fabricated or installed work as required to secure the WI Certified Compliance Certificate.
   2. Fees charged by WI to either WI licensee or non-licensee are the responsibility of the Contractor.
   3. Casework and/or installation determined to be non-compliant by WI and not corrected will be rejected.
   4. Issuance of the WI Certified Compliance Certificate is a prerequisite of final acceptance by the Architect.

D. Mockups:
   1. Build mockups of typical base and upper cabinet to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
   3. Comply with additional requirements of Section 01 4339, “Mockup Requirements.”

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

B. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until wet work is complete and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS

A. Solid Stock:
   1. Concealed: Species and grade as specified in woodworking standard for casework construction, unless otherwise indicated.
   2. Moisture content at time of fabrication: As specified in woodworking standard.

2.2 PANEL MATERIALS

A. Plywood:
   1. Substrate for High Pressure Plastic Laminate: Natural birch veneer core plywood.
   2. Other Locations: Types, grades, and cores as specified in the woodworking standard, except as otherwise specified.

B. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 155 meeting MR30 moisture resistance, and formaldehyde free; “Medite II.” by Roseburg Forest Products, or equal.

C. Thermally-Fused Laminate (TFL): Melamine resin-impregnated decorative paper thermally fused to a formaldehyde free MDF core complying with LMA SAT-1, “Voluntary Product Standard and Typical Physical Properties of Saturated Paper Overlays.”
   1. Color: White.

D. Hardboard: Tempered Grade, conforming to standards of American Hardboard Association or PS-50; use smooth side exposed.
   1. Thickness: 1/4 inch, unless otherwise noted.

E. Particle Board: Not permitted.

2.3 LAMINATE MATERIALS

A. High-Pressure Plastic Laminate ("PL"): Conforming to NEMA LD3.1 and ISO 4586 Parts 1 and 2.
   1. Horizontal Surfaces, Exposed Exterior Vertical Surfaces, and Exposed Interior Vertical Surfaces: 50/HG.
   2. Semi-Exposed Interior Vertical Surfaces: ISO 32/VG.
   3. Backing Sheets:
      a. Horizontal Surfaces: 89/BG.
      b. Vertical Surfaces: 87/BL.

B. Manufacturers, Colors, and Patterns: As scheduled; refer to Finish Plan Legend on the Drawings.

2.4 HARDWARE

A. General: Comply with requirements of BHMA A156.9, Type 2 (Institutional).

B. Finishes:
   1. Exposed Items: Satin chromium plated, 626, unless otherwise specified or noted on the Drawings, and complying with ANSI/BHMA A156.18.
   2. Concealed Items: Manufacturer's standard finish, complying with applicable product class of ANSI/BHMA A156.9, BO1521-3, Grade 1.

C. Hinges: Fully concealed (European type), complying with BHMA A156.9, B01601, 170 degree swing opening, self-closing; "Salice" by Häfele with soft close feature, or accepted equal.
   1. Provide hinges that limit opening to 90 degrees at doors adjacent to walls or other obstruction.
   2. Provide at least 3 hinges where doors exceed 24-inch wide and 36-inch high.

D. Drawer Slides: Accuride, Knape & Voght, or equal.
   1. Heavy Duty, Grade 1HD-100.
   2. Side mounted; full-overtravel-extension type; zinc-plated steel ball-bearing slides; soft close.
   3. In addition to capacity, slides shall be sized in accordance with manufacturer's recommendations for drawer width.

E. Door and Drawer Pulls: Wire type, satin chrome, 4-inches long, mounted in direction indicated; Häfele #116.39.446, Stanley, EPCO, or accepted equal.
   1. Unless otherwise indicated, provide one for each door or drawer, two for each drawer 30 inches or wider.
   2. Mounting Direction: As follows, unless otherwise shown.
      a. Doors: Vertical.
      b. Drawers: Horizontal.

F. Interior Cabinet Shelf Supports: Knape & Vogt No. 346, nickel finish, or accepted equal for insertion into 1/4-inch holes.

G. Locks: Comply with BHMA 156.11; Schlage or equal.
   1. Locations: As indicated on the Drawings or, if not shown, to be provided at locations selected by Owner's Project Manager.
   2. Cylinders to be keyed into door keying system specified in Section 08 7100, "Door Hardware."

H. Bumper Pads (Silencers): Hemispherical, quiet clear type, 55 Shore A hardness; 3M Bumpon Protective Products, or accepted equal.

I. Additional Hardware: As indicated on the Drawings.

2.5 ADDITIONAL MATERIALS

A. Laminate Adhesive: High solids, low VOC contact adhesive for non-postforming applications as provided or recommended by laminate manufacturer.

2.6 FABRICATION

A. General:
   1. Make job measurements as required for proper fabrication of the work.
   2. Shop-assemble casework for delivery to site in units easily handled and to permit passage through building openings and transportation facilities.
   3. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

B. Construction shall conform to NAAWS Custom Grade casework requirements and the following.
   1. Backs of doors and drawer fronts shall be finished to match front of door and drawer.
   2. Interior carcass surfaces behind solid doors shall be considered semi-exposed surfaces.

C. Carcass: Frameless. Provide Type II (former WI designation) at open shelf Cabinets.

D. Door and Drawer Front Style: Flush overlay.

E. Provide silencers at doors and drawers.

F. Plastic Laminate:
   1. Apply plastic laminate finish in full uninterrupted sheet consistent with manufacturer's sizes.
   2. Fit corners and joints hairline; secure with concealed fasteners.
   3. Securely bond laminated plastic to panel product; do not use plywood.
   4. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   5. Do not miter corners of laminated plastic.
   6. Cap exposed finish edge, including ventilation cutouts if used, with material of same finish and pattern. Low-pressure laminate, PVC, or other edging materials are not acceptable.

G. Back Painting: Surfaces which are not exposed to view at any time shall be thoroughly back painted with one heavy coat of finishing material of fabricator's choice before leaving the shop.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify painting, mechanical, electrical, and other work that will be concealed by casework, are completed.

3.2 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.3 INSTALLATION

A. General:
1. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
2. Installation shall comply with the Woodwork Institute Certified Seismic Installation Program (CSIP).

B. Install cabinetwork plumb and level and in conformance with requirements of the Premium Grade requirements of the woodworking standard and as shown.
1. Shim as necessary with concealed shims.
2. Accurately scribe and closely fit faceplates and filler strips to irregularities of adjacent surfaces.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches on center with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish. Anchorage shall comply with NAAWS recommendations and be acceptable for Project seismic requirements.
4. Fasten base cabinets to floor at toe space, unless base levelers are used, and to walls at 24 inches on center maximum.
5. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
6. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

C. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

D. Install sealant as specified in Section 07 9200, “Joint Sealants,” as required to close any small unavoidable gaps between casework and abutting surfaces.

3.4 ADJUSTING AND CLEANING

A. Adjust moving or operating parts to function smoothly and correctly.

B. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

C. Clean cabinets on exposed and semi-exposed surfaces.

D. Damaged, stained, scratched, or otherwise disfigured portions of the work shall be replaced.

END OF SECTION

SECTION 06 6420

FIBER-REINFORCED PLASTIC (FRP) PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiber-reinforced plastic (FRP) wall paneling.

B. Related Requirements:
   1. Joint Sealants: Section 07 9200.
   2. Gypsum Board: Section 09 2900.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.3 ACTION SUBMITTALS

A. Shop Drawings:
   1. Dimensioned plans and elevations, drawn to scale.
   2. Large-scale details identifying components used, and indicating method of attachment.

B. Product Data: Manufacturer's literature describing materials and installation instructions.

C. Samples:
   1. FRP panels: 8 inches square, in specified color and texture.
   2. Trim pieces: 6-inch lengths.

1.4 QUALITY ASSURANCE

A. Materials and installation shall meet USDA/FSIS requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Immediately upon delivery to jobsite, place materials in area protected from weather.

B. Protect materials from breakage and damage while unloading and when stored.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Flammability: ASTM E84, Class A.

1. Flame Spread: Less than 200.
2. Smoke Developed: Under 450.

2.2 WALL PANELING

A. Glass-Fiber-Reinforced Plastic (FRP) Wall Panels: "Glasbord" by Crane Composites, Inc., "Marlite Standard FRP" by Marlite, or accepted equal.
   1. Size: 48 inches wide x height shown.
   2. Thickness: 0.090 inch, minimum.
   3. Texture: Smooth.
   4. Color: White, in value as selected by Architect.

2.3 ACCESSORIES

A. Trim: Manufacturer’s matching solid polymer moldings for corners and end caps. Divisions between panels shall be filled with sealant.

B. Sealant: Silicone type, as provided by panel manufacturer. Color to match wall panels.

C. Adhesives: VOC compliant, high quality, low odor, non-flammable, water and mold resistant, latex-based as recommended or provided by panel manufacturer.

D. Provide fasteners, trim, clips, cleaner and other materials as recommended by panel manufacturer and required for a complete installation.

2.4 OTHER MATERIALS

A. Sealant: Silicone type, as provided by panel manufacturer. Color to match wall panels.

B. Adhesives: VOC compliant, high quality, low odor, non-flammable, water and mold resistant, latex-based as recommended or provided by panel manufacturer.

C. Provide fasteners, trim, clips, cleaner, and other materials as recommended by panel manufacturer and required for a complete installation.

PART 3 - EXECUTION

3.1 WALL PANELING INSTALLATION

A. Install panels with manufacturer's recommended gap for panel field and corner joints.

B. Set panels on top of flooring base. Secure to walls with adhesive in accordance with panel manufacturer's instructions.

C. Install matching trim at joints, corners, and other exposed edges.

D. Install panels vertically, cut to required height, without horizontal joints. Where used as a wainscot 48 inches or less in height, install horizontally without vertical joints except where wall length exceeds maximum available panel length. Joints shall be balanced on each wall with each end panel of equal width or length and not less than one-half full size.

E. Seal joints between panels remaining after installation with silicone sealant.

3.2 CLEANING

A. Clean soiled or discolored surfaces after installation.

B. Remove and replace damaged or improperly installed work.

END OF SECTION

SECTION 07 1616

CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Crystalline slurry waterproofing system at elevator pit.

B. Related Requirements:
   1. Cast-in-Place Concrete: Section 03 3000.
   2. Hydraulic Elevator: Section 14 2600.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Pre-installation Meeting: Prior to installation of waterproofing; Contractor, manufacturer's representative, waterproofing installer, and other appropriate installers shall meet at the Project site to coordinate related requirements and waterproofing work.
   1. Contractor shall notify participants at least 5 business days before conducting meeting.
   2. Review material selections and procedures to be followed in performing the work.
   3. Review in detail job conditions, schedule, construction sequence, application requirements, quality of completed installation, product limitations, testing procedures and acceptance criteria.
   4. Contractor shall record discussions of conference and any conflict, incompatibility, or inadequacy. Furnish a copy of record to each participant.

C. Coordinate concrete forming and finishing requirements with Section 03 3000, “Cast-in-Place Concrete.”

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's material specifications and recommended installation instructions for application of waterproofing over substrates on Project.

1.4 INFORMATIONAL SUBMITTALS

A. Certification that applicator is acceptable to materials manufacturer.

B. Minutes of pre-installation meeting.

C. Sample Warranty: Copy of material manufacturer’s warranty, stating obligations, remedies, limitations, and exclusions.

1.5 CLOSEOUT SUBMITTALS

A. Following completion of Work, submit completed material manufacturer's warranty.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: Acceptable to waterproofing materials manufacturer. Work shall be performed by or under the direction of a person who is thoroughly experienced in the application of the materials.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturers original, unopened, and undamaged containers with identification labels intact.

B. Store in unopened containers at 60 degrees F to 80 degrees F in clean, dry conditions.

C. Do not use materials which have been stored longer than 1 year.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not apply below 40 degrees F or when temperatures are expected to fall below 40 degrees F within 48 hours.

B. Install materials in strict accordance with safety requirements required by the material manufacturer, Material Safety Data Sheets, and local, state, federal rules and regulations.

1.9 WARRANTY

A. Manufacturer's Warranty: Furnish Owner with manufacturer's standard material warranty as available where the manufacturer agrees to replace waterproofing material that does not comply with performance and other requirements and fails to be watertight for the specified warranty period:

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. A crystalline capillary waterproofing coating for concrete designed for below grade applications.

B. Performance Requirements
   1. VOC: 0 pounds per gallon (0 g/L).
   2. Positive resistance to hydrostatic pressure: In accordance with CRD C48.
      a. Virtually impermeable under 125 psi hydrostatic pressure. After 300 hours at 200 psi (1.4 MPa), flow measured 0.075 cm3/hr over the final 120 hours.
   3. Negative resistance to hydrostatic pressure: per CRD C48.
      a. Virtually impermeable; no visible degradation; no water flow. Slight dampening after 420 hours at 200 psi (1.4 MPa) hydrostatic pressure.
   4. Potable Water (direct contact): Suitable approved in accordance with NSF Standard 61.

5. Compressive Strength: ASTM C109/C109M Acid Exposed.
   a. 7 days: 3540 psi (24.4 MPa).
   b. 28 days: 5160 psi (35.6 MPa).
   c. 56 days: 5500 psi (37.9 MPa).
6. Compressive Strength: ASTM C109/C109M Salt Exposed.
   a. 7 days: 3490 psi (24.1 MPa).
   b. 28 days: 5540 psi (38.2 MPa).
   c. 56 days: 5720 psi (39.4 MPa).
7. Chemical Resistance: Gram weight change at 56 days per ASTM C267.
   a. Control Samples: Plus 0.3 gm.
   b. Acid Exposed: Minus 4.8 gm.
   c. Salt Exposed: Plus 0.7 gm.

2.2 MATERIALS

A. Crystalline Waterproofing: Crystalline Capillary waterproofing coating on concrete walls for below grade applications; Master Builders “MasterSeal 500” by BASF, or equal.

2.3 MIXING

A. Mix material for slurry coat and mortar in accordance with manufacturer’s instructions, allowing material to rest before premixing and application.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Comply with manufacturer's product data, including product application and installation instructions.

B. The Contractor’s installer shall examine conditions of substrates and other conditions under which this Section work is to be performed, and shall notify the Contractor in writing of circumstances detrimental to the proper completion of the work.

C. Do not proceed with work until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturer's warranty requirements.

D. Ensure that substrates are sound and free of dust, dirt, laitance, paints, oils, grease, curing compounds, and other contaminants.

E. Concrete:
   1. Waterblast or acid etch as required to remove oils and laitance from forms.
   2. Leave surface damp for waterproofing.

3.2 APPLICATION

A. Slurry Coat:
   1. Apply slurry coat with a brush (synthetic bristle), broom or plastic sprayer at 1.5 pounds per square yard. Work slurry well into openings, rough surfaces, joints, and routed out areas.
   2. Apply second coat after the first has reached its initial set. If the first coat has dried out, moisten surface before applying second coat.

3.3 CURING

A. Cure waterproofing continuously for a minimum of 48 hours.

B. After initial set, moist cure using a wet spray. Fog-spray treated surfaces 3 to 4 times daily for the 48-hour period or as needed for warmer conditions.

3.4 CLEANING

A. Clean waterproofing material from tools and equipment from water. Remove cured materials mechanically.

B. Clean up and properly dispose of debris remaining on Project site related to application.

C. Remove temporary coverings and protection from adjacent Work areas.

3.5 PROTECTION

A. Provide protection and maintain conditions in manner acceptable to the Installer and material manufacturer to ensure that the systems are not damaged at time of Substantial Completion.

B. Protect waterproofing from damage caused by backfilling and other causes.

C. Replace waterproofing materials damaged before and during backfilling.

END OF SECTION

SECTION 07 2117

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Batt insulation at exterior framed walls and new roof and where required to replace existing roofs impacted by work under this Contract.

B. Related Requirements:
   1. Thermoplastic-Polyolefin Roofing: Section 07 5423; rigid insulation integral with membrane roofing.
   2. Acoustic Insulation and Sealants: Section 09 8200; acoustical batts.
   3. Plumbing: Division 22; plumbing pipe insulation.
   4. Mechanical: Division 23; mechanical pipe and duct insulation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications and installation recommendations for each type of insulation required.

1.4 QUALITY ASSURANCE

A. Thermal resistance factors (R-values) listed are aged values tested in accordance with ASTM C518 at 75 degrees F and 50 percent relative humidity for at least six months.

B. Regulatory Requirements:
   1. Insulation shall be certified by manufacturer to comply with state standards for insulating materials.
   2. Insulating materials shall be installed in compliance with Flame Spread Rating and Smoke Density requirements of CBC Section 707.3. Foam insulation shall comply with CBC Section 2602.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Clearly identify manufacturer, contents, brand name, applicable standard, and R-value.

B. Store materials off ground, protected against weather, condensation, and damage.

C. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

D. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

PART 2 - PRODUCTS

2.1 BLANKET INSULATION

A. Thermal Blanket (Batt): Formaldehyde free, conforming to ASTM C665 Type II, Class A, Category 1.
   1. Fire Resistive Requirements: ASTM E84:
      a. Batt:
         1) Smoke Developed: 50 or less.
         2) Flame Spread: 25 or less.
   2. Product: Johns Manville “ComfortTherm,” Guardian, or CertainTeed.
   3. Thickness: As required to achieve R-19 insulating value, unless otherwise scheduled on the Drawings.

2.2 ACCESSORIES

A. Miscellaneous Fastenings, Straps, and Accessories: As acceptable to insulation manufacturer and required to secure insulation in place.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas scheduled to receive insulation to ensure protection against inclement weather and other hazards and to verify that work of preceding trades is completed.

B. Examine space allocated for insulation for proper depth to receive material.

C. Proceed with installation when conditions are satisfactory.

D. Prior to closing walls or ceilings, obtain Architect’s observation of insulation installation.

3.2 INSTALLATION OF THERMAL BLANKETS

A. Install to fill all typical and odd spaces completely in framing where required, other than providing air space where indicated.

B. Install snugly between framing members. Provide straps to prevent sagging at vertical applications exceeding 8 feet, and netting at horizontal applications, to prevent sagging.

C. Trim to required height and width in place.

D. Carefully cut and fit insulation around pipes, conduit, and other obstructions and penetrations. Split blankets around wires as required.

E. Where wall blankets are not in contact with gypsum board, provide straps to prevent sagging.

F. Shim space between framing and window and door jambs shall be filled solid with batt or foam-in-place insulation. Fill spaces completely to a uniform monolithic density without voids.

3.3 PROTECTION

A. Coordinate with other Sections for prompt installation of finishes.

B. Where coordination with other Sections is not practical, protect insulation by temporary covering or enclosure.

END OF SECTION

SECTION 07 2513

SHEET MEMBRANE WEATHER BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Vapor impermeable and air barrier membrane applied over exterior sheathing, and other exterior locations as shown on the Drawings.

B. Related Requirements:
1. Gypsum Sheathing: Section 06 1643.
2. Flexible Flashing and Underlayment: Section 07 6500.
3. Joint Sealants: Section 07 9200.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action and Informational Submittals shall be submitted in accordance with Section 01 3000, “Submittals.”
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Pre-installation Meeting: Prior to application of air barrier and associated work, Contractor, manufacturer's representative, and applicator shall meet at the Project site to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
1. Notify participants a minimum of 5 working days before conducting meeting.
2. Agenda for meeting shall include but not be limited to the following:
   a. Review of surface preparation, minimum curing period and installation procedures.
   b. Review of special details and flashings.
   c. Sequence of construction, responsibilities, and schedule for subsequent operations.
   d. Review of inspection, testing, protection and repair procedures.
   e. Review of submittals.
3. Record discussions of conference and any conflict, incompatibility, or inadequacy and furnish a copy of record to each participant.

C. Coordinate installation of air barrier with other trades to assure proper and adequate provision in the work of those trades for interface with the air barrier system.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Large scale, dimensioned drawings specific to the Project to supplement manufacturer’s data and standard details. Show the following:
1. Details of typical and atypical conditions.
2. Intersections with other envelope systems and materials.
3. Membrane counterflashings.
4. Details showing bridging of gaps in the construction, treatment of inside and outside corners, and sealing of miscellaneous penetrations.

B. Product Data: Manufacturer's material specifications, use limitations, and installation instructions. Include manufacturer's written instructions for evaluating, preparing, and treating substrate. Data shall include certified test report showing compliance with requirements specified for ASTM E2178.

C. Samples: Representative samples of the following, if requested:
1. Membrane material applied to suitable panel backing.
2. Transition membrane.
3. Through wall flashing.

1.4 INFORMATIONAL SUBMITTALS

A. Minutes of pre-installation meeting.

B. Qualifications as specified.

1.5 CLOSEOUT SUBMITTALS

A. Extended warranty and guarantee.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with manufacturer's requirements and NRCA standards.

B. Installer Qualifications and Requirements:
1. At least 5 years' experience installing self-adhering weather barrier systems.
2. Use adequate numbers of skilled workers thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the weather barrier.
3. Applicator shall designate a single individual as project foreman who shall be on site at all times during installation.

C. The Owner may engage an independent consultant to observe the work during application to ascertain compliance with the specified requirements. Provide safe access to work areas and information necessary for Owner's consultant to accomplish observation.

D. Mockup: Before beginning installation of air barrier, provide a mockup area of no less than 100 square feet which will include at least one inside corner, one outside corner, and one penetration, one rough opening transition, overlying insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
1. Contractor shall secure attendance of authorized representative of material manufacturer during preparation of mockup.
2. Mockup shall be installed by same crew or personnel scheduled to do the work.
3. If mockup does not comply with requirements, reconstruct and apply air barrier until mockup area is approved.
4. Approved mockup may remain as part of the Work.
5. Comply with additional requirements of Section 01 4339, "Mockup Requirements."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled packages.

B. Store and handle in strict compliance with manufacturer's instructions, recommendations, and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.8 FIELD CONDITIONS

A. Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer.

B. Protect substrates from environmental conditions that affect performance of air barrier.

C. Do not apply air barrier to a wet substrate or during rain, fog, or mist.

1.9 GUARANTEE AND WARRANTY

A. Contractor: In addition to its standard Contract guarantee/warranty, furnish Owner with a special 5-year guarantee agreeing to remove and replace other work, as required, that has been connected to or superimposed over weather barrier material to be replaced under manufacturer’s warranty.

B. Manufacturer: Furnish Owner with manufacturer's 5-year warranty that weather barrier and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical properties and material specifications. Warranty shall be on manufacturer’s standard form. Failures include, but are not limited to, the following:
1. Failure to maintain air permeance rating not to exceed 0.004 cfm/square foot when tested in accordance with ASTM E2178, within specified warranty period.
2. Failure to maintain a vapor permeance rating greater than 10 perms when tested in accordance with ATM E96/E96M, Method B.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. General:
1. Weather barrier shall be capable of performing as a continuous vapor-permeable weather barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration.
2. Weather barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
3. Products shall be compatible with one another and with other specified or existing materials with which they may come in contact.

B. The building envelope has been designed and shall be constructed with a continuous weather barrier to control air leakage into and out of the conditioned space:
1. It shall be continuous with all joints made airtight.
2. The weather barrier shall be joined in an airtight and flexible manner to the weather barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep.

3. Penetrations of the weather barrier and paths of air infiltration/exfiltration shall be made airtight including fastener locations for furring, anchors, and relief angles.

C. Weather barrier shall meet Air Barrier Association of America (ABAA) requirements for “Adhesive Backed Commercial Building Wraps.”

D. Performance Characteristics:
1. Membrane Air Permeance: Not to exceed 0.00002 cfm/sq. ft. of surface area when applied to specified thickness at 1.57-lbf/sq. ft. pressure difference when applied to CMU wall and tested in accordance with ASTM E2178.
2. Membrane Water Permeance: Not more than 0.05 perms when tested in accordance with ASTM E96/E96M, Method B.
3. Assembly Air Performance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.0008 cfm/sq. ft. of surface area under a pressure differential of 1.57 pounds per square foot when tested in accordance with ASTM E2357.
4. Multi-Story Wall Assembly Burn Test: Passed in assembly tested and acceptable for use in various wall assemblies per engineering analysis in accordance with NFPA 285.
5. Surface Burning Characteristics: ASTM E84.
   a. Flame Spread: 5.
   b. Smoke Developed: 15.
   c. NFPA Class A.
6. UV Exposure: Capable of sustaining minimum 6 months UV exposure prior to installation of overlying materials.
7. Water Penetration Resistance Around Nails, ASTM E331: Pass.

2.2 MEMBRANE MATERIAL

A. Weather Barrier Membrane: 3/64 inch (1mm) thick composite of high-density, cross-laminated, polyethylene film, coated on one side with rubberized asphalt, with disposable release sheet; “Perm-A-Barrier” by GCP Applied Technologies, Inc. as specified and the basis of design, or accepted equal.

2.3 ADDITIONAL MATERIALS

A. Transition Membrane: A 36 mil thick self-adhesive rubberized asphalt membrane integrally bonded to 4 mil thick cross-laminated, high-density polyethylene film to provide a minimum 40 mil thick membrane; “Perm-A-Barrier Detail Membrane.”

B. Self-Adhering Flashing Membrane: 40 mil thick, self-adhesive tape of rubberized asphalt integrally bonded to a high density, cross-laminated, polyethylene film; "Perm-A-Barrier Wall Flashing."
1. Width: As selected for conditions of use from manufacturer’s standard roll widths.

C. Primer: Water-based.
1. Weather Barrier Membrane: “Perm-A-Barrier Primer Plus.”
2. Transition and Flashing Membranes: “Perm-A- Barrier WB Primer.”

D. Liquid Membrane for Detailing, Patching, and Terminations: Two-component, 100 percent solids modified urethane, cold-applied; "Bituthene Liquid Membrane," or accepted equal.

E. Sealant in Contact with Membrane: Neutral one part silicone sealant, designed for adhering to low energy surfaces common in sheet or peel-and-stick weather resistant barriers,

conforming to ASTM C920, Type S, Grade NS, Class 25; “DOWSIL” “758 Silicone Weather Barrier Sealant,” or accepted equal.

F. Penetration flashing collars: Prefabricated (QuickFlash) collars or custom sheet metal flashing collars with 4 inch flanges and fully soldered seams.

G. Self-Adhering Transition Flashing: 40 mil thick, aluminum faced, self-adhesive rubberized asphalt integrally bonded to a high density, cross-laminated, polyethylene film; "Perm-A-Barrier Aluminum Flashing."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Applicator shall examine the areas and conditions under weather barrier work will be performed.
   1. Report unsatisfactory conditions in writing.
   2. Do not proceed until unsatisfactory conditions are corrected.

B. All surfaces must be dry, sound, clean, free of oil. grease, dirt, or other contaminants detrimental to the adhesion of the weather barrier and flashings. Fill voids and gaps in substrate greater than 7/8 inch width to provide an even substrate.

3.2 PREPARATION

A. Ensure that the sheathing is stabilized with moisture content within limits required of weather barrier manufacturer and with corners and edges fastened. Fasteners in sheathing should not be over driven but should sit with only the head of the fastener proud of the surface.

B. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions.
   1. Remove contaminants such as grease, oil, curing compounds, or wax from exposed surfaces.
   2. Fill all voids and holes with approved patching compound or detailing sealant.

C. Primer:
   1. Apply primer at rate recommended by manufacturer, or approximately 300 square feet per gallon, to all areas to receive sheet membrane by roller or spray and allow minimum 30 minute open time.
   2. Primed surfaces not covered by sheet membrane during the same working day must be re-primed.

D. Detailing:
   1. Install detailing sealant cants and flashings at penetrations as detailed in the Drawings or as required by the manufacturer.
   2. Install detailing sealant cant at all inside corners.
   3. Install 6-inch wide reinforcing sheet of field membrane centered over detail cants at transitions in plane and at outside corners.

3.3 INSTALLATION

A. General:
   1. Refer to manufacturer’s literature for recommendations on installation except where more rigorous requirements are contained herein.

2. Substrate surface shall be dry.

B. Apply barrier membrane according to the manufacturer's instructions, within the manufacturer's recommended application temperatures.

C. Install membrane vertically or horizontally, with laps shingled to shed water and overlapped a minimum of 2 inches.

D. Use a hand roller to firmly press the membrane into place.

E. Seal all membrane leading edges with sealant.

F. Seal around all cladding attachment fasteners.

G. Fit membrane tightly around penetrations and seal. Install penetration flashing collars over barrier membrane. Install transition membrane over top and side flanges of flashing collar.

3.4 TRANSITION MEMBRANE

A. Install strips, transition membrane, and auxiliary materials according to the barrier manufacturer's instructions to form a seal with adjacent construction and to maintain a continuous air and water membrane.
1. Coordinate the installation of the barrier with installation of roofing membrane and base flashing to ensure continuity of barrier with roofing membrane.
2. Install strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved on both substrates.
3. Install flashings only after application of air and water barrier.

B. Apply primer to substrates to receive transition membrane at required rate and allow to dry.
1. Limit priming to areas that will be covered by transition tape in same day. Reprime areas exposed for more than 24 hours.
2. Prime gypsum sheathing not covered with air membrane material with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal barrier membrane continuously to roofing membrane air and water barrier, floor-to floor construction, exterior glazed assemblies, door framing, and other assemblies in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Prime concealed perimeter frame surfaces of exterior glazed assemblies and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than one inch of full contact.

G. Roll transition membrane firmly into place with a hand roller.

H. Fill gaps in perimeter frame surfaces of glazed assemblies, doors, and miscellaneous penetrations of barrier membrane completely with foam sealant.

I. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

J. Seal all membrane leading edges with sealant.

3.5 FIELD QUALITY CONTROL

A. Tests:
1. Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.
2. Testing will be used to determined evidence of air leakage according to ASTM E1186, smoke pencil with pressurization or depressurization.

B. Inspections: Weather barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following.
1. Continuity of barrier system is achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of barrier system is provided.
3. Site conditions for application temperature and dryness of substrates have been maintained.
4. Maximum exposure time of materials to UV deterioration is not exceeded.
5. Surfaces have been primed, if applicable.
6. Laps in strips and transition strips comply with minimum requirements and are shingled in the correct direction (or mastic is applied on exposed edges), with no fishmouths.
7. Termination mastic is applied on cut edges.
8. Strips and transition strips are firmly adhered to substrate.
9. Compatible materials have been used.
10. Transitions at changes in direction and structural support at gaps are provided.
11. Connections between assemblies (membrane and sealants) comply with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
12. All penetrations are sealed.

C. Deficiencies:
1. Do not cover weather barrier until it is tested and inspected by Owner's testing agency, unless the Owner decides not to have tests performed in which case cover weather barrier after work is reviewed and found acceptable.
2. Correct deficiencies in or remove weather barrier components that do not comply with specified requirements; repair substrates and reapply.

3.6 PROTECTION

A. Protect completed membrane from subsequent construction activities and the environment as recommended by manufacturer.

B. Apply cladding as soon as possible. Apply temporary protection from UV exposure if product will be left uncovered for more than 30 days.

END OF SECTION

SECTION 07 4646

FIBER-REINFORCED CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The following exterior cementitious products.
   1. Lap siding.
   2. Shingle siding.
   3. Trim.

B. Related Requirements:
   1. Rough Carpentry: Section 06 1000.
   2. Gypsum Sheathing: Section 06 1643.
   3. Sheet Metal Flashing and Trim: Section 07 6200.
   4. Flexible Flashing and Underlayment: Section 07 6500.
   5. Joint Sealants: Section 07 9200.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Pre-Installation Meeting: Contractor, installer, and Architect shall meet prior to beginning siding installation to review and finalize installation methods and procedures.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's recommended installation details and technical literature describing cementitious products, shop-applied coatings, and installation instructions and recommendations.

B. Samples: Submit samples of each product type proposed for use.
   1. Lap siding, full height by 18 inches long.
   2. Typical trim, 12 inches long.
   3. Typical shingle.
   4. Exposed fasteners.

1.4 INFORMATIONAL SUBMITTALS

A. Certification that materials meet specified requirements.

1.5 CLOSEOUT

A. Warranty as specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Panels shall be laid flat on a smooth level surface, on skids, not to exceed height recommended by manufacturer.

B. Keep dry. Cover if stored exposed to weather, and ensure good air circulation. If panels become wet, allow to dry thoroughly before installing.

C. Boards must be carried on edge. Do not carry or lift boards flat; improper handling may cause cracking or board damage.

1.7 WARRANTY

A. Manufacturer: Furnish Owner with fiber cement manufacturer's non-pro-rated 30-year product warranty against manufacturing defects:

B. Contractor: In addition to its guarantee/warranty under the Contract, furnish Owner with a 3-year extended warranty against defects in installation of manufactured fiber cement products.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Products shall not contain asbestos and shall be non-combustible when tested in accordance with ASTM E136.

B. Flammability: Meet the following when tested in accordance with ASTM E84:
1. Flame Spread Index: 0.
2. Smoke Developed Index: 5.

C. Panels shall comply with ASTM C1186, Grade II, Type A.

2.2 MANUFACTURER

A. Cement Siding and Trim: Nichiha Corporation, Johns Creek, GA, 866-424-4421, as specified and basis of design, or equal.

2.3 CEMENT SIDING

A. Horizontal Lap Siding Board: "Savannah Smooth."
1. Profile: Smooth.
2. Width: Match existing.
3. Thickness: 1/2 inch.
4. Exposure: To match existing.
5. Length: 9 feet, 4 inches.
6. Factory sealed on 6 sides.

B. Shingles: "Sierra Premium Shake."
1. Edges: Straight.
2. Thickness: 1/2 inch.
3. Length: 9 feet, 4 inches.
4. Exposure: To match existing.

C. Trim:
1. Type: As provided by manufacturer compatible with board and shingles.
2. Surface Texture: “Smooth.”
3. Thickness: As shown.
4. Widths: Manufacturer’s standard widths as noted on the Drawings.
5. Length: 10 feet, unless otherwise standard with manufacturer.
6. Rout to custom profiles where shown.

D. Factory Finish on Cement Siding and Trim: Products shall be factory sealed and primed.

2.4 ADDITIONAL MATERIALS

A. Fasteners: Stainless steel or hot-dip galvanized in accordance with ASTM A153/A153M. Electro-galvanized and aluminum fasteners are not acceptable.
1. Siding Nails: 0.09 inch shank x 0.221 inch head.
2. Roofing Nails: 11 gage (0.121 inch shank x 0.371 inch head).
3. Length: As recommended by panel manufacturer for blind nailing and to penetrate sufficient depth into framing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that wall sheathing is straight and flat to within 1/8-inch in 10 feet.

B. Verify that stud or solid blocking will occur at all nailing locations.

C. Verify underlayment and flashings have been installed and are ready to be covered.

3.2 INSTALLATION

A. General:
1. Fiber-cement products shall be installed and finished in accordance with manufacturer's latest printed instructions, as summarized herein, and as required to maintain product warranty.
2. Confirm required panel sizes from actual field measurements. Use cutting saws and blades recommended by manufacturer. Clean frequently to provide the smoothest possible cut edge.
3. Field Prime-Painting:
a. Seal cut edges of factory-primed siding panels prior to installation using primer as specified in Section 09 9000, “Painting and Coatings.”
b. Siding visible in completed installation shall be back-primed.

B. Lap Siding:
1. Locate vertical splices in siding at least two stud spaces from the edge of openings. Install subsequent courses of siding with end laps between courses offset two stud bays apart.
2. Install pressure-treated wood starter strip under first row as shown to maintain consistent plank angle.
3. Maintain tongue and groove joint offsets with studs and minimum fastener distance from end of panels. Comply with other clearances as recommended by siding manufacturer.

4. Secure siding using specified fasteners and in accordance with manufacturer's "blind nailing" instructions.
   a. Drive fasteners perpendicular to siding and framing.
   b. Fastener heads shall be set flush with surface; do not countersink.
   c. Hammer, tool marks, and marred surfaces and edges are not acceptable on exposed surfaces.
   d. Nail uniformly at each stud framing line.

C. Siding, and trim shall be field finish-painted as specified in Section 09 9000, "Painting and Coating."

3.3 CLEANING

A. Review manufacturer's guidelines for detailed care instructions.

END OF SECTION

SECTION 07 5423

THERMOPLASTIC-POLYOLEFIN ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Adhered, single ply, thermoplastic-polyolefin (TPO) membrane roofing system.
   2. Rigid insulation and cover board/protection board under roofing, if required.

B. Related Requirements:
   1. Sheet Metal Flashing and Trim: Section 07 6200.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Pre-installation Meeting: Prior to installation of roofing and associated work, Contractor, Architect, manufacturer's representative, roofing installer, and other installers whose work may affect quality of roofing shall meet at the Project site to coordinate related requirements and waterproofing work.
   1. Notify participants at least 10 working days before conducting meeting.
   2. Review material selections and procedures to be followed in performing the work.
   3. Review in detail job conditions, schedule, construction sequence, installation requirements, and quality of completed installation.
   4. Review surface preparation, substrate condition and pre-treatment, forecasted weather, sheet metal flashings, installation procedures, testing and inspection procedures, installation layout, protection, and repairs.
   5. Review in detail the means of protecting completed work during remainder of construction period.
   6. Record discussions of conference and any conflict, incompatibility, or inadequacy.

C. Coordinate installation of membrane roofing system so insulation is not exposed to precipitation or left exposed at the end of the workday. Do not install more insulation than can be covered with roofing membrane before end of working day or onset of inclement weather.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Include plans, sections, and details as follows:
   1. Roof plan for Building showing slopes, drains, roof-mounted equipment, roof hatch, and locations of flashing and termination details.
   2. Base flashings and membrane terminations. Provide details drawn for this specific installation, not manufacturer's standard details.
   3. Tapered insulation sloping layout showing slopes, crickets, spot heights, and thickness.

B. Product Data: Manufacturer's published specifications for products to be used in roofing system and installation instructions.

C. Samples for Verification:
1. 12-inch squares of sheet roofing and walk pad, in specified color.
2. Each type of termination bar and fastener.

1.4 INFORMATIONAL SUBMITTALS

A. Sample copy of standard roofing system manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.

B. Statement of installer qualifications:
1. Include a letter from manufacturer of roofing system stating that installer is approved, authorized, or licensed by manufacturer to install specified roofing system.
2. Letter shall certify that installer has previously and satisfactorily applied the specified roofing system under manufacturer’s supervision.
3. Letter shall be on manufacturer’s letterhead and shall be signed by an officer of the company, not by a local sales representative.

C. Statement of manufacturer qualifications for manufacturers not named in this Section. Submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

D. Inspection report on completed roofing by representative of roofing system manufacturer.

E. Record of pre-installation meeting.

1.5 CLOSEOUT SUBMITTALS

A. Extended warranties and guarantees as specified.

B. Certificates signed by roofing manufacturer certifying that installed roofing system complies with specified performance requirements.

C. Manufacturer's recommendations for proper maintenance of the roofing system including inspection frequencies, penetration addition/modification policies, temporary repairs, and leak call procedures.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
1. Trained and approved by manufacturer of roofing materials.
2. Workers shall be skilled and experienced in installing the type of roof specified.
3. Mechanics intending to use hot air welding equipment shall have successfully completed a course of instruction provided by a manufacturer’s representative prior to welding.
4. 5 years’ minimum specialized experience in installation of specified products on projects similar in scope.
5. Able to comply with manufacturer’s warranty requirements, and acceptable to manufacturer.
6. Employ a supervisor who is fluent in English and to be on-site at all times during work.

B. Manufacturer Qualifications: Company specializing in production and marketing of thermoplastic membrane roofing systems, with at least 20 years' documented continuous experience in manufacture of roofing products, and employing experienced in-house technical and field observation personnel qualified to provide expert technical support.

C. Comply with recommendations of the NRCA Roofing and Waterproofing Manual, including any conditions not indicated on the Drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original, undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturers written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in such a manner as to not exceed designed loading capacity of deck.

1.8 FIELD CONDITIONS

A. Ambient Conditions: Proceed with roofing work only when current and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

B. Provide watertight seals at perimeter of work and at penetrations through the work at end of each work day. Remove such seals before continuing with roofing work. Water entry and resulting damage to Building, its contents, or to partially completed roofing work is the responsibility of the Contractor.

1.9 GUARANTEE AND WARRANTY

A. Contractor: In addition to its standard guarantee/warranty under the Contract, furnish Owner with a special extended written 5 year guarantee for roofing system agreeing to repair or replace roof that leaks water, deteriorates, or otherwise fails to perform as a result of failure of materials or workmanship, at no expense to the Owner.
   1. By terms of guarantee, also agree to remove and replace other work, as required, that has been connected to or superimposed on substrate material to be replaced.
   2. Include entire installation and roofing membrane assembly, including base flashing, with no dollar limit.
   3. Extended guarantee shall be countersigned by installer.

B. Manufacturer: Furnish Owner with an executed copy of roofing system manufacturer's standard 20-year "Membrane System Warranty" with a no-dollar-limit penal sum.
   1. Warranty shall be signed by an authorized representative of the roofing system manufacturer on a form published with the manufacturer's product literature as of the date of the Contract Documents.

2. Warranty shall cover both labor and material necessary to provide watertightness, including that required to repair roof leaks caused by structural movement or standing water on roof membrane.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Roofing system, base flashing, and interface with other materials shall be watertight; shall not permit passage of liquid water; and shall withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Roofing materials shall be compatible with one another and with other specified materials, under conditions of service and installation required.

C. Membrane, base flashings, and component materials shall meet requirements of FM 4450 and FM 4470 as part of a roofing system and shall be listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable.

D. Installed fully adhered systems shall meet FM Windstorm Classification ratings as follows, or as required based upon calculated wind uplift values for claddings and components.
1. Field of Roof: FM 1-120.
2. Perimeter Requirement: FM 1-195.
3. Corner Requirement: FM 1-300.

E. Exterior Fire-Test Exposure: Class A; ASTM E108, for installation and slopes indicated. Roofing system shall have specified fire-test-response characteristics as determined by testing identical products in accordance with specified test method by UL, FM, or another testing and inspecting agency acceptable to authorities having jurisdiction.

F. Structural, Seismic, and Wind Loads: Conform to loads specified in the CBC and “Minimum Acceptable” requirements of FM Global Property Loss Data Sheet 1-28, “Wind Design,” and FM Global Property Loss Data Sheet 1-29, “Roof Deck Securement and Above-Deck Roof Components.”

G. Installed system shall have a relatively smooth surface with a total surface fusion weld that creates a consistent, watertight, monolithic roof assembly.

2.2 MANUFACTURED MEMBRANE ROOFING SYSTEMS

A. Roofing System: Reinforced, single ply, thermoplastic polyolefin (TPO) membrane laminated to 55 mil thick non-woven polyester polypropylene blended fleece resulting in a total finished sheet thickness of 115 mils; “Platinum TPO” by Firestone, “Sure-Weld Adhered Roofing System” by Carlisle; Johns Manville, GAF, or equal.
1. Attachment: Fully adhered.
2. Color: White.
3. Nominal TPO Thickness: 60 mils.
4. Joint Treatment: Manufacturer's standard hot-air weld.
5. Provide heat weldable, reinforced flashing membrane of material, color, and thickness to match primary roofing membrane.

2.3 BOARD INSULATION

A. Tapered and Non-Tapered Thermal Rigid Board, if Required: Rigid polyisocyanurate board insulation complying with ASTM C1289, Type II, Class 1, Grade 2; acceptable to membrane manufacturer.
   1. Thickness: As required to maintain an average insulating value of R-4.
   2. Compressive Strength: 25 psi minimum when tested in accordance with ASTM D1621.
   3. Fire Rating: Underwriters Laboratories' listing as required by code for roof deck.
   4. Provide black mat facer on both surfaces.
   5. Provide tapered insulation at crickets and elsewhere to achieve slopes indicated or required by roofing manufacturer.

B. Tapered Edge Strips at Drain Sump Transitions, if Reqired: Cellulose-fiber board; ASTM C208, Type II, Grade 2 (unprimed), water-resistant with non-asphaltic binders, chemically treated for deterioration.
   1. Minimum Thickness: 1/2 inch.
   2. Slope: 1/4 inch per foot. Taper to a feather edge and size to suit application.

2.4 BOARD UNDERLAYMENT

A. Cover Board for Over Insulation, if Required: Glass mat faced, gypsum fiber roof board with silicone treated core, conforming to ASTM C1278/C1278M and ASTM C1177/C1177M, and approved for use in the specified roofing system; "Dens-Deck Prime" by Georgia-Pacific, or equal acceptable to roofing membrane manufacturer.
   1. Thickness: 1/4 inch.
   2. Provide as an underlayment board over wood deck if required to achieve Class A fire rating or required by CBC.

B. Board Adhesive: “Fast 100-LV Adhesive” by Versico, “Flexible FAST Adhesive” by Carlisle, or equal.

2.5 ADDITIONAL MATERIALS

A. Walkway Pads: By roofing membrane manufacturer; reinforced, heat-weldable membrane with surface embossment specifically designed as a protection layer from rooftop traffic.
   1. Size: Roll; at least 36 inches wide.
   2. Thickness: 180 mils.
   3. Color: To match roofing membrane.

B. Roof Vapor Barrier: Self-adhered; 32 mil self-adhesive vapor barrier acceptable to membrane manufacturer; “Carlisle 725 Air and Vapor Barrier” by Carlisle, or equal.

C. Insulation Fasteners: As recommended by roofing system manufacturer; appropriate for substrates. Fasteners shall meet FM Standard 4470 for corrosion resistance.

D. Mechanical Membrane Fasteners: As recommended by roofing system manufacturer; appropriate for substrates. Fasteners shall meet FM Standard 4470 for corrosion resistance.

E. Termination Reinforcement: Flexible thermoplastic extrusion that is compatible with roofing and flashing membranes.

F. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch wide, roll formed and pre-punched.

G. Sealants and Caulking: As recommended by roofing membrane manufacturer.

H. Nailers, if Required: Pressure-treated wood, #2 quality or better conforming to FM Loss Prevention Sheet 1-49. Creosote and asphaltic treatments are not acceptable.

I. Foil Tape: 2 inch wide, nominal 5 mil thick; 3M “Aluminum Foil Tape 425/427,” or equal. Pressure sensitive aluminum tape with transparent acrylic adhesive, used as:
   1. A separation layer between small areas of asphalt contamination and membrane.
   2. Bond breaker under cover strip at joints.
   3. Separation between TPO membrane and adjacent asphaltic or butyl flashings.

J. Adhesives: As recommended by membrane manufacturer for each roofing condition.

K. Parapet Wall/Curb Flashing: TPO clad metal as recommended by membrane manufacturer; a TPO-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles.
   1. Sheet Metal: 24 gage, G90 galvanized sheet metal with 20 mil unsupported TPO membrane laminated on one side.
   2. Dimensions: 4 x 8 feet, or 4 x 10 feet.

L. Flashing Corners: Prefabricated from 0.060 inch thick TPO membrane, inside and outside profiles, heat weldable to roofing membrane or base flashings.

M. Flashing Boots and Vent Pipe Flashing: Prefabricated from same material as roofing membrane, at least 45 mils thick.

N. Additional Accessories and Materials: Provide primers, protection sheets, slip sheets, preformed cone and vent sheet flashings, in-seam sealants, termination reglets, and other accessories compatible with roofing membrane and recommended by roofing system manufacturer for intended use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that work of other trades which penetrates roof deck or requires workers and equipment to traverse roof deck has been completed.

B. Verify roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

C. Verify metal flashing and curb cants are in good condition and free of damage.

3.2 PREPARATION

A. Tear off existing roofing, insulation, and related flashings.

B. Clean substrate of dust, debris, and other substances detrimental to roofing installation. Remove sharp projections.

C. Prevent materials from entering and clogging roof drains and from spilling or migrating onto surfaces of other construction. Remove roof drain plugs when no work is taking place or when rain is forecast.

D. Complete terminations and base flashings.

E. Protect adjacent construction from damage during roofing operations.

3.3 INSULATION INSTALLATION

A. Comply with roofing system manufacturer's written instructions and FM requirements for installing roof insulation.

B. Install tapered insulation under area of roofing in order to achieve required slopes and to conform to layout on reviewed shop drawings.

C. Endeavor to install insulation in two or more layers to greatest extent possible with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches in each direction. Do not mechanically fasten supplemental layers.

D. Trim insulation, where necessary, at roof drains so that completed surface is flush and does not restrict flow of water. Form a slight saucer around each roof drain.

E. Fill gaps exceeding 1/4 inch with insulation.

F. Cut and fit insulation to within 1/4 inch of nailers, projections, and penetrations.

G. Install the insulation by securing to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roofing insulation to deck type indicated.

3.4 INSTALLATION OF GYPSUM SHEATHING/COVER BOARD OVER INSULATION

A. Adhere specified gypsum board panel over insulation. Do not use fasteners.

B. Lay panels with joints staggered from joints in underlying insulation.

C. Butt board edges and ends loosely.

D. Provide adhesive in strict compliance with the roof system manufacturer’s installation recommendations, Factory Mutual Global (FMG) Loss Prevention Data Sheet 1-29 and in accordance with specified FMG approval requirements, and as follows:
   1. Place adhesive in 1-inch wide beads at 12 inches on center in the field of roof areas.
   2. Place adhesive in 1-inch wide beads at 8 inches on center within 8 feet of roof area perimeters.

E. Stagger all joints 6 inches minimum and offset joints with insulation by 6 inches minimum.

F. Walk boards into place with a 30-inch-wide, 100-150 pound weighted steel roller to ensure full contact with adhesive. Continue to walk boards in place until adhesive has set.

3.5 APPLICATION OF MEMBRANE

A. General:
   1. Install roofing, as shown on the Drawings and reviewed submittals, in accordance with manufacturer's recommendations and as specified. In case of discrepancy, the more rigorous requirement shall govern.
   2. Coordinate installation with related work, such as sheet-metal flashing.
   3. Unroll sheet.

4. Accurately align sheets, maintaining uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
5. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
6. Use maximum size sheets of sheet materials to reduce the number of joints in the system.

B. Fully Adhered Installation: Membrane shall be fully adhered to cover board in accordance with membrane manufacturer's installation instructions, using manufacturer's specified foam adhesive. Refer to manufacturer's Technical Manual.

C. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld and roll side and end laps of roofing membrane a minimum of 1-1/2 inches according to manufacturer's written instructions to ensure a watertight seam installation.
1. Test lap edges with probe to verify seam weld continuity. Re-weld openings or discontinuities.
2. Apply lap sealant to seal cut edges of roofing membrane.
3. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
4. Repair tears, voids, and lapped seams in roofing membrane that do not meet requirements.
5. Complete all seams by end of day.
6. T-Joints (Three-way Overlaps): When welding a three-way overlap, shave down top edge of second sheet create a smooth transition for top membrane layer to conform to for welding. Chamfer edge of membrane. Install T-joint cover.
7. Weld cover strips at membrane seams that do not have a factory selvage edge.

D. Membrane Flashings:
1. Install sheet flashings and preformed flashing accessories, adhering to substrates according to roofing system manufacturer's written instructions.
2. Flashings shall extend a minimum of 8 inches above the membrane surface unless previously accepted by the membrane manufacturer, the Owner, and Architect.
3. Flashings that exceed 30 inches in height shall receive additional securement in accordance with securement methods recommended by manufacturer.
4. Flashing membranes shall be adhered to substrates. Interior and exterior corners and miters shall be cut and hot-air welded into place. No bituminous elements shall be in contact with roofing membrane.
5. Flashings shall be hot-air welded at their joints and at their connections with the roofing membrane.
6. Flashings shall be terminated according to membrane manufacturer's recommended details.
7. Avoid pipe clusters; sealant pockets are not acceptable.

E. Metal Flashings:
1. Sheet Metal Flashing: As specified in Section 07 6200, "Sheet Metal Flashing and Trim." Coordinate installation where metal flashing interfaces with roofing membrane so as to prevent metal from pulling free or buckling, and provide seal to prevent moisture from entering the roofing system or building.
2. Complete metal work in conjunction with waterproofing and flashings so a watertight condition exists daily.
3. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.
4. Metal joints shall be watertight.
5. Metal flashings shall have a 4 inch minimum nailing flange and shall be fastened into substrate with fasteners of the same type with two rows of fasteners, 4 inches on

center staggered into wood blocking, concrete, or metal at 6 inches on center staggered. Fasteners shall penetrate into substrate a minimum of 1-1/4 inches.

6. Adjacent sheets of coated metal shall be spaced 1/4 inches apart. End joints of metal shall be fastened 6 inches on center. Joints shall be covered with 1-inch wide aluminum tape. A 4-inch wide membrane flashing strip shall be hot air welded over the joint.

F. Termination Bars:
   1. Install termination bar around square penetrations including equipment curbs, and termination disks around round penetrations including drains, pipes, standoffs, and other membrane terminations within the field. Fasten in accordance with manufacturer's requirements at 4 inches on center minimum.
   2. Install termination bars at membrane perimeters at parapet walls. Fasten in accordance with manufacturer's requirements at 12 inches on center minimum.

G. Roof Drains: Coordinate installation of roof drains and sumps and related flashings.
   1. Spread sealant or mastic bed over drain flange and securely seal roofing membrane in place with clamping ring.
   2. Solidly coat drain bowl flange with sealant.
   3. Install a 36 inch square piece of membrane flashing over the drain.
   4. Fasten clamping ring in a solid bed of sealant on top of membrane flashing. Trim membrane flashing within 1 inch of inside edge of clamping ring.
   5. Lap outer edge of flashing sheet onto deck sheet a minimum of 6 inches and heat weld.

H. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.

I. Intersections with Vertical Surfaces:
   1. Extend field membrane over to corner and attach as required.
   2. Install termination reinforcement along termination edge at termination bars.

3.6 TEMPORARY CUT-OFFS

A. Flashings shall be installed concurrently with the membrane in order to maintain a watertight condition as the work progresses.

B. When a break in the day's work occurs, install a temporary watertight seal.
   1. The membrane shall be sealed to the deck and/or the substrate so that water will not be allowed to travel under the installed roofing.
   2. The edge of the membrane shall be sealed in a continuous heavy application of membrane manufacturer's approved adhesive of 6-inch girth.
   3. When work resumes, the contaminated membrane shall be removed from the work area and removed from the site. None of the temporary cut-off materials shall be reused in the completed work.

C. If inclement weather occurs while a temporary water stop is in place, the Contractor shall provide the labor necessary to monitor the situation to maintain a watertight condition.

D. If water enters under the completed roofing, then insulation, cover board, and membrane in the affected area shall be removed and replaced at the Contractor's expense.

3.7 FIELD QUALITY CONTROL

A. Upon completion of installation, a representative of the roofing membrane manufacturer shall inspect to verify that the membrane system has been installed in accordance with manufacturer's approved specifications and details.

B. Conduct a 72-hour flood test around each roof drain in accordance with ASTM D5957 (modified).

3.8 PROTECTION

A. Protect roofing from damage and wear during remainder of construction period.

B. At completion of construction, inspect roofing for deterioration and damage, describing its nature and extent in a written report.

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sheet metal for maintaining weather and water resistance of building enclosure impacted by work under this Contract.
2. Sealant work related to sheet metal flashing and trim.
3. Requirements for miscellaneous sheet metal integral with products and systems included under other Sections.

B. Related Requirements:
1. Rough Carpentry: Section 06 1000.
2. Fiber Reinforced Cement Siding: 07 4646
3. Thermoplastic-Polyolefin Roofing: Section 07 5423.
4. Flexible Flashing and Underlayment: Section 07 6500.
5. Joint Sealants: Section 07 9200.
6. Painting and Coating: Section 09 9000.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Shop Drawings:
1. Fully detailed, large-scale drawings for fabrication and installation layout of flashing and other custom or unique sheet metal flashing and trim conditions when requested by Architect or where deemed necessary to clarify installation.
2. Include plans, elevations, and keyed details. Distinguish between shop and field-assembled work.

B. Products Data: Manufacturer's literature for manufactured items including shop applied coatings.

C. Samples: Provide as requested by Architect.

1.4 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.5 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications: At least 5 years' documented experience in fabrication and installation of custom flashing and sheet metal of type and scope similar to that required for this Project.
   1. Workers shall be skilled and experienced in installing the type of sheet metal specified.
   2. Installer shall maintain a full-time supervisor/foreman, fluent in English, at the jobsite during times that sheet metal work is in progress.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirement."

1.7 FIELD CONDITIONS

A. Verify existing dimensions and details prior to installation of materials. Notify Architect of conditions found to be different from those indicated on the Drawings. Architect will review situation and will inform Contractor and installer of changes.

B. Install materials in strict accordance with safety requirements of material manufacturer, Material Safety Data Sheets, and local, state, and federal rules and regulations.

1.8 GUARANTEE AND WARRANTY

A. Contractor: In addition to its standard guarantee/warranty under the Contract, furnish Owner with an extended written 2-year guarantee agreeing to repair or replace work that fails in materials or workmanship. Failure includes failure to perform as specified and/or deterioration of finish or construction in excess of that to be expected under normal weathering.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. General:
   1. Installed flashing and sheet metalwork shall be weathertight. Coordinate with work of other Sections for weathertight installation at interface with other materials and systems.
   2. Materials shall be compatible with one another and with other specified materials with which they may come into contact. Promptly bring discrepancies to the attention of the Architect.

B. Industry Standards:
   1. Conform to applicable provisions of the "Architectural Sheet Metal Manual" of the Sheet Metal and Air Conditioning Contractors' National Association Inc. (SMACNA Manual), except where more stringent requirements are specified or shown.
   2. Conform to applicable provisions of NRCA "Waterproofing Manual."

C. Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Completed sheet metal flashing and trim shall not rattle, leak, or loosen.
   2. Temperature Change Range: 120 degrees F ambient, 180 degrees F at material surface.

2.2 SHEET METAL

A. General:
   1. Thickness: As required by SMACNA for specific conditions and as shown on Drawings but not less than 24-gage.
   2. Thickness at continuous cleats shall be minimum 20-gage.

B. Metallic-Coat Steel Sheet: Typical for flashing unless otherwise shown, specified, or required to match existing.
   1. Restricted flatness steel sheet, metallic coated by the hot-dip process.
      a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, Z275 (G90) coating designation; Commercial designation.
      b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, Class AZM150 coating designation, Grade 275 (Class AZ50 coating designation, Grade 40); structural quality; “Zincalume,” “Galvalume,” or “Zintro-Alum” manufactured under license from BIEC International, Inc., Vancouver, WA.
   2. Finish: Shop primed and field finish painted.

C. Aluminum: ASTM B209/B209M, alloy 3003, 0.027 inch thick, except as otherwise indicated or required by SMACNA.

2.3 ADDITIONAL MATERIALS AND COMPONENTS

A. Pop rivets, made from same type material as metals to be fastened, may be used for metal-to-metal connections when future disassembly is not required and where not exposed to view.

B. Fasteners exposed to view shall be reviewed with Architect.

C. Provide EPDM washers at exposed fastener locations.

D. Solder for Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

E. Flashing Cement: ASTM D4586/D4586M, Type II.

F. Slip Sheet; if not Indicated on the Drawings: One of the following.
   1. Rosin-sized, unsaturated building paper, 4-6 pounds per 100 square feet; FS UU-B-790, Type I, Grade A.
   2. Inorganic, high-performance, non-woven, non-perforated, spunbonded polyolefin; DuPont “Tyvek CommercialWrap.”

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.4 FABRICATION

A. General:
1. Obtain field measurements for accurate fit before proceeding with shop fabrication.
2. Exposed edges of sheet metal flashing shall be folded and hemmed.
3. Fabricate inside and outside corners, intersections, and complex flashing conditions in shop with folded, constructed, mechanically fastened, and soldered joints.

B. Shop-fabricate flashing, trim, expansion joints, and similar items to comply with profiles and sizes shown and in accordance with standard details shown in "Architectural Sheet Metal Manual" by SMACNA.
1. Finished work shall be strong and rigid, neat in appearance and free from defects.
2. Seams and joints shall be kept to a minimum.

2.5 FINISHES

A. Factory Priming:
1. Galvanized Surfaces:
a. Surface Preparation: SSPC No. 1 and additional recommendations included in the AGA document “Suggested Specification for Preparing Hot Dip Galvanized Surfaces for Painting.”
b. Primer: Low VOC polyamidoamine epoxy, Tnemec “Series L69,” or equal applied at 2.0 to 3 mils DFT.
2. Other Metals: In accordance with coating manufacturer’s recommendations.

B. Field-finish shop primed sheet metal as specified in Section 09 9000, “Painting and Coating.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrates are smooth and clean to extent needed for sheet metalwork.

B. Before installing sheet metal, verify shapes and dimensions of surface to be covered.

C. Notify the Architect of any discrepancies between the Drawings and field conditions, and of any elements that required repair.

D. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to installer or applicator. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Comply with details and profiles indicated on Drawings and SMACNA "Architectural Sheet Metal Manual" recommendations for installation of the work.

B. Coordinate installation with other work that comprises entire system of weatherproofing, waterproofing, and rain drainage.

C. Conceal fastenings, except as otherwise indicated.

D. Install flashings and counterflashings where shown or required to provide watertight protection.

E. Unless otherwise noted, separate dissimilar metals with suitable coating. Coating shall be invisible in finished work, except for ends of sections.

F. Install work watertight, without waves, warps, buckles, fastening stresses, distortion, "oil canning," and true to line and surface, allowing for expansion and contraction.

G. Torch cutting of sheet metal flashing and trim is not permitted.

H. Apply sealants as specified in Section 07 9200, "Joint Sealants."

3.3 CLEANING AND TOUCH-UP

A. Flashings and counterflashings shall be replaced where deterioration or damage is beyond successful repair by finish touchup or similar minor repair procedures.

B. If applicable, touch up shop-applied primer on galvanized sheet metal, and paint as specified in Section 09 9000, "Painting and Coating."

END OF SECTION

SECTION 07 6500

FLEXIBLE FLASHING AND UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Self-adhering sheet membrane underlayment at copings, cornice, and other locations where shown.
   2. Self-adhering sheet flashing at perimeter openings, and other locations where shown.

B. Related Requirements:
   1. Sheet Membrane Weather Barrier: Section 07 2513.
   2. Sheet Metal Flashing and Trim: Section 07 6200; metal flashings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

B. Coordination:
   1. Coordinate with other Sections for continuity of waterproofing of building envelope at interface of flashings and underlayment installed by various trades.
   2. Coordinate with installers of anchorage for wall panels and other work anchored to substrate or otherwise penetrating self-adhering membranes, to ensure that all penetrations are sealed.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's descriptive data for proposed product, installation instructions, use limitations of materials, and recommendations for proposed installation.

B. Material Safety Data Sheets (MSDS): For storage on site.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty.

B. Installer qualifications as specified.

1.5 QUALITY ASSURANCE

A. Manufacturer: Regularly engage in the manufacture of self-adhering sheet flashing for at least 10 years, capable of furnishing a list of five satisfactory installations of the material which has been in service for at least 10 years.

B. Installer: Certified or approved by the self-adhering sheet flashing manufacturer to install the specified products with a minimum of 5 years’ continuous experience installing the specified materials.

1.6 DELIVERY, HANDLING, AND STORAGE

A. Store materials away from sparks or flames, protected from rain and physical damage, and within temperature range recommended by manufacturer.

1.7 FIELD CONDITIONS

A. Temperature of air and surfaces to receive underlayment shall be within the range recommended by system manufacturer.

B. Substrate surfaces shall be dry at application.

C. Provide adequate ventilation of enclosed spaces where primer is used.

1.8 WARRANTY

A. Contractor: Provide City with a special written warranty that the installed systems will be free of defects related to workmanship or material deficiency for a period of 5 years from date of Substantial Completion. The following problems shall be specifically covered under the warranty:
   1. Cohesive or adhesive failure of the system.
   2. Weathering deficiencies resulting in failure of the system.
   3. Abrasion or tear failure of the system resulting from normal use.

B. Special Installer's Warranty: Specified form, signed by installer, covering work of this Section for warranty period of 2 years from date of substantial completion.

C. Warranties shall be in addition to and not a limitation of other rights the City may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Sustainable Design:
   1. Recycled content is the sum of postconsumer recycled content plus one-half the preconsumer recycled content, based on cost. Products meeting recycled content criteria are valued at 100 percent of their cost for the purposes of credit achievement calculations. If products are not available that meet the above requirements, provide materials with the highest available levels of post-consumer and pre-consumer recycled content.
   2. All paints and coatings, primers and sealers wet-applied on site must meet the applicable VOC limits of the California Air Resources Board (CARB), Suggested Control Measure (SCM) for Architectural Coatings, current edition, or the South Coast Air Quality Management District (SCAQMD) Rule 1113.
   3. All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.
      a. Meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

b. Aerosol adhesives shall meet the VOC limits of the “Green Seal Environmental Standard for Certification of Commercial Adhesives” (GS-36) of Green Seal, Inc.

2.2 MATERIALS

A. High Temperature Self-Adhering Sheet Underlayment at Copings and Cornice: 30-mil-thick composite of aggressive butyl rubber based adhesive backed by a layer of high density cross laminated polyethylene; "Grace Ultra" by Grace Construction Products, or equal.

B. Self-Adhering Flashing: 40-mil-thick, self-adhesive, cold applied tape consisting of a rubberized asphalt integrally bonded to a high density, cross laminated polyethylene film; "Perm-A-Barrier Wall Flashing" by Grace Construction Products, or equal.

2.3 ACCESSORIES

A. Sealant for Flexible Flashing and Underlayment: Sealing mastic as provided or recommended by membrane manufacturer.

B. Primers: As recommended and provided by membrane manufacturer for each type of substrate.

C. Liquid Membrane: Two-component, 100 percent solids modified urethane, cold-applied; "Bituthene Liquid Membrane."

D. Mechanical Fasteners: Washer-type, as recommended by membrane manufacturer for attachment to substrate.

E. Additional Accessories: Provide as recommended by manufacturer for conditions of installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check to ascertain whether surfaces to receive sheet membrane flashing or underlayment are free of dirt, debris, sharp protrusions, and irregularities at joints.

B. Correct deficiencies.

C. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Where priming is required, prime substrates with primer suitable for each substrate and recommended for this use by membrane manufacturer.
   1. Prime concrete if bottom of membrane overlaps and is adhered to concrete foundation or slab. Prime only areas that can be covered with membrane on the same day. Re-prime areas not covered with membrane within 24 hours.
   2. Prime other substrates as recommended by manufacturer for installation of sheet membrane.

B. At external corners or gaps in sheathing, install liquid membrane to smooth and ease gaps, and to round corners.

3.3 INSTALLATION OF SELF ADHERING FLASHING AND UNDERLAYMENT

A. Install at locations specified and as shown on Drawings. Coordinate the installation of the self-adhesive membranes with the waterproofing and roofing systems to ensure continuity of self-adhesive underlayment with other waterproofing assemblies.

B. Cut membrane from roll to required lengths, and apply in continuous strips.

C. Comply with manufacturer’s recommendations and specified requirements for overlapping or side and end seams.
1. If dimension is not shown on the Drawings, provide minimum 3 inch lap between self-adhesive underlayment and adjacent interfacing underlayment or substrate.
2. At perimeter terminations turn up side dams a minimum of 4 inches and fold to form watertight inside corners with seams sealed.

D. Flashing at Openings: As shown on the Drawings in accordance with details and recommendations of manufacturer.
1. Fold and lap flashing to prevent water from migrating behind underlayment.
2. Provide sealant at any “pinholes.”

E. Flashing at Corners: Install prefabricated corner flashing as recommended by the manufacturer. In addition, carefully notch and fold flashing membrane at corners and returns.

F. Press membrane into place using heavy hand pressure and then roll with a wall or countertop roller, as is required.

G. Patch tears and inadequately lapped seams.

H. Provide mechanical fasteners where recommended by membrane manufacturer. Fastener heads shall be sealed with liquid membrane.

I. Seal joints caused by pipes, conduits, electrical boxes, anchors, and similar items penetrating membrane with liquid membrane to create an airtight seal between penetrating objects and membrane. Apply liquid membrane to seal termination edges.

J. Seal all top edges (leading edges) of self-adhesive membrane terminating on a vertical surface with liquid membrane. In addition, apply a bead of liquid membrane at seams, cuts, and penetrations through the self-adhering flashing membrane.

K. Inspect membrane for continuity. Patch tears, fishmouths, damage, and inadequately lapped seams in accordance with manufacturer's instructions.

L. Apply overlying materials as soon as possible and within the allowable exposure time limits specified and stated in manufacturer's instructions.

3.4 ADJUSTING

A. Remove and replace self-adhering flashing that does not comply with the specified requirements. Holes in the flashing shall be patched with a minimum 6-inch overlap or in accordance with the self-adhering flashing manufacturer's instructions.

END OF SECTION

SECTION 07 8400

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Through-penetration firestop systems.
   2. Fire-rated joint systems.

B. Related Requirements:
   1. Gypsum Board: Section 09 2900; gypsum wallboard fireproofing at structural members.
   2. Divisions 21 through 28: Infrastructure systems work requiring firestopping.

1.2 DEFINITIONS

A. Firestopping: A material, or combination of materials, to retain the integrity of time-rated construction by maintaining an effective barrier against the spread of flame, smoke and gases.

B. Other Definitions: Follow CBC.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

B. Coordination:
   1. Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed in accordance with specified requirements.
   2. Sequence work to permit firestopping to be installed after completion of penetrating item installation but prior to covering or concealing of openings.

1.4 ACTION SUBMITTALS

A. Shop Drawings:
   1. Manufacturer's UL-approved assembly drawings are acceptable as shop drawings if they reflect actual job conditions.
   2. For job conditions where no clearly defined UL-approved assembly exists, provide an engineering judgment from manufacturer acceptable to local governing authorities and following requirements set forth by the International Firestop Council.

B. Product Data: Manufacturer's specifications and installation instructions for materials and prefabricated devices sufficient for identification at the jobsite. Include certification or certified laboratory test report stating that materials or combination of materials meet ASTM E814 and are classified in UL's Building Materials Directory.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Firestopping installation shall meet requirements of Underwriters Laboratories, Inc. (UL) Test UL 1479, "Standard for Fire Tests of Through-Penetration Firestops," or ASTM E814 and UL 2079.
   2. Materials shall meet requirements of NFPA 101, "Life Safety Code" and NFPA 70, "National Electrical Code."

B. Installer Qualifications: Experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.

C. At Contractor's option, work under this Section may be assigned to a single qualified installer or be divided among various trades, subject to limitation that same products for each firestopping system are used throughout and each installer meet qualification requirements specified in this Section.

D. Fire-Test-Response Characteristics: Firestopping shall comply with the following requirements and those specified under "Design and Performance Criteria" Article in Part 2:
   1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, ITS-Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
   2. Through-penetration firestop systems are identical to those tested in accordance with ASTM E814 under conditions in which positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Systems shall comply with the following requirements:
      a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
      b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by ITS-Warnock Hersey, or by another qualified testing and inspecting agency.
   3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics in accordance with UL 2079 under conditions in which the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from face exposed to furnace fire. Systems shall comply with the following requirements:
      a. Fire Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
      b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.

E. Mockups:
   1. Concealed Locations: Seal one wall opening under firestopping system manufacturer's supervision to show completed system and to verify installation method and procedure.
   2. Exposed Locations: Prepare and seal a typical penetration to be sealed with foam firestopping.
      a. Exposed surface shall be made smooth and suitable to receive a paintable surface.
      b. Installation shall be reviewed by the Architect.

c. Modify mockup as necessary until appearance is accepted.

3. Accepted mockups shall serve as a standard of workmanship and appearance for all penetrations remaining exposed in completed construction.]

4. Comply with additional requirements of Section 01 4339, “Mockup Requirements.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened packages or containers clearly identifying manufacturer's names, brand designations, product descriptions, applicable standards, lot numbers, and test or rating labels.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.7 FIELD CONDITIONS

A. Do not install materials when temperatures exceed manufacturer's recommended limitations for installation. Maintain minimum temperatures before, during, and for 3 days after installation of materials.

B. Provide masking and drop cloths during installation to prevent firestopping materials from contaminating adjacent surfaces.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. General:

1. Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and passage of smoke and other gases.
2. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E84.
3. Firestopping shall remain sufficiently flexible after installation to accommodate expected vibration and movement between penetrating items and rated building components or assemblies or between adjacent building components or assemblies at joint systems, without affecting adhesion or integrity of system.
4. Materials shall not shrink noticeably after installation.
5. Caulk, foam, mortar, and putty materials shall be autobonding to permit changes to penetrating items.
6. Intumescent fireproofing products shall not be used in sound-rated assemblies.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings as determined in accordance with ASTM E814 but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined in accordance with ASTM E814, where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas.

D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per UL 2079, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

E. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

F. Provide firestopping assemblies that do not deteriorate when exposed to view, traffic, moisture, and physical damage.

G. Rating of firestopping materials or system shall in no case be less than rating of rated floor or wall assembly.

H. Fire and Sound-Rated Conditions: Use fire-rated acoustic sealants compliant with requirements specified in Section 09 8200, “Acoustical Insulation and Sealants.”

2.2 FIRESTOPPING MATERIALS

A. General:
1. Materials listed below are not necessarily all-inclusive, nor are all materials listed necessarily required to be used for the assemblies noted on the Drawings and to be used on this Project.
2. Although several manufacturers are listed for each type of firestopping and listed manufacturers also vary for each Type, Contractor shall develop systems for firestopping using approved systems from a single manufacturer unless products for required systems are not available from the selected manufacturer.

B. Job-Mixed Vinyl Compound: “USG Firecode Compound” by United States Gypsum Co., "Gold Bold Sta-Smooth FS 90 Fire-Shield Compound," or accepted equal.

C. Firestop Mortar: Prepackaged dry mix of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar; Hilti FS 637 “Firestop Mortar," or accepted equal.

D. Non-intumescent Firestop Sealant: One-part, non-hardening, silicone elastomer; Grace Construction Products Hilti CP 601S “Elastomeric Firestop Sealant," or accepted equal.

E. Intumescent Firestop Sealant: Hilti "FS-One," or accepted equal.

F. Mastic Firestop Sealant: Single component, water based, mastic grade; Rectorseal "Metacaulk 1100" or accepted equal.

G. Firestop Foam: Two-component silicone elastomer; Hilti CP 620 "Fire Foam," or accepted equal.
1. After dispensing, foam shall be fully expanded in 5 minutes and fully cured in 24 hours. Approximate density 16 pcf, with uniform cell structure.
2. Forming and Damming Materials, as required: Mineral fiberboard or as selected by installer.
3. Primer, sealant, and solvent cleaner as recommended by foam manufacturer.

H. Intumescent Fire Blocks: Hilti "FS-657" or accepted equal.

I. Flexible Firestop Spray Coating: Sprayable water-based coating; designed to form a flexible seal over mineral fiber firesafing; Hilti CP 672 "Speed Spray," or accepted equal.

J. Intumescent Putty and Putty Pads (for Use at Electric Boxes): Hilti CP 617 “Firestop Putty Pads" in required lengths and CP 618 “Firestop Putty Sticks," or accepted equal.

K. Intumescent Pipe Wrap: Hilti CP 645, 648E or 648S "Firestop Wrap Strip," or accepted equal.

L. Intumescent Sheet: Self-supporting board or panel. Hilti CP 675T “Firestop Board with Accessories,” or accepted equal.

M. Intumescent Sleeves, Collars, and Plastic Pipe Devices: Shop or field fabricated; heavy gauge galvanized steel with intumescent liner; Hilti CP 643N and 644 “Firestop Collar," or accepted equal.

N. High Temperature Firestop Calk: Single component; The Carborundum Company "FyrePutty,” Tremco "FYRE-Shield," or accepted equal.

O. Electrical Box Treatment: 3M "Fire Barrier Moldable Putty Pads," Hevi-Duty Nelson Products "FSP Firestop Putty Pads," International Protective Coatings Corp. "Flamesafe FSP 1077 Firestop Pads," or accepted equal.

P. Spray-Applied, Elastomeric, Firestop Joint Sealant: Non-halogenated latex-based sealant at perimeter fire barriers; “SpecSeal Series AS200 Elastomeric Spray” by Specified Technologies, Inc., or equal.

Q. Intumescent Pillows/Bags: Not permitted.

2.3 FIRESAFING, ACCESSORIES AND OTHER MATERIALS

A. Mineral Fiber Firesafing/Backing Material:
   1. Types:
      a. Unfaced Mineral Fiber: 4 pcf, suitable for friction fit in voids. Melt point 2000 degrees F minimum, ASTM C24. Ceramic or cementitious-blend fiber is also approved. Do not use glass fiber.
      b. Foil Faced Mineral Fiber: Same as unfaced mineral fiber but with aluminum foil facing on one side.
   2. Thermal Conductivity: 0.25 to 0.23 k-value per ASTM C518.
   3. Flammability:
      a. Noncombustible as defined by NFPA Standard 220 when tested in accordance with ASTM E136.
      b. Surface-Burning Characteristics:
         1) Flame Spread: 15 (10 to 25 with foil facing).
         2) Fuel Contributed: 0 (5 with foil facing).
         3) Smoke Developed: 0.

B. Accessories:
   1. Provide joint fillers, packing, and other accessory materials required for installation of firestop sealants, as applicable to installation conditions indicated.
   2. Provide primers, sealers, and solvent cleaners as recommended by firestopping manufacturers for specific substrate surfaces.
   3. Provide impaling clips, cinch shields, and similar items required for installation of backing material.
   4. Provide protective covers or devices for soft firestopping and firesafing products that will be exposed in finished construction.

C. Other Facing and Backing Materials: As recommended by firestopping manufacturer. Use fire resistive material where possible.

2.4 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install backing materials, forms, clips, and other items as required to hold firestopping and firesafing in place.

B. Firestopping or firesafing shall completely fill void spaces, regardless of geometric configuration.

C. Use mineral fiber to fill gaps at fire-resistive joint systems, as a backing material for firestop sealants and calks, and elsewhere as permitted by code. Pack mineral fiber snugly into voids. Install firestop sealant to cover backing material completely. Do not use unfaced mineral fiber by itself for firestopping purposes.

D. Use foam, sealant, mortar, or ceramic fiber putty to firestop duct, conduit, and metal pipe penetrations at fire-rated construction.

E. At sound-rated fire-rated construction, use only permanently resilient non-intumescent firestopping materials.

F. Firestop ceiling penetrations from exposed side only. Firestop wall penetrations on both sides.

G. Fill voids behind firestopping with mineral fiber backing material.

H. Firestop space between penetrating element and sleeve or collar. Also, seal space between sleeve, collar, or penetrating element and adjacent construction.

I. Installation of Firestopping Sealants:
   1. Comply with manufacturer's printed instructions, except where more stringent requirements are shown or specified.
   2. Comply with ASTM C1193 for installation of elastomeric joint sealants.

J. Use firestop mortar or high-temperature calk at penetrations by high-temperature items such as flues.

K. Exposed sealant shall be trowelled smooth in accordance with accepted mockup.

3.2 INTUMESCENT FIRESTOPPING

A. Use intumescent materials or devices where nonmetal and insulated piping penetrates fire-rated construction.

B. Where nonmetal pipe penetrations are too large to be firestopped by other means or where polypropylene pipe penetrates fire-rated construction, use intumescent devices or pipe wrap in telescoping configuration.
   1. If annular space is larger than 1/8 inch, backfill opening with firestop mortar.
   2. Seal to penetrating element and to adjacent construction with intumescent or firestop sealant.

C. Intumescent materials are approved for use in lieu of or in addition to other firestopping products in other locations where appropriate.

3.3 ELECTRICAL BOXES AND UTILITY OUTLETS

A. Steel electrical outlet boxes on opposite sides of walls requiring protected openings shall be separated by a horizontal distance of 24-inches.

B. Steel electrical outlet boxes which occur in combination with outlet boxes of any size such that the aggregate area of unprotected outlet boxes exceeds 100-square inches in any 100-square feet of wall area shall be protected by an approved material or detail to decrease the aggregate area of unprotected utility boxes to less than 100-square inches in any 100-square feet of wall.

C. Steel electrical outlet boxes which exceed 16-square inches in area shall be protected with specified electrical box treatment.

D. Utility and electrical outlets or boxes shall be securely fastened to the stud or framing of the wall or ceiling assembly.
   1. The opening in the gypsum board shall be cut so that the clearance between the box and the gypsum board does not exceed 1/8-inch.
   2. In smoke partitions, fill the 1/8-inch gap with an approved fire-rated sealant.

E. See additional requirements specified in Section 09 8200, “Acoustical Insulation and Sealants.”

3.4 FIELD QUALITY CONTROL

A. Firestopping shall remain accessible until inspection and approval by governing authorities.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior sealants at locations impacted by the work under this Contract.
   2. Interior sealants.

B. Related Requirements:
   1. Firestopping: Section 07 8400; firestop sealants.
   2. Glazing: Section 08 8000; glazing sealants.
   3. Gypsum Board: 09 2900
   4. Acoustical Insulation and Sealants: Section 09 8200; acoustical sealants.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications, recommendations, and installation instructions, including cleaning of joint surfaces, for each sealant material to be used.

B. Samples: Color selection for each product exposed to view; manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available.

1.4 INFORMATIONAL SUBMITTALS

A. Statement of qualifications for applicator of exterior sealant.

1.5 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.6 QUALITY ASSURANCE

A. Material Compatibility: Sealant materials shall be compatible with one another and with other specified and existing materials, under conditions of service and application required.

B. Installer Qualifications for Exterior Sealants: A firm experienced in installing sealants similar to those indicated for this Project, with a record of successful in-service performance, and acceptable to material manufacturer if required for issuance of manufacturer’s warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with manufacturer’s labels showing manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.8 GUARANTEE AND WARRANTY

A. General:
1. Repair or replace joint sealants that fail to achieve airtight and watertight seal or otherwise fail to perform as intended because of leaking, crumbling, hardening, shrinkage, bleeding, sagging, staining, loss of adhesion or cohesion, or do not cure within the specified warranty periods.
2. Extended warranties specified in this Section exclude deterioration or failure of joint sealants from the following:
a. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
b. Disintegration of joint substrates from natural causes exceeding design specifications.
c. Mechanical damage caused by individuals, tools, or other outside agents.
d. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

B. Contractor: In addition to its standard guarantee/warranty under the Contract, furnish Owner with a written 2-year guarantee/warranty, co-signed by installer, agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section.

C. Manufacturer: Furnish Owner with manufacturer’s written 20-year warranty for sealant Types 1 and 2 agreeing to furnish sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty shall include failure due to loss of adhesion, weather seal. In addition, Type 2 sealant warranty shall include staining.
2. Contractor shall be responsible for scheduling, arranging, and providing print review and testing required by manufacturer as a condition for issuance of its warranty.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

A. Colors:
1. Concealed Material: Any of manufacturer's standard colors.
2. Exposed Material: As selected by Architect from manufacturer's standard colors.

B. Type 1 - Sealant for General Exposed Exterior Use: One part, neutral cure, gun-grade silicone conforming to ASTM C920, Type S, Grade NS, Class 50; “DOWSIL 795 Building Sealant" by The Dow Chemical Company, "SilPruf” by Momentive Performance Materials, or equal.

C. Type 2 - Sealant for Use at Concrete and Other Porous Surfaces: One part, medium modulus, silicone polymer conforming to ASTM C920, Type S, Grade NS, Class 50 and formulated to reduce or eliminate dirt pickup, surface streaking, and substrate staining; “DOWSIL 756 SMS" by The Dow Chemical Company, "SCS9000 SilPruf NB" by Momentive Performance Materials, or equal.

D. Type 3 - Concealed Bedding Conditions: One-part butyl-rubber calk conforming to ASTM C1311, FS TT-S-001657, Type I, and FS TT-C-1796A; Pecora "BC158," or equal.

E. Type 4 - Exterior and Interior Small to Medium Width Horizontal Joints Subject to Pedestrian Traffic: One-part, self-leveling polyurethane conforming to ASTM C920, Class 25, Type S, Grade P; Pecora " NR-201,” or equal.

F. Type 5 - Interior Nonwet Areas: One-component acrylic latex water-based sealant conforming to ASTM C834; “Tremco "Acrylic Latex," or equal.

G. Type 6 - Interior Wet Areas: One-part mildew-resistant silicone rubber conforming to ASTM C920, Type S, Class 25, Grade NS; Dow Corning "786," or equal.

2.2 MISCELLANEOUS SEALANT MATERIALS

A. Paving Joint Backing for Interior Use: Preformed, self-expanding cork complying with ASTM D1752, Type III, or as recommended by paving sealant manufacturer.

B. Fiber Expansion Joint Material for Exterior Use: Preformed cellular fiber complying with ASTM D1751; 1/2 inch thick unless otherwise indicated; "SealTight Fiber Expansion Joint Filler" by W.R. Meadows, or equal.

C. Perimeter Gap Sealant: Gun-dispensed, foam polyurethane or polyisocyanurate type conforming to ASTM C1620; Hilti “CF 810/812,” or equal.

D. Additional Sealant Materials: As specified in other Specification Sections.

2.3 SEALANT ACCESSORIES

A. Joint Primer/Sealer: As recommended by sealant manufacturer for joint surfaces to be primed or sealed.

B. Sealant Backer Rod: Compressible, rod-stock, as recommended for compatibility with sealant by sealant manufacturer and complying with ASTM C1330.

C. Cleaner for Nonporous Surfaces: Nonstaining chemical cleaner acceptable to manufacturer of sealer and backing materials, harmless to substrates and adjacent nonporous materials.

D. Masking Tape: Nonstaining, nonabsorbent, compatible with joint sealants and adjacent surfaces.

E. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer. Provide self-adhesive tape where applicable.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Verify that joint dimensions are not less than or greater than recommended by joint sealer manufacturer for application indicated.

B. Clean joint surfaces immediately before installation of sealant.

3.2 INSTALLATION

A. General:
1. Comply with manufacturer's printed instructions, except where more stringent requirements are shown or specified.
2. Comply with ASTM C1193 for installation of elastomeric joint sealants.

B. Prime or seal joint surfaces as recommended by sealant manufacturer.
1. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
2. Prime surfaces using primer recommended by sealant manufacturer, unless sealant manufacturer certifies in writing, that primer is not required.

C. Install sealant backer rod for elastomeric sealants, except where recommended to be omitted by sealant manufacturer for application shown.

D. Install bond-breaker tape wherever backer rod is not used and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

E. Use only proven installation techniques that will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides.
1. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces.
2. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

F. Install sealants to depths as recommended by sealant manufacturer.

3.3 FIELD QUALITY CONTROL

A. Provide field testing, observation, or other services of the representative of the exterior sealant manufacturer if required for issuance of the specified extended warranty.

3.4 CLEANING AND CURING

A. Clean adjoining surfaces to eliminate excess sealant.

B. Cure sealants in compliance with manufacturer's instructions and recommendations to obtain high early-bond strength, internal cohesive strength, and surface durability.

END OF SECTION

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior fire rated and non-fire rated flush hollow metal doors.
2. Exterior and interior glazed hollow metal doors.
3. Hollow metal frames for doors.

B. Related Requirements:
1. Wood Doors: Section 08 1400.
2. Door Hardware: Section 08 7100.
3. Painting and Coating: Section 09 9000; field finish painting.
4. Door Schedule and Door Notes on the Drawings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.3 ACTION SUBMITTALS

A. Shop Drawings:
1. Cover each type of door, frame, and frame condition.
2. Include the following specific information:
a. Elevation and material of doors and frames.
b. Jamb and head details.
c. Hardware preparation locations and reinforcing details of doors and frames.
d. Door and frame location schedule.
e. Complete door and frame descriptive nomenclature.
f. Material description and gages.
g. Meeting stile details.
h. Methods of anchorage.
i. Details of moldings, removable stops, and glazing with glass Types coordinated with Section 08 8000, “Glazing.”
3. Use same reference numbers for details and openings as those indicated on Drawings.

B. Product Data:
1. Manufacturer's technical data substantiating products comply with specified requirements.
2. Test Reports for each type of fire-rated hollow metal door and frame assembly

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel doors and frames in such a manner as to prevent damage or deterioration.

B. Provide such packaging as cardboard or other containers, separators, banding, spreaders, and paper wrappings in order to protect items during transit and Project site storage.

C. Follow special storage and handling requirements of manufacturer.

D. Inspect products upon delivery for damage. Minor damage may be repaired, provided that refinished items are equal in all respects to new work and acceptable to the Architect. Otherwise, remove and replace damaged items as directed.

E. Store doors upright in a protected dry area on a raised platform at least 1 inch off the ground. Provide blocking between units so as to provide air circulation.

F. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.5 FIELD CONDITIONS

A. Post-Set Frames: Prepared openings shall be properly located and sized, plumb and square. Do not force-fit frames into improperly constructed openings.

B. Preset Frames: Wall/partition and frame locations shall be accurately marked before frames are erected.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Doors and Frames: Ceco, Curries, Security Metal Products, or equal SDI Certified manufacturer or member of the Hollow Metal Manufacturers Association (HMMA).

2.2 DESIGN AND PERFORMANCE CRITERIA

A. Steel doors and frames shall comply with ANSI/SDI A250.8.

B. Fire-Rated Assemblies: Wherever a fire-resistance classification is indicated, provide fire-rated steel doors and frames, investigated and tested as part of a fire door assembly, complete with type of fire door hardware to be used.
   1. Identify each fire-rated door and frame with permanent metal labels, in accordance with NFPA Standard 252, UL 10C, and the CBC, from approved testing and inspection agency, indicating applicable fire rating.
   2. Construct and install assemblies in such a manner as to comply with NFPA Standard No. 252, or UL 10C and NFPA 80 and as specified herein.
   3. Pairs of doors with vertical-rod panic exit devices shall be labeled without use of overlapping astragals.

C. Work shall meet applicable requirements of the Hollow Metal Manufacturers Association (HMMA), a Division of the National Association of Architectural Metal Manufacturers (NAAMM).

2.3 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A568/A568M and ASTM A1011/A1011M.

B. Cold-Rolled Steel Sheets: Commercial-quality carbon steel complying with ASTM A568/A568M and ASTM A1008/A1008M, exposed, matte finish, oiled.

C. Galvanized Steel Sheets: Commercial-quality zinc-coated carbon steel complying with ASTM A653/A653M with A60 or G60 zinc coating.

D. Supports and Anchors: Not less than 18-gage galvanized sheet steel.

E. Frame Anchors:
1. Typical: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
2. Anchors Built Into Exterior Walls: Steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot-dip galvanized according to ASTM A153/A153M, Class B.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units, hot-dip galvanized according to ASTM A153/A153M.

G. Shop-Applied Paint: Rust-inhibitive primer, either air dried or baked on, suitable as a base for specified finish paints.

H. Glass: As shown on the Drawings and as specified in Section 08 8000, "Glazing."

2.4 FABRICATION - GENERAL

A. Conform to requirements of SDI or NAAMM.

B. Fabricate steel doors and frames to required profiles and sizes by forming with edges straight and sharp with corner hairline joints and all surfaces free from warp, wave, buckle, and other defects.

C. Doors and frames subject to exterior environmental conditions shall be fabricated from specified galvanized-steel sheets.

D. Welding: In accordance with AWS standards for high-grade hollow metal work.
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain complete fusion without discontinuity or undercut.
2. Continuously welded door and frame seals with no filler.
3. Remove weld spatter, oxides, and flux.
4. Grind exposed welds smooth.

E. Shop Painting:
1. Finish shall comply with ANSI/SDI A250.10.
2. Provide different colored shop primer to differentiate galvanized from non-galvanized products when delivered to Project site.

2.5 STEEL FRAMES

A. Provide steel frames of the types and styles indicated on the Drawings.

B. Gages:
1. Interior:
a. Frames in Openings 4 Feet or Less in Width: 0.053-inch (16-gage) unless thicker gage is included in UL test procedure for rated frames.
b. Frames in Openings over 4 Feet in Width: 0.067-inch (14-gage).
2. Exterior: 0.067-inch (14-gage).

C. Design and Construction – Standard Frames:
1. Fabricate frames from either cold-rolled or hot-rolled steel, at fabricator's option.
2. Frames shall be welded units with integral trim and backbends, of the sizes and shapes shown on approved shop drawings. Knocked-down frames will not be accepted.
3. Jamb depths, trim, profile and backbends shall be as shown on Drawings.
4. Corner joints shall have all contact edges closed tight, with trim faces mitered and continuously back welded, and stops mitered. Unless otherwise noted, the use of gussets will not be permitted.
5. Minimum depth of stops shall be 5/8-inch unless otherwise noted. Drill stops for silencers: three in strike stops for single swing doors, two in head stops for double swing doors.
6. Profile bottom of jamb to contour of concrete at change in floor elevation occurring within jamb width.
7. Floor Anchors:
a. Floor anchors shall be securely welded inside each jamb for floor anchorage.
b. Where required, provide adjustable floor anchors, providing not less than 2 inch height adjustment.
c. Minimum thickness of floor anchors shall be 0.067-inch (14-gage).
8. Jamb Anchors:
a. Frames for installation in stud partitions shall be provided with steel anchors of suitable design, not less than 18-gage thickness, securely welded inside each jamb as follows:
1) Frames up to 7 Feet 6 Inches High: 4 anchors.
2) Frames 7 Feet 6 Inches to 8 Feet High: 5 anchors.
3) Frames over 8 Feet High: 5 anchors plus one additional for each 2 feet or fraction thereof over 8 feet.
b. Provide ceiling struts for fire rated frames where required by UL 10B.
9. Frames shall be provided with a steel spreader temporarily attached to the feet of both jambs to serve as a brace during shipping and handling.

D. Door Silencers and Seals:
1. Provide door silencers except on frames to receive seals provided under Section 08 7100, “Door Hardware.”
2. Locate three on strike jamb for single doors and four on head for pairs of doors.

E. Exposed Fasteners: Unless otherwise indicated, provide countersunk, flat Phillips or Jackson heads for exposed screws and bolts.

2.6 HOLLOW METAL DOORS

A. ANSI/SDI Classification:
1. Exterior: Level 3 and Physical Performance Level A, Model 2, extra heavy-duty seamless construction.
a. Face sheets shall be minimum 0.053-inch (16-gage).
b. Insulated, steel stiffened, for a minimum "U" value of 0.24 except where opening into unconditioned spaces.

2. Interior Non-Fire-Rated: Level 3 and Performance Level A, Model 2, seamless construction.
   a. Face sheets shall be minimum 0.042-inch (18-gage).
   b. Core: Honeycomb or polystyrene, laminated to the inside of both face sheets.
3. Interior Fire-Rated: Level 3 and Performance Level A, Model 2, seamless construction.
   a. Face sheets shall be minimum 0.042-inch 18 gage) unless otherwise required for required rating.
   b. Core: Mineral fiber or as standard with manufacturer to meet scheduled fire rating.
   c. Rating: As scheduled.
4. Doors shall be insulated, steel stiffened, for a minimum "U" value of 0.24 except where opening into unconditioned spaces.

B. Design and Construction: In addition to requirements of the specified ANSI/SDI Classification, doors shall comply with the following.
1. Doors shall be of the types and sizes shown on the approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges.
2. Thickness: As scheduled.
3. Doors shall be strong, rigid and neat in appearance, free from warpage or buckles. Corner bends shall be true and straight and of minimum radius for the gage of metal used.
4. Fabricate exposed faces of doors only from cold-rolled steel.
   a. Door faces shall be joined at their vertical edges by a continuous weld extending the full height of the door.
   b. Welds shall be ground, filled and dressed to make them invisible and provide a smooth flush surface.
5. Face sheets shall be stiffened by continuous vertical formed steel sections spanning the full thickness of the interior space between door faces.
   a. Stiffeners shall be not less than 22-gage spaced not more than 6 inches apart and securely attached to face sheets by spot welds not more than 5 inches on center.
   b. Spaces between stiffeners shall be sound-deadened and thermal insulated the full height of the door with an inorganic non-combustible batt-type material.
6. Doors Subject to Precipitation:
   a. The top and bottom of out-swinging doors shall be closed with either a flush or inverted channel cap, welded, filled, and finished smooth to provide protection from entry of water inside door.
   b. Openings shall be provided in the bottom closure to permit the escape of water.
7. Flatness: Doors shall maintain a flatness tolerance of 1/16 inch maximum, in any direction, including in a diagonal direction.
8. Edge profiles shall be provided on both vertical edges of doors as follows:
   a. Single-acting swing doors: beveled 1/8 inch in 2 inches.
   b. Double acting swing doors: rounded on 2-1/8 inch radius.

C. Provide door clearances in accordance with ANSI/SDI A250.8 except as required to coordinate with hardware specified in Section 08 7100, “Door Hardware.”

2.7 FINISH HARDWARE PREPARATION

A. Comply with ANSI A115, where applicable, and ANSI/SDI A250.6.

B. Provide minimum gage hardware reinforcing in accordance with Table 1 of ANSI/SDI A250.6 or Table IV of ANSI/SDI A250.8 and the following.
   1. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only in accordance with the approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware (or hardware, the interrelation of which is to be adjusted upon installation - such as top and bottom pivots, floor closers, etc.) is to be applied, doors shall have reinforcing plates.
   2. Minimum gages for hardware reinforcing plates shall be as follows:
      a. Hinge and Pivot Reinforcement: 0.167-inch (7-gage).
      b. Reinforcement for Lock Face, Flush Bolts, Concealed Holders, Concealed or Surface Mounted Closers: 0.093-inch (12-gage).
      c. Reinforcements for All Other Surface Mounted Hardware: 0.053-inch (16-gage).
   3. Interior Hollow Metal frames at Fire Rated Openings: Meet manufacturer's specifications for indicated level of fire rating.

C. Drilling and tapping for surface-applied finish hardware shall be done at Project site by hardware installer.

D. Concealed Overhead Closers: Provide spaces, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames as applicable.

E. Reinforce steel doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware shall be done at Project site by hardware installer.

F. Locate finish hardware as shown on final shop drawings or, if not shown, in accordance with NBHA publication "Recommended Location for Builder's Hardware."

G. Labeled Doors and Frames: Refer to Section 08 7100, "Door Hardware" for mounting heights of hardware on doors and frames, unless otherwise noted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions where steel doors and frames are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION OF FRAMES

A. Install frames in accordance with ANSI/SDI A250.11 and the additional requirements of manufacturer for concealed jamb frames.

B. Exercise care in setting of frames in order to maintain scheduled dimensions, hold head level, and maintain jambs plumb and square.

C. Secure anchorages and connections to adjacent construction.
   1. Provide not less than three anchors and one floor clip per side for doors up to 7 feet high and four anchors and one floor clip per side for doors over 7 feet high.
   2. Frames over 36 inches wide shall have one anchor at head.

3. Anchors shall be furnished to suit wall conditions and floor angles or clips welded to frame for fastening to floor.

D. Wherever possible, leave frame spreader bars intact until frames are set perfectly square and plumb and anchors are securely attached. Do not use shipping bars as spreaders.

E. Allow for expansion movement as required.

F. Install fire-rated frames in accordance with NFPA Standard No. 80.

3.3 INSTALLATION OF DOORS

A. Install steel doors in accordance with manufacturer's instructions and Project requirements.

B. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

C. Do not erect members that are observed to be warped, bowed, deformed, or otherwise damaged or defaced to such extent as to impair strength or appearance. Remove and replace members that have been damaged in process of erection.

D. Apply hardware in accordance with requirements specified in Section 08 7100 "Door Hardware."

3.4 ADJUST AND CLEAN

A. After erection, items with damaged prime coat shall be sanded smooth and touched up with same or compatible primer as applied at shop.
1. Remove rust before touch-up is applied.
2. Touch-up shall not be obvious after application of finish coats.

B. Check and readjust operating finish hardware items, leaving steel items undamaged and in complete and proper operating condition.

C. Hollow metal frames or doors which are defective, have hardware cutouts of improper size or location, or which prevent proper installation of doors, hardware, or work of other trades, shall be removed and replaced with new hollow metal frames or doors at no additional cost to Owner.

END OF SECTION

SECTION 08 1400

WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Solid core, flush wood doors.
2. Factory preparation (premachining) for finish hardware.
3. Shop priming.

B. Related Requirements:
1. Door Hardware: Section 08 7100.
2. Glazing: Section 08 8000.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action and Informational Submittals shall be made in accordance with Section 01 3300, “Submittal Procedures.”
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Sustainable Design General Requirements:
1. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

B. Product Data:
1. Manufacturer’s specifications for each type of door proposed for use on this Project. Indicate door core and edge materials and construction, veneer species, type and characteristics, trim for openings, factory finishing and machining criteria, and the following additional information usually provided as a shop drawing or Schedule:
a. Opening-identifying symbol. Use same identification as Door Schedule on Drawings.
b. Size.
c. Swing.
d. Undercut.
e. Location and extent of any required hardware blocking.
2. Shop-applied primer.

C. Door Schedule: Include the following minimum requirements:
1. Opening-identifying symbol. Use same identification as on Drawings.
2. Location and sizes of each door.
3. Door type and grade.
4. Glazing.
5. Face veneer and finish.
6. Swing.
7. Undercuts.

D. Samples: Each type of door construction and face veneer, 12 inches square minimum, cut from corner of door, illustrating veneer and shop-applied primer.

1.4 INFORMATIONAL SUBMITTALS

A. Sample of manufacturer’s warranty.

1.5 CLOSEOUT SUBMITTALS

A. Warranty as specified.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain wood doors from single manufacturer.

B. Qualifications of Manufacturer:
1. Qualified to affix each door with Seal of Acceptance or quality certification stamp from WI or AWI.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package doors at factory prior to shipping, using manufacturer’s standard method.

B. Deliver, store and handle in compliance with manufacturer’s written instructions and recommendations.

C. Seal all four edges of site-finished doors after delivery if stored for more than 1 week at the Project site.

D. Label and identify doors for each opening to facilitate proper location using temporary, removable, or concealed markings. Correlate door identification with designation system used on shop drawings.

E. Store doors flat on level surface in clean, dry, and properly ventilated spaces.
1. Do not expose doors to abnormal heat, dryness, and humidity.
2. Do not store in areas where sunlight might bleach veneer.

F. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

1.8 WARRANTY

A. Manufacturer: Furnish warranty on door manufacturer's standard form, co-signed by supplier and installer and Contractor, agreeing to repair or replace defective doors which warp (bow, cup, or twist), which show telegraphing of core construction in face veneers, or which do not conform to tolerance limitations of specified quality standards.
1. Include reinstallation if required owing to repair or replacement of defective doors where defect was not apparent prior to hanging.
2. Warranty Period:
a. Interior Solid-Core Doors: Lifetime of the original installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wood Doors: “Aspiro Series” | Marshfield-Algoma by Masonite Architectural, Eggers Industries, V-T Industries, or equal member of WI, AWI or WDMA and approved by Architect.

2.2 DESIGN AND PERFORMANCE CRITERIA

A. Except as otherwise specified or standard with manufacturer, doors shall be manufactured in accordance with Section 9 of the "North American Architectural Woodwork Standards (NAAWS),” published jointly by WI and AWMAC, and referenced WDMA Standards where noted.

B. Allowable Tolerances for Fabrication of Doors: In accordance with referenced NAAWS standard.

C. Fire-Rated Assemblies: Wherever a fire-resistance classification is indicated, provide fire-rated doors investigated and tested as part of a fire door assembly, complete with type of fire door hardware to be used.
1. Identify each fire-rated door with a label from an approved laboratory indicating applicable fire rating and other specified requirements.
2. Construct fire-rated doors in accordance with NFPA Standard 252.

2.3 FABRICATION - GENERAL

A. Conform to requirements of regulatory agencies, referenced NAAWS standard, reviewed shop drawings, and Contract Documents.

B. Performance Duty Level (WDMA): Extra Heavy Duty.

C. Thickness: 1-3/4 inches, unless otherwise noted.

D. Sizes: As scheduled.

E. Factory-cut openings, insofar as practicable.
1. Seal raw edges immediately after cutting and fitting, including areas routed for hardware.

F. Prefit and premachine doors.
1. Coordinate preparation of doors with hardware requirements specified in 08 7100: Door Hardware.
2. Comply with the tolerance requirements of NAAWS or WDMA for prefitting.

G. Undercut doors where indicated or required by submittals.

H. Provide door clearances in accordance with the WDMA Standard and as follows, unless otherwise noted.
1. For non-rated doors provide clearances of 1/8 inch at jambs and heads, and 1/4 inch from bottom of door to top of floor finish, unless otherwise indicated on Drawings.
2. When threshold is shown or scheduled, provide 1/8 inch clearance from bottom of door to top of threshold.

3. Provide 7/16-inch at bottom to top of threshold or floor finish where there is a door bottom seal. Modify clearance as required for specified seal.

2.4 FABRICATION - FLUSH DOORS

A. Door Appearance Grade: Premium, except as otherwise specified.

B. Face Veneers: Plain Sliced White Birch, A Grade or better.

C. Cross Banding: Hardwood veneer, 1/16 inch thick.

D. Cores: Solid, 5-ply, of type optional with manufacturer, in accordance with NAAWS or WDMA I.S.1-A.

E. Edge Construction:
1. General:
a. Securely glue edge-bands to core. Top and bottom bands may be secured in place with machine joint.
b. Doweling of vertical to horizontal edge-bands for oversize doors is permitted.
2. Vertical: Full length hardwood; NAAWS Type D, 3/4-inch thick minimum after trimming, Structural Composite Lumber (SCL) backer, with cross band edges covered.
3. Horizontal: SCL, 1-1/4-inch thick minimum after trimming.

F. Additional Requirements for Fire-Rated Doors:
1. Ratings: As scheduled on Drawings.
2. Provide mineral core where required for fire rating.
3. Provide fire-retardant-treated cross banding on 90-minute rated doors.
4. Doors rated over 20 minutes shall be Type A with built-in intumescent seals.
5. Provide 5-inch top and bottom rail and lock blocks to suit hardware for mineral-core fire-rated door.

G. Metal Louvers: 18-gage cold-rolled steel frame and 22 gage steel blades, fixed sightproof design; Anemostat Model AFDL, or equal.
1. Provide rated louvers bear fire rating label from approved testing laboratory at fire-rated doors.
2. Finish: Manufacturer's standard pretreatment and primer; units shall be field finished painted as specified in Section 09 91 23, “Interior Painting and Coating,” to match door finish.

2.5 FINISHING

A. General: Comply with “Premium” Grade requirements of Section 5 of the NAAWS with shop applied coatings applied in accordance with manufacturer's written instructions.

B. Preparation Requirements:
1. General:
a. Seal the top and bottom edges of all doors and around all cutouts with two coats of varnish or sealer before the hardware is set into place.
b. All four edges of doors, door faces, and factory-made cutouts shall be primed or sealed before hardware is set into place.

2. Doors to Receive Transparent Finish:
   a. Before finishing, remove handling marks or effects of exposure to moisture with a complete, thorough, final block sanding over all surfaces of the door, using at least 150-grit sandpaper, and clean before applying sealer or finish.
   b. Deep scratches shall be steamed out before sanding and door replaced if damage is visible.
   c. Sharp edges shall be eased by sanding.
   d. Manufacturer's standard preparation procedures, if equal to or more stringent, are acceptable.

C. Transparent Finish: WDMA System TR-8, UV-Cured acrylated polyester/urethane or equivalent as standard with manufacturer.
   1. Gloss Level: To match existing.
   2. Provide factory finishing only; field finishing will not be permitted.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that doorframes are of type required for door and are installed as required for proper installation of doors.

B. Do not install doors in frames which would hinder door operation.

C. Condition doors to average prevailing humidity in installation area prior to hanging.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and requirements of NAAWS or WDMA Standard.

B. Door Bevel:
   1. Nonrated Doors: Bevel 1/8 inch in 2 inches.
   2. Rated Doors: Bevel as permitted by labeling agency.

C. Install fire-rated doors in fire-rated frames in accordance with requirements of National Fire Protection Association (NFPA) Standard No. 80.

D. Hardware: For installation, see Section 08 7100 "Door Hardware."

E. Fit to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

3.3 ADJUSTING AND CLEANING

A. Replace or rehang doors which are hinge bound and do not swing or operate freely.

B. Protect installed wood doors from damage or deterioration until acceptance of work.

C. Refinish or replace finished doors damaged during installation as directed.

END OF SECTION

SECTION 08 3113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and panels in walls and ceilings as required for access to controls and valves behind surfaces, supplementing the requirements included in Divisions 22, 23 and 26.

B. Related Requirements:
   1. Mockups: Section 01 4339.
   2. Tiling: Section 09 3000.
   3. Gypsum Board: Section 09 2900.
   4. Painting and Coating: Section 09 9123; field-applied coatings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures: Action Submittals shall be submitted in accordance with Section 01 3300, “Submittals.”

1.3 ACTION SUBMITTALS

A. Shop Drawings: Indicate locations of required access doors, including those not shown on the Drawings.

B. Product Data: Manufacturer's specifications and installation instructions for each type of access door.

1.4 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where required, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in UL "Classified Building Materials Index" for the rating indicated. Provide UL label on each access door.

B. Size Variations: Obtain Architect’s acceptance of manufacturer’s standard size units, which may vary slightly from sizes shown, scheduled, or specified in Divisions 22, 23, and 26.

C. Mockups: First installed example of each type of access door shall serve as a mockup for review of workmanship, visual effect, and interface with adjacent construction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Fire-Resistance Ratings: Where required, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in UL "Classified Building Materials Index" for the rating indicated. Provide UL label on each access door.

B. Provide doors and panels with and without lock functions, in locations indicated and to be confirmed by Architect.

2.2 MANUFACTURERS

A. Metal Access Doors for Walls and Ceilings: Karp Associates, Inc. as specified and the basis of design, Milcor Inc., Nystrom Building Products, J. L. Industries, or equal.

2.3 INTERIOR ACCESS DOORS AND PANELS

A. General:
1. Provide attachment devices and fasteners of type required for specific project conditions.
2. Products specified in Divisions 22, 23, 26, 27 and 28 that meet the requirements of this Section are acceptable.

B. Gypsum Board Partitions - Nonrated, Tiled: Metal; Karp Model DSC-214M.
1. Trim Style: 3/4-inch wide, flush flange.
2. Frame: 16-gage stainless steel.
3. Door: Not lighter than 14-gage stainless steel.
4. Hinges: Continuous piano type or concealed spring, allowing opening to 175 degrees.

C. Gypsum Board Partitions and Ceilings - Rated: Metal; Karp Model KRP-350FR.
1. Type: Manufacturer's fire-rated access doors with UL "B" Label.
2. Style: Textured 1-inch frame and bead to receive drywall joint compound installed in sufficient thickness to conceal flange.
3. Frame: 16-gage galvanized steel.
4. Door: 20-gage galvanized steel, insulated sandwich type at ceilings, self-latching.
5. Hinges: Allow opening to 175 degrees, self-closing.

D. Gypsum Board Partitions- Rated, Tiled: Metal; Karp Model KRP-250FR.
1. Type: Manufacturer's fire-rated access doors with UL "B" Label.
2. Style: 1-inch wide trim with welded corners, ground smooth.
3. Frame: 16-gage stainless steel.
4. Door: 16-gage stainless steel.
5. Hinges: Allow opening to 175 degrees, self-closing.

E. Finishes:
1. Metal Doors and Other Metal Surfaces: Factory-applied rust-resistant prime coat over phosphate coating on steel. Doors shall be field finish painted as specified in Section 09 9000 “Painting and Coating” to match adjacent wall or ceiling finish.
2. Stainless Steel: No. 4 satin finish.

F. Locking Devices: Provide flush, key-operated cylinder lock for each access door; provide two keys per lock and key locks alike, unless otherwise scheduled. Coordinate keying with Section 08 7100 “Door Hardware.”

2.4 MATERIALS AND FABRICATION

A. General:
1. Provide access door assemblies consisting of an integral unit, complete and ready for installation.
2. Fabricate metal access doors of continuous welded construction. Grind welds smooth and flush with adjacent surfaces.
3. Provide attachment devices and fasteners of type required for specific project conditions.
4. At sound-rated conditions use "fire-rated"-type doors.

B. Latching Device:
1. Typical: Spring loaded, screwdriver operated, sliding bolt or cam lock of number required to hold door in flush, smooth plane when closed.
2. Locations Accessible to Public or Determined by Architect as Requiring Locking: Key-operated cylinder lock.
a. Provide two keys per lock and key locks alike, unless otherwise scheduled or directed by the Owner.
b. For locks on panels 24 inches in any dimension, provide interior latch mechanism to allow door to be opened from the inside without a key.
c. Coordinate keying with Section 08 7100, “Door Hardware.”

C. Sizes: As indicated, and as required for access and by regulatory agencies but not less than 10 inches square.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which access doors are to be installed. Do not proceed with work until unsatisfactory conditions are corrected; installation signifies acceptance of conditions.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for installation of access doors.

B. Install fire rated access doors in accordance with NFPA 80.

C. Set frames accurately in position. Securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

D. When installed in tile surfaces, coordinate panel location with the tilework so that the panel will align and fit within the tile module with no tile cutting, or a minimum of cutting.

E. Install in locations required to give access to plumbing, mechanical, electrical, or similar devices concealed in walls or ceilings, whether or not specifically indicated on the Drawings.

F. Conceal frames with tape and joint compound at painted gypsum board partitions as specified in Section 09 2900, "Gypsum Board."

G. Adjust hardware and doors after installation for proper operation. Verify that locks operate properly and are keyed into the Building keying system.

H. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 3323

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior, non-insulated, motor-operated overhead coiling doors at Apparatus Bay.
2. Vibration isolation for track and for motorized operators.
3. Maintenance service as specified.

B. Related Requirements:
1. Metal Fabrications: Section 05 5000.
2. Door Hardware: Section 08 7000; masterkeyed cylinder.
3. Painting and Coating: Section 09 9000; field painting of items exposed when door is in up (open) position and are not prefinished in shop.
4. Electrical: Division 26.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Coordination: Provide setting drawings, templates, instructions, and directions for installation of anchorage devices.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Include elevations, plans, sections, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include rough-in dimensions, vibration isolation, controls, and hardware locations.

B. Product Data:
1. Furnish manufacturer's product data, details of construction and fabrication, rough-in diagrams, and installation instructions for overhead coiling door, components, and shop-applied coatings.
2. Furnish preparation instructions, storage and handling requirements and recommendations.
3. Include information on hardware, motor, and controls.

C. Samples:
1. 12-inch length of slat type and finish.
2. Hardware and Fittings: As requested by the Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Statement of installer qualifications.

B. Sample copy of manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance and Operating Manual: Complete manual describing the materials, devices and procedures to be followed in operating and maintaining overhead coiling door. Include manufacturer's brochures and parts lists describing the actual materials used in the product. Include lubrication requirements and frequency, and periodic adjustments required.

B. Specified warranty.

C. Maintenance service contract as specified.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Documented experience in installation of electrically operated overhead doors; approved in writing by manufacturer.

B. Regulatory Requirements: Products requiring electrical connection shall be listed and classified by Underwriters Laboratories Inc. (UL) or other testing firm acceptable to the authority having jurisdiction as suitable for purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store materials in manufacturer's original packaging, labeled to show name, brand, and type.

B. Store materials in a protected dry location off the ground in accordance with manufacturer's instructions.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.8 FIELD CONDITIONS

A. Coordinate with fabrication and installation of work of other trades which interface with work specified in this Section.

B. Verify measurements at site prior to fabrication to insure proper fit.

1.9 WARRANTY

A. Manufacturer: Furnish to Owner door manufacturer’s written 5-year warranty for overhead coiling doors against all defects in materials and workmanship, including without limitation against failure of factory applied finish. Warranty shall be countersigned by Contractor and installer.

1.10 MAINTENANCE SERVICE CONTRACT

A. Beginning at Notice of Final Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling door installer.
   1. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation.

2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

B. Perform maintenance, including emergency callback service, during normal working hours.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE REQUIREMENTS FOR DOORS

A. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

B. Design components to resist wind load as determined by wind tunnel testing, with no failure of door frame, hardware, anchorage, gaskets, or joinery seals. Maximum deflection of framing members and guides when subject to design wind load shall not exceed L/240 of the clear span. Maximum permanent deflection of framing members shall not exceed 0.2 percent of the clear span when tested to 150 percent of the design wind load.

C. Side guides and anchorage shall be sufficient to retain curtain based on specified seismic requirements.

D. Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

E. Minor differences from specified components will be allowed as approved by the Architect.

F. Design for not less than 500,000 cycles lifetime.

2.2 COILING SERVICE DOORS

A. Manufacturer and Products: Galvanized steel; Model 610/620 with RSX front-mounted commercial operator and high usage package by Overhead Door Company as specified and the basis of design, or accepted equal.
1. Size(s): As scheduled.
2. Electrical Requirements: 3 hp, 3 phase, 460 volts.

B. Mounting: Face of wall.

C. Steel Slats: F-265, flat profile, interlocking sections of formed or rolled galvanized-steel sheet, not less than 20 gauge, unless otherwise recommended by manufacturer for indicated door width.

D. Side Guides: Nested hot-rolled steel angles with wool pile or neoprene weatherstripping.

E. Foot Pieces: Two hot-rolled steel angles galvanized in accordance with ASTM A123/A123M with all-weather flexible astragal safety edge.

F. Brackets: 1/4 inch-thick (minimum) galvanized steel plate.

G. Hood: 22 gauge galvanized steel with baffle and weatherstripping.
1. Hood shall entirely enclose curtain and counterbalance barrel assembly.

H. Counterbalance Assembly: Adjustable steel helical torsion springs attached to shaft enclosed in pipe with required mounting blocks or rings for attachment of curtain. Grease sealed or self-lubricating graphite type bearings shall be attached to the spring barrel which shall be fabricated of hot formed structural quality carbon steel seamless pipe.

I. Motor Operator: UL-listed integral power unit with high starting torque, and instant reversing, as recommended by manufacturer for proper door operation for size and weight but not less than specified for each door. An efficient overload protection device, which will break the power circuit and protect against damage to the motor windings shall be integral with the unit. Operator is to be housed in a NEMA type 1 enclosure.
   1. Drive: Gear type, matched to motor size.
   2. Power: As specified. Contractor to verify power requirements.
   3. Opening Speed: 20 inches per second.
   4. Closing Speed: 12 inches per second.

2.3 DOOR CONTROLS AND SAFETY FEATURES

A. Control Stations: 24 volt circuit.
   1. Interior, Surface-Mounted, Three-Button Station. “Open,” “Close,” and “Stop” in NEMA 1 enclosure.
   2. Exterior Key Station. Fully recessed, momentary contact, “Open-Close” with spring return to center, in NEMA 4 enclosure.
   3. Cylinders: Keyed into masterkey system; coordinate with Section 08 7100 “Door Hardware.”

B. Auxiliary Emergency Operator: Unless wall-mounted crank is required by manufacturer for size of door, provide an endless galvanized hand chain interlocked to disconnect motor mechanically and electrically when engaged. Locate not more than 12 inches from wall and within reach of floor.

C. Locking Device: Cylinder lock on bottom bar masterkeyed into building system. Include manufacturer’s integral electrical interlock to prevent door operation before door is unlocked.

D. Isolation: Provide isolators for motor mounting to minimize transfer of vibration to slab.
   1. Vibration Isolator: Maximum 50-durometer, Mason Industries BR mount, or equal, with ceiling support struts, adapter plates, and hardware as required.
   2. Resilient mounting incorporating maximum 50-durometer; Mason Industries BR or RBA isolators, or equal.

E. Obstruction Detection Device:
   1. Provide each door with automatic safety edge extending full width of bottom and located within neoprene or rubber astragal mounted to bottom rail.
   2. Contact with astragal before fully closing will immediately stop downward travel and reverse direction to fully opened position.

F. Safety Devices: Provide door with following safety devices.
   1. UL 325 compliant NEMA 4X photoelectric sensors that cast an invisible beam across the door opening and reverse the downward motion of the door when an object enters the path of the beam.
   2. Self-monitoring 2-wire, electric fail-safe sensing edge reverses downward motion upon impact.
   3. Drop stop device eliminates uncontrolled curtain travel independent of other safeties.

2.4 PROTECTIVE COATINGS

A. Shop Painting:
1. Door Curtain, Bottom Bar, and Guides: Manufacturer's premium epoxy primer and premium shop-applied polyester powder coat.
a. Color: Custom color as selected by the Architect.
b. Provide with factory-supplied touch-up paint.
2. Hood and Endplate Brackets: Manufacturer's premium polyester powder coat in custom color to match door curtain.
3. Other Steel Components: Galvanized, with factory-baked-on acrylic primer.

B. Field Finish Painting:
1. Exposed Shop-Primed Only Items: As specified in Section 09 9000, "Painting and Coating," with standard performance coating, in color to match door.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings are prepared with headers level, jambs plumb, and are acceptable and correctly dimensioned to receive coiling door.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Do not proceed with work until unsatisfactory conditions are corrected; installation signifies acceptance of conditions.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and reviewed shop drawings, free of springing, forcing, racking, or distortion.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Provide necessary hardware, and fasten door-guide assemblies to adjacent structure with minimum 3/8-inch galvanized fasteners at approximately 24 inches on center.

D. Install motor operator according to UL 325 and governing code. Materials shall be UL listed. Coordinate with Division 26, "Electrical." Complete wiring from disconnect to unit components.

E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

F. Erection Tolerances:
1. Maintain dimensional tolerances and alignment with adjacent work.
2. Maximum Variation from Plumb: 1/16 inch.
3. Maximum Variation from Level: 1/16 inch.
4. Longitudinal or Diagonal Warp: 1/8 inch per 10-foot straightedge.

G. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 9200, “Joint Sealants.”

H. Install perimeter trim and closures.

3.4 ADJUSTING

A. Upon completion of installation, lubricate, test, and adjust coiling door to operate easily, smoothly and noiselessly, free from warp, twist, or distortion, and with snug secure fit for the entire perimeter.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

3.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.
1. Perform installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.7 PROTECTION

A. Protect installed products until completion of Project.

3.8 MAINTENANCE SERVICE

A. Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door installer.
1. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for smooth door operation.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

B. Perform maintenance, including emergency callback service, during normal working hours.

END OF SECTION

SECTION 08 4213

ALUMINUM-FRAMED ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exterior glazed aluminum swing entrances.

B. Related Requirements:
1. Aluminum Windows: Section 08 5113.
2. Door Hardware: Section 08 7100; automatic door operators, cylinders, thresholds, and other components.
3. Glazing: Section 08 8000; requirements for system glass, glazing, glazing gaskets and sealants.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
2. Closeout Submittals shall be submitted in accordance with Section 017700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Shop Drawings: Show elevations, dimension, member profiles, details of interface with adjacent construction, reinforcement, and glazing materials and methods.
1. Indicate deviations from the Contract Documents.
2. Indicate field measurements.
3. Manufacturer's standard drawings modified to show clearly that actual Project conditions and proposed work are acceptable.

B. Product Data: Manufacturer’s literature for each door configuration and for hardware items provided by door manufacturer. Include construction details, material descriptions, dimensions of individual components and profiles, and factory-applied finish.

C. Samples: 12-inch-long section of typical stile extrusions in required width with specified finish.

D. Hardware Schedule: Submit the following if not included as part of information submitted under Section 08 7100 “Door Hardware.””
1. Detailed hardware Groups/Sets for each opening shall be prepared by Contractor and submitted for aluminum-framed entrances.
2. Schedule shall be prepared under direct supervision of a member of the Door and Hardware Institute (DHI). Include verification of supervision on submittal
3. Coordinate function requirements with the Architect prior to submission of Schedule.
4. Coordinate with the Hardware Schedule required under Section 08 7100 “Door Hardware.”
5. Review of Hardware Schedule shall not be construed as certifying that the list is complete.

1.4 INFORMATIONAL SUBMITTALS

A. Verification of compliance with specified performance criteria if not included with product data submittal. Include a test report by an independent testing agency, verifying that proposed product is in compliance with specified performance criteria.

B. Statement of fabricator/installer qualifications, if requested by Architect.

C. Sample copy of specified warranty stating obligations, remedies, limitations, and exclusions of warranty.

1.5 CLOSEOUT SUBMITTALS

A. Extended warranty.

B. Operating and Maintenance Manuals for entrances and manufacturer-provided hardware.

1.6 QUALITY ASSURANCE

A. Qualifications: In addition to the following, both fabricator and installer shall be approved by the manufacturer.
1. Fabricator: Ten years documented experience on jobs of similar type and complexity.
2. Installer: Five years documented experience on jobs of similar type and complexity.

B. Comply with AAMA "Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver fabricated units and component parts to Project site completely identified in accordance with numbering system used on shop drawings or erection diagrams.

B. Protect prefinished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

C. Store inside building, protected from weather and from construction activities.

D. Comply with additional requirements specified in Section 01 6000 "Product Requirements."

1.8 FIELD CONDITIONS

A. Field Measurements: Where entrances are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on shop drawings.
1. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay work.
2. Coordinate fabrication schedule with construction progress to avoid construction delays.

B. Established Dimensions: Where field measurements cannot be made without delaying work, establish dimensions, and proceed with fabrication without field measurements. Coordinate with other construction to ensure that actual dimensions correspond to established dimensions.

C. Do not install sealants when ambient temperature is less than 40 degrees F.

1.9 WARRANTY

A. Contractor: Provide Owner with a written 5-year warranty agreeing to repair or replace work that fails in materials or workmanship.
   1. Failure includes:
      a. Glass breakage in excess of expected accidental breakage.
      b. Leakage or air infiltration in excess of specified requirements.
      c. Faulty operation of doors or hardware.
      d. Deterioration of finish or construction in excess of normal weathering.
      e. Defects in hardware, weatherstripping, and other components of the work.
   2. Warranty shall be signed by Contractor and countersigned by manufacturer and installer.

B. Manufacturer: Insulating glass; as specified in Section 08 80 00: Glazing.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Swing Door Entrances: NAAMM "Medium Stile."
   1. Door Thickness: 1-3/4-inches.
   2. Nominal door stile face dimensions shall be as follows:
      a. Vertical Stiles: 3-1/2 inches.
      b. Top Rail Height: 3-7/8 inches.
      c. Bottom Rail Height: 10 inches.
   3. Glazing Stops: Square snap-in type for specified glazing infill.

B. Glass: Factory-installed 1 inch thick clear insulating as specified in Section 08 8000 “Glazing.”

2.2 DESIGN AND PERFORMANCE CRITERIA

A. General Design Requirements: Comply with recommendations of AAMA “Aluminum Store Front and Entrance Manual” except where more stringent requirements are specified or required by applicable codes.
   1. Air Infiltration, ASTM E283/E283M:
      a. Pairs of Doors: Maximum of 0.05 cfm per linear foot of perimeter crack at a pressure differential of 1.57 psf.
   2. Water Penetration:
      a. Static Pressure: None, when subjected to laboratory testing in accordance with ASTM E331 at not less than 8 psf.
      b. Dynamic Pressure: None, when subjected to laboratory testing in accordance with AAMA 501.1 at not less than 8 psf.
   3. Expansion/Contraction: Provide for expansion and contraction of door components caused by a temperature range of 170 degrees F over a 12-hour period without causing detrimental effect.
   4. Energy Performance: Aluminum-framed entrances shall have certified energy performance ratings in accordance with NFRC standards and approved software. The following parameters shall be documented:
      a. Value for U-factor shall be as defined by the Architect, but shall not be more than 0.45 for glazed doors, as defined in the prescriptive requirements of the

2018 IECC, unless superseded by Performance Compliance based Energy Modeling.

b. Value for SHGC shall be as specified for the Glass Type scheduled and specified in Section 08 8000 “Glazing” but shall not be more than 0.23 for glazed doors unless superseded by Performance Compliance based Energy Modeling.

B. Entrances and doors shall meet resistance to corner racking when tested by the Dual Moment Load test.

C. Safety Glass Standard: Comply with CBC and CPSC 16 CFR 1201, and pass ANSI Z97.1.

D. Air Infiltration Performance: Shall not exceed 0.5 cfm per square foot of unit at 1.57 psf static air pressure differential, when tested in accordance with ASTM E283/E283M.

E. Forced Entry Resistance when tested in accordance with AAMA 1304: 300 pounds.

F. Expansion/Contraction: Provide for expansion and contraction of door components caused by a temperature range of 170 degrees F over a 12-hour period without causing detrimental effect.

2.3 MATERIALS

A. Aluminum Extrusions: ASTM B221, alloy 6063-T5.

B. Fasteners: Aluminum, nonmagnetic, stainless steel or other materials which are non-corroding and compatible with aluminum components.
1. Provide reinforcement where fasteners are screwed into aluminum members of less than 1/8-inch thickness.
2. Do not use exposed fasteners.

C. Miscellaneous Concealed Metal Members: Aluminum or nonmagnetic stainless steel.

2.4 GLAZING

A. Glazing Gaskets: Full-Density EPDM conforming to NAAMM Standard SG-1.

B. Glazing Blocks, Spacers, and Accessories: As specified in Section 08 8000 “Glazing.”

C. Glass: Insulating, as shown on the Drawings and specified in Section 08 8000 “Glazing.”

2.5 HARDWARE – GENERAL

A. Weatherstripping: Manufacturer's standard and optional bottom gasketing as required to meet specified performance requirements.

B. Keying and Additional Hardware Requirements for Each Opening: As specified in Section 08 7100, “Door Hardware.”

2.6 FABRICATION

A. General:
1. Perform all finishing prior to shipping to Project.

2. Whenever it is necessary to proceed with fabrication without actual field measurements, provide adequate fabrication and installation tolerances for proper fit.
3. Maintain accurate relationships of planes and angles, with hairline fit of contacting members.
4. Perform fabrication operations, including cutting, fitting, forming, drilling, and grinding of metalwork in such a manner as to prevent damage to exposed finish surfaces.

B. Corner construction shall consist of mechanical clip fastening and SIGMA deep-penetration plug welds at top and bottom of channel clip.

C. Provide SIGMA fillet welds along both top and bottom webs of rail extrusion.

2.7 PROTECTIVE COATINGS AND FINISHES

A. Perform all finishing prior to shipping to Project site.

B. Protect against galvanic action where dissimilar metals are in contact, except in case of aluminum in contact with galvanized steel, zinc, or relatively small areas of stainless steel or nickel silver (white bronze). Protect by applying one coat of specified bituminous paint or zinc chromate primer or by application of an appropriate sealant or tape.

C. Architectural Class I dark bronze anodic coating to match appearance of existing and conforming to AA-M10C22A44. Coordinate with Section 08 5113, “Aluminum Windows,” for appearance match.
1. Color: “Bronze Anodized.”

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions, drawings, specifications, and reviewed submittals. Erection shall be plumb, level, square, and in proper alignment and relationship to other work.

B. Glazing shall comply with requirements of Section 08 8000 "Glazing." Ensure proper seating of gaskets for continuous contact with glass around perimeter of glazed openings.

C. Adjust entrances for proper operation of each door and its mechanical hardware. Comply with additional hardware installation requirements specified in Section 08 7100 "Door Hardware."

D. Finished work shall be free of waves, buckles, dents, or other defects.

3.2 FIELD QUALITY CONTROL

A. Testing:
1. General:
a. Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test and inspection reports.
b. Testing does not relieve warranty responsibility required for watertightness.

B. Water Penetration Test:
   1. Perform in accordance with ASTM E1105 on the installed entrance doors to evaluate installed performance; minimum uniform and cyclic static air pressure differential of 0.67 times the static air pressure differential specified for laboratory test in performance requirement Article, but not less than 6.24 pounds per square foot, and shall not evidence water penetration.
   2. If leak should occur during water testing, then at least one additional water test shall be made at a randomly selected location.
   3. Correct deficiencies, modify system, and retest. Modify installation and retest as necessary until system passes water leakage requirements.
   4. Costs for modifications and subsequent testing shall be the responsibility of the Contractor at no additional cost to the Owner.

C. Manufacturer’s representative shall periodically inspect installation of entrances to ensure installation is proceeding in accordance with manufacturer’s recommendations and warranty requirements. Representative shall submit a written report of each visit indicating observations, findings, and conclusions of inspection.

D. Entrances will be considered defective if they do not pass tests and inspections.

3.3 CLEANING AND TOUCH-UP

A. Leave manufacturer's labels in place, intact, and legible until installation is reviewed and accepted.

B. After initial inspection, remove labels, protective coating, and other foreign materials from glass and aluminum surfaces.

C. Clean glass and metalwork of smears, spots, and other markings. Comply with additional requirements for final cleaning specified in Section 01 7700 "Closeout Procedures.”

D. Institute protective measures through remainder of construction period to ensure that aluminum-framed entrances will be without damage or deterioration at time of acceptance.

E. Touch up field abrasions and damage to factory-painted finish. Touch-up shall be unnoticeable in completed installation. Components touched-up in field determined as unacceptable by the Architect shall be replaced at no additional cost to Owner.

END OF SECTION

SECTION 08 5113

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fixed and operable aluminum windows.
2. Factory glazing.
3. Window screens.

B. Related Requirements:
1. Fiber-Reinforced Cement Siding: Section 07 4646.
2. Sheet Metal Flashing and Trim: Section 07 6200; sill flashing and end dams.
3. Flexible Flashing and Underlayment: Section 07 6500.
4. Joint Sealants: Section 07 9200; sealant at perimeter of windows.
5. Aluminum-Framed Entrances: Section 08 4213.
6. Glazing: Section 08 8000.
7. Window Schedule in the Drawings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Prior to installation of aluminum framing systems and associated work, Contractor, Architect, and fabricator's field and office representatives responsible for work under this Section shall meet at the Project site to coordinate and discuss installation.
1. Notify participants at least 5 working days before conducting meeting.
2. Review materials selections and procedures to be followed in performing the work.
3. Review in detail job conditions, schedule, construction sequence required to construct a watertight and weathertight exterior building envelope, installation requirements, and quality of completed installation.
4. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.
6. Review in detail the means of protecting completed work during remainder of construction period.
7. Review testing, inspection, and remedial repair procedures.
8. Contractor shall record discussions of conference and any conflict, incompatibility, or inadequacy, and shall furnish a copy of record to each participant.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, "Submittal Procedures."
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, "Closeout Procedures."

1.4 ACTION SUBMITTALS

A. Shop Drawings: Dimensioned and annotated, including plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and project specific details of installation.
   1. Show details of interface with other building construction, method and location of attachment to structural system, glazing materials, and field measurements.

B. Product Data: Manufacturer's descriptive information for each window Type including hardware, finish, and glazing, and documentation confirming compliance with specified performance criteria.

C. Samples:
   1. 12 inch long section of extrusion in required width and specified finish.
   2. Glass and Glazing Accessories: As specified in Section 08 8000, "Glazing."

D. Schedule for Windows: List of each opening using same opening designations shown on Drawings giving rough opening and unit size dimensions, finishes, factory-applied coatings, and glass type and thickness.

1.5 INFORMATIONAL SUBMITTALS

A. Laboratory and field test reports indicating compliance with design criteria.

B. Structural Certification by registered structural engineer indicating that system complies with the Contract Documents and CBC.

C. Results of field testing by independent inspector, and any directions given Contractor for corrective action.

1.6 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle windows and accessories in accordance with AAMA CW-10.

B. Protect prefinished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.8 FIELD CONDITIONS

A. Verify that field measurements are as indicated on shop drawings.

1.9 WARRANTY

A. Manufacturer: Furnish to Owner the following manufacturer warranties:
   1. Windows: 10 years against all defects in materials and workmanship.
   2. Finish: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials within 20 years. Warranty does not include normal weathering.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. System shall meet or exceed the air and water infiltration requirements for CW PG50 Performance Class and Grade of American Architectural Manufacturers Association (AAMA) 101, "Standard/Specification for Windows, Doors, and Unit Skylights."

B. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440.
   1. Performance Class and Grade: CW-PG50.

C. Window Certification: AMMA certified with label attached to each window.

D. Forced Entry Resistance: Conform to ASTM F588, Grade 10.

2.2 ALUMINUM WINDOWS

A. Manufacturer and Product: ""Performance Series" by Western Window Systems, 877-268-1300, as specified and the basis of design, or equal subject to compliance with the single source responsibility requirements.
   1. Sliding: Series 7620.
   2. Casement: Series 7670.
   3. Fixed: Series 7675.

B. Frames and Sashes: Thermally improved aluminum extrusions.

C. Finish: As specified.

2.3 MATERIALS AND COMPONENTS

A. Glass: Insulating, clear, Low E, tempered; as scheduled on the Drawings and specified in Section 08 8000 "Glazing."

B. Glazing Stop: Snap-in type finished to match window frame.

C. Fasteners: Except as otherwise specified, non-corrosive and compatible with window members, trim, hardware, anchors, and other components.

D. Screens: Provide screens at operable units.
   1. Mesh: Fiberglass mesh, charcoal-colored.
   2. Frame: Roll-formed or extruded aluminum finished to match window frame.

2.4 FABRICATION

A. Fabricate windows to sizes and configurations shown on accepted shop drawings.
   1. Provide flush Phillips flat-head or Allen screws where exposed.
   2. Indicate exposed fasteners on shop drawings for specific approval.
   3. Provide concealed fasteners for glazing stops.
   4. Finish exposed aluminum fasteners to match aluminum work.
   5. All visible edges shall be smooth and factory painted.

B. Shop-glaze window units with specified insulating glass in accordance with glazing requirements specified in Section 08 8000 "Glazing."

C. Windows shall be reglazable without dismantling sash or framing.

2.5 FINISHES

A. Architectural Class I dark bronze anodic coating to match appearance of existing and conforming to AA-M10C22A44. Coordinate with Section 08 4213, “Aluminum-Framed Entrancess,” for appearance match.
1. Color: “Bronze Anodized.”

PART 3 - EXECUTION

3.1 PREPARATION

A. Install self-adhering flashing into window openings as specified in Section 07 6500 “Flexible Flashing and Underlayment,” as indicated on the Drawings, and in accordance with recommendations of AAMA 2400.

B. Where priming or corrosion isolation is required, apply before sash is installed.

3.2 INSTALLATION

A. Install window units, hardware, and other components of work in accordance with manufacturer’s instructions, as shown on accepted shop drawings, and as required for weather-tightness and water-tightness.

B. Windows shall be plumb, level, and true to line, without warp or rack of frames or sash.

C. Anchor securely in place by fastening to framing as recommended by window manufacturer. Seal fastener penetrations.

D. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction. Additional interior and exterior perimeter sealing shall be as indicated, conforming to requirements specified in Section 07 9200 “Joint Sealants.” Give special attention to proper cleaning of painted aluminum surfaces in contact with sealant.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation, a representative of window manufacturer shall inspect in order to verify that windows have been installed in accordance with manufacturer's approved specifications and details.

B. The Contractor shall engage a qualified consultant to perform field tests and inspections on the first completed window installation, as selected in coordination with the City Representative, to verify compliance with specified requirements.
1. Required Tests: As specified in Section 08 4213 “Aluminum-Framed Entrances.”
2. Inspector and/or testing agency shall interpret tests and state in a report whether tested work complies with or deviates from specified requirements.

C. Retesting: Where installed units fail initial testing, additional testing and inspecting will be performed as necessary to achieve successful corrective measures.
1. Scope of retesting will be determined by City Representative based on results of previous tests and inspections.
2. Retesting will continue until satisfactory results are achieved.

3. Cost of retesting, correcting deficiencies, and modify system as required to achieve satisfactory results shall be at the Contractor's expense with no additional cost to Owner.

3.4 CLEANING AND TOUCH-UP

A. Protect installation from damage by tools, plaster, lime, acid, cement, or other compounds.

B. Leave specified labels in place, intact, and legible until review and acceptance of installation.

C. After inspection and acceptance of installation, remove labels, protective wrapping, and other foreign materials from glass and frame surfaces.

D. Clean glass and metalwork of smears, spots, and other markings.

END OF SECTION

SECTION 08 6300

METAL-FRAMED SKYLIGHTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fixed and operable aluminum-framed, curb-mounted skylights.
2. Skylight related flashings, closures and accessories.

B. Related Requirements:
1. Thermoplastic-Polyolefin Roofing: 07 5423.
2. Sheet Metal Flashing and Trim: Section 07 6200.
3. Glazing: Section 08 8000.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Coordination:
1. Coordinate with submittal and warranty requirements of other Sections to ensure a complete waterproof installation.
2. Coordinate and schedule installation of skylight with installation of curb construction, roofing, sheet metal work, and other adjoining or substrate work integral or contiguous with skylights.

C. Pre-installation Meeting: Schedule a job meeting to review skylight work prior to installation.
1. Conference shall be attended by representatives of the Contractor, Owner, Architect, skylight installer, and others whose work may affect quality of skylight installation.
2. Notify attendees a minimum of 5 business days prior to date of meeting.
3. Agenda items relating to skylights shall include:
   a. Substrate and other preparatory work performed by other trades including skylight curbs.
   b. Field testing procedures.
   c. Protection of adjacent roof areas.
   d. Preparation and other requirements for installing structural silicone sealant.
4. Record discussions of conference and any conflict, incompatibility, or inadequacy and furnish a copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Shop Drawings:
1. Include to-scale dimension plans and elevations and full-size detail sections for each skylight assembly type.
2. Show anchors and other components not included in manufacturer's standard data.
3. Include glazing details.
4. Show relationship to adjacent construction, including roof deck, roofing, and flashings.

B. Product Data:
   1. Manufacturer's drawings and printed literature indicating method of construction, materials, finishes, and anchorage to adjoining work.
   2. Product test reports from a qualified testing agency, indicating that skylights comply with specified performance requirements.
   3. Maintenance and reglazing instructions.

C. Samples:
   1. Exposed Aluminum: 12 inches long of typical profile, finished as specified.
   2. Glass: 12 inches square of insulating glass shall be constructed from same material and by method as to be installed in Project.

D. Delegated Design: Calculations prepared by the engineer in responsible charge retained by the Contractor shall be submitted to demonstrate compliance with CBC and specified performance requirements.
   1. Cross-reference calculations to shop drawings.
   2. Although all calculations shall be submitted, only reactions to structure are subject to review by Architect and Project Structural Engineer. Review of calculations by Architect will not relieve Contractor of any responsibilities for providing systems of required strength.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports from a testing agency qualified according to ASTM E699 indicating skylight complies with specified performance requirements based on comprehensive testing of current products.

B. Qualification data for installer.

C. Results of field water testing.

D. Report on pre-installation meeting if not provided under other Sections.

1.5 CLOSEOUT SUBMITTALS

A. Extended warranty.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Installer: A firm experienced in installing skylights similar to those indicated for this Project, with a record of successful in-service performance, and trained and approved by manufacturer of skylight system.
   2. Design Engineer: A professional engineer who is experienced in providing engineering services for installations of skylights that are similar to those indicated for this Project in material, design, and extent and is licensed in the State of California.

1.7 FIELD CONDITIONS

A. Verify dimensions of roof openings by field measurements before fabrication and indicate measurements on shop drawings.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Provide wrapping or strippable material to protect prefinished aluminum surfaces. Do not use adhesive papers or spray coatings that bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

B. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.9 WARRANTIES AND GUARANTEE

A. Manufacturers: Furnish Owner with the following manufacturer extended warranties.
1. Skylight System: 10-year warranty agreeing to replace skylights which leak water, deteriorate, or otherwise fail to perform as required within warranty period as a result of failure of materials or workmanship.
2. Electrical and Control Systems: 5-year warranty.
3. Aluminum Coating: 20-year warranty for protective coating on aluminum agreeing to repair or replace work with finish defects. “Defects” is defined as peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.
4. Insulating Glass: As specified in Section 08 8000, “Glazing.”

B. Contractor: Furnish Owner with a written extended 5-year guarantee/warranty agreeing to repair or replace work which fails in workmanship.
1. Include all components of skylight as well as related work integral with skylights, including but not limited to flashings and other miscellaneous components.
2. Failure includes but is not limited to failure to perform as specified, glass breakage other than accidental breakage, uncontrolled water penetration, and deterioration of finish or construction in excess of that to be expected under normal weathering.

PART 2 - PRODUCTS

2.1 METAL-FRAMED SKYLIGHTS

A. Manufacturer and Products (“SL”): Single-pitch glass in aluminum frame, factory fabricated into a single assembly; Velux-America, Inc., 800-888-3589, as specified and the basis of design, or accepted equal.
1. Fixed: Curb-mounted; Model “FCM.”
2. Operable: Curb-mounted; Model ”VCE.”

B. Sizes: As indicated on the Drawings.

C. Glass: Insulating, as specified.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

A. General: Skylights shall be capable of withstanding loads and thermal movements specified without failure. Failure includes:
1. Deflection exceeding specified limits.
2. Framing members' transferring stresses, including those caused by thermal movement to glazing.
3. Noise or vibration created by thermal movement of components and winds.
4. Loosening or weakening of fasteners, attachments, and other components.
5. Sealant failure.

B. Skylights shall withstand a 30 psf live load acting inward or outward without failure, leaks, or permanent distortion.

C. Installed skylights shall be capable of withstanding thermal expansion and contraction movements for an ambient temperature change of 100 degrees F without failure, leaks, or noise.

D. Product Standard: Aluminum-framed skylights shall meet or exceed the following Performance Class and Grade requirements of AAMA/WDMA/CSA 101/I.S.2/A440, “NAFS - North American Fenestration Standard/Specification for windows, doors, and skylights.”
   1. Performance Class: CW.
   2. Performance Grade: 100.

2.3 MATERIALS AND COMPONENTS

A. Glazing:
   1. Glass: Clear, insulating; Velux-America, Inc. Type 04.
      a. Upper Glass Ply: Clear, tempered float with Low E coating on the #2 surface.
      b. Lower Glass Ply: Two lights of clear, heat-strengthened, clear float glass with a clear 0.030 inch thick PVB interlayer.
      c. Nominal Overall Unit Thickness: 17.6mm.
   2. Glazing Gaskets and Tapes: As standard of skylight manufacturer.

B. Exterior and Interior Caps: Extruded-aluminum alloy 6063-T5, thickness 0.094 inch minimum.

C. Miscellaneous Materials:
   1. Exterior Fasteners: Type 316 stainless steel.
   2. Provide anodic corrosion isolation where required, and provide neoprene washer or gasket where fastener penetration is subject to water penetration.
   3. Sealants: As specified in Section 07 9200, "Joint Sealants."

2.4 PROTECTIVE COATINGS AND FINISHES

A. Corrosion Isolation: Bitumastic paint of alkali-resistant type with minimum 15-mil dry-film thickness.

B. Exposed Aluminum: Prefinished with high-performance coating containing polyvinylidene fluoride (PVDF) resin and meeting or exceeding all the requirements of AAMA 2605; PPG “Duranar,” or equal as standard with skylight manufacturer.
   1. Colors:
      a. Exterior: Manufacturer’s standard gray.
      b. Interior: Manufacturer’s standard white.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install skylights under direction of skylight manufacturer's representative and in accordance with manufacturer's instructions, reviewed submittals, and ICC ES Report.

B. Set skylights plumb, true in plane, accurately aligned and without warp or rack.

C. Field installed fasteners shall be concealed unless otherwise shown on reviewed shop drawings.

D. Sheet Metal Work:
1. Where factory fabrication is not practicable, field-fabricate in accordance with Section 07 6200, “Sheet Metal Flashing and Trim.”
2. Coordinate installation of perimeter flashing with installation of metal roofing.

E. Field Glazing:
1. Locate and size extruded elastomeric setting blocks and spacers in accordance with the glazing manufacturer’s recommendations.
2. Ensure that glazing is thermally and physically isolated from framing members. At no point shall the glazing come in contact with the skylight frame or fasteners.
3. Install glass in accordance with skylight manufacturer's recommendations and as specified in Section 08 8000, "Glazing."

F. Erection Tolerances: Install skylight components true in plane, accurately aligned, and without warp or rack. Adjust framing to comply with the following tolerances:
1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 10 feet; 1/4 inch over total length.
2. Alignment: Where surfaces abut in line and at corners and where surfaces are separated by less than 3 inches, limit offset from true alignment to less than 1/32 inch; otherwise, limit offset from true alignment to 1/8 inch.

3.2 FIELD QUALITY CONTROL

A. Water Test: Perform field testing of each completed skylight system for water-penetration resistance.
1. Test in accordance with AAMA 501.2 ("hose") test.
2. There shall be no uncontrolled water leakage as defined in AAMA 501.2.
3. If testing results in uncontrolled leakage, repair deficiencies discovered by testing, and retest assembly. Remedial measures shall maintain standards of quality, durability, and appearance and shall be approved by the Owner, in advance.
4. Tests shall be observed by Owner's Representative.

3.3 CLEANING AND PROTECTION

A. Clean skylights inside and outside, immediately after installation and after sealants have cured, according to manufacturer’s written recommendations.

B. Remove temporary protective coverings and strippable coatings from pre-finished metal surfaces. Leave manufacturer's labels in place, intact, and legible until installation is reviewed and accepted.

C. Remove excess sealant according to sealant manufacturer’s written recommendations.

D. After initial inspection, remove labels and other foreign materials from glass and aluminum surfaces.

END OF SECTION

SECTION 08 7100

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Finish hardware for doors supplementing the information included on the Drawings.
   2. Miscellaneous hardware accessories.

B. Related Requirements:
   1. Architectural Wood Casework: Section 06 4100; cabinetwork hardware.
   2. Hollow Metal Doors and Frames: Section 08 1113.
   3. Wood Doors: Section 08 1400.
   4. Door Schedule and Door Notes on the Drawings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Contractor shall have the finish hardware supplier be responsible for furnishing physical hardware and templates of all hardware to the respective door manufacturers prior to fabrication and for coordinating hardware delivery requirements with the hardware manufacturer to ensure the project is not delayed.

1.3 ACTION SUBMITTALS

A. Hardware Schedule: List opening number, hardware Group/Set, and name of each item and its manufacturer, catalog number, material, and finish associated with each Group/Set. Use same opening numbers and references as scheduled and noted on the Drawings.
   1. Submit in sufficient time for Architect's review and for supplier to place order with manufacturer in order to meet Project Schedule and requirements of door fabricators for shop preparation and hardware to be installed in shop.
   2. Do not order hardware until Hardware Schedule has been reviewed and returned.
   3. Review of Hardware Schedule shall not be construed as certifying that the list is complete.

B. Product Data: Manufacturer's catalog cuts of each specific item of hardware specified and to be provided. Include labeling and listing information in accordance with the CBC and NFPA 80 for fire rated doors.

C. Templates: Provide listing of manufacturer’s template numbers for each item of hardware in hardware schedule.

D. Installation Instructions: Provide manufacturer’s written installation and adjustment instructions for finish hardware.

E. Samples: Full-size operating hardware in each specified finish when requested by the Architect.
   1. Affix labels to sample fully to identify manufacturer, class, type, and Project.
   2. After review, accepted samples may be obtained from Architect for installation on the Project.

1.4 CLOSEOUT SUBMITTALS

A. Extended warranties.

B. Keys and access cards if required; coordinate with Owner.

1.5 QUALITY ASSURANCE

A. General Requirements:
   1. This Specification and Door Schedules on the Drawings are intended to provide a general guide to the Contractor to establish type, standard of quality, and function, but it is the responsibility of the Contractor to retain a qualified hardware consultant to prepare a detailed Hardware Schedule and to furnish proper hardware for all openings for a complete installation, whether specified or not.
   2. No extra cost will be allowed because of changes or corrections necessary to facilitate the proper installation of any hardware.

B. Door closing devices shall comply with the following maximum opening-force.
   1. Interior Hinged Doors: 5 pounds applied perpendicular to door at latch.
   2. Exterior Hinged Doors: 5 pounds applied perpendicular to door at latch.
   3. Hinged Fire Doors: 8.5 pounds applied perpendicular to door at latch.
   4. Multiple Hinged Entry Doors: Exterior entry doorways that are adjacent to power operated doors and serve the same room can have up to 8.5 pounds of opening force applied perpendicular to door at latch.

C. Thresholds shall be maximum 1/2-inch in height above floor and landing on both sides of openings. Bevel raised thresholds with a slope of not more than 1:2.

D. Special attention shall be given to coordinate with Section 08 1113, “Hollow Metal Doors and Frames,” and Section 08 1400, “Wood Doors,” to ensure proper fitting and matching of hardware supplied under this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hardware to shop of door subcontractor or directly to the Project site as required.

B. Each article of hardware, whether delivered to site or door manufacturer, shall be individually packaged in manufacturer's original container, and properly marked or labeled in conformity with the reviewed Hardware Schedule.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.7 FIELD CONDITIONS

A. Templates: Furnish paper templates required by manufacturers of doors and frames to enable frame and door manufacturers to make proper provisions to receive hardware. Where paper templates cannot be used effectively, furnish physical templates.

1.8 GUARANTEE AND WARRANTIES

A. Contractor: In addition to its Standard Guarantee under the Contract, furnish Owner with an extended 2-year guarantee against defects related to installation of door hardware.

B. Manufacturers: Furnish Owner with the following written manufacturer warranties.
   1. Hinges: Life span of Building.
   2. Mortise Locksets and Latchsets: 10 years.
   3. Electromagnetic Locks: 5 years.
   4. Exit Devices: 5 years.
   5. Manual Closers: 25 years.
   6. Electromechanical Door Hardware: 2 years.

PART 2 - PRODUCTS

2.1 DOOR HARDWARE

A. General Requirements:
   1. This Specification and Door Schedules on the Drawings are intended to provide a general guide to the Contractor to establish type, standard of quality, and function, but it is the responsibility of the Contractor to retain a qualified hardware consultant to prepare a detailed Hardware Schedule and to furnish proper hardware for all openings for a complete installation, whether specified or not.
   2. No extra cost will be allowed because of changes or corrections necessary to facilitate the proper installation of any hardware.
   3. Coordinate specified hardware with door manufacturer for proper preparation.
   4. Entire door hardware package shall be factory priced and coordinated. Verify handing.

B. Hinges:
   1. Type: Five-knuckle.
   2. Exterior Out-Swinging: Stainless steel or solid bronze base material with non-removable pins.
   3. Labeled Doors: Steel.
   4. Furnish two hinges for doors up to 5 feet high and one additional hinge for each 2-1/2 feet of height or fraction thereof over 5 feet.
   5. Provide widths sufficient to clear trim projection when door swings 180 degrees.
   6. Provide ball-bearing hinges for doors with closers.

C. Mechanical Locksets and Latchsets:
   1. Heavy Duty Cylindrical Locks and Latches: Refer to the “Door Notes” on Drawing A501.
   2. Extra Heavy-Duty Commercial Mortise Locks: Schlage “L” Series, or equal.
   3. Lever and Rose Design: To be finalized by Architect.
   4. Strikes:
      a. Furnish standard strikes with extended lips where required to protect trim from being marred by latch bolt.
      b. Verify whether standard or ANSI cutouts are provided in metal frames.
      c. Provide dust pocket to conceal interior of doorframe.
   5. Dead bolts shall have a 1-inch projection.
   6. Backset:
      a. Flush Doors: 2-3/4 inches.

b. Stile and Rail Doors: 2-3/4 inches unless otherwise selected by Architect in coordination with vertical stile width of door.

7. Provide matching dummy trim on inactive leaf of double doors.

D. Programmable Keypad Locks: Simplex or equal approved by Owner.

E. Closers: Refer to the “Door Notes” on Drawing A6.01.

F. Strikes:
1. Furnish standard strikes with extended lips where required to protect trim from being marred by latch bolt.
2. Provide dust pocket to conceal interior of doorframe.

G. Doorstops at Hinged Doors:
1. Install to prevent door or hardware from striking an adjacent wall or obstruction.
2. Types:
a. Typical: Floor mounted low dome; refer to the “Door Notes” on Drawing A6.01.
b. Provide wall–mounted where floor mounting not possible or if selected by Architect for specific opening.

H. Exit Devices: Comply with ANSI A156.3, function as scheduled. Exit devices shall be UL rated and shall meet requirements of local fire marshal and CBC Section 1008.1.9.

I. Flush Bolts: 12 inches long, at top and bottom of inactive or designated door leaf, except at exit doors.
1. At exit doors, provide automatic flush bolts on inactive leaves.
2. At doors over 7 feet high, provide longer rods as required.

J. Weatherstripping and Sound Seals: Pemko, or accepted equal.
1. General: Except where provided by door manufacturer, as proposed by Contractor and approved by Architect.
2. Automatic Door Bottoms: Concealed; Pemko 434ARL.
3. Head and Jambs: Kerf installed thermoplastic elastomer.
4. Meeting Stiles: Kerf installed, gray pile.
5. Provide door shoe (drip) at bottom of exterior inswinging doors.
6. Weatherstripping shall not interfere with operation of doors and shall be adjusted for proper performance.

K. Furnish metal thresholds complying with CBC Section 1133B.2.4.1.

L. Keys and Keying: Refer to the “Door Notes” on Drawing A6.01.
1. Locks shall be keyed and registered at lock factory.
2. Furnish three masterkeys each MK set, and three keys per lock for each keyed lock.
3. Tag keys with location and deliver them as instructed upon completion of Work.
4. Destroy all temporary keys.

M. Fastenings: Of suitable sizes, quantity, and material to match hardware finish. All fasteners at exterior openings shall be nonferrous or Type 316 stainless steel.

N. Finishes: Refer to the “Door Notes” on Drawing A6.01.

2.2 MISCELLANEOUS ACCESSORIES

A. Coat Hooks: Refer to the “Door Notes” on Drawing A6.01.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Install hardware neatly and properly in accordance with manufacturer's instructions and reviewed submittals.

B. Provide hardware items not definitely specified or scheduled but necessary for proper operation of a door assembly at no additional cost to Owner. Such items shall be of type and quality suitable for service required and comparable to adjacent hardware.

C. Mounting Heights: Comply with the following:
   1. Hinges at Exterior Doors:
      a. Top: 5 inches from head to top of hinge leaf.
      b. Bottom: 10 inches from bottom of hinge to finished floor.
      c. Intermediate: Equal distance between top and bottom hinges, 3 feet 0 inches maximum.
      d. Top and bottom hinge locations may vary from above if standard with door manufacturer.
   2. Hinges at Interior Doors, Deadlocks/Deadbolts/ and Door Pulls: As shown or, if not shown, as provided by Architect.

3.2 CLEANING

A. Just prior to final acceptance or as directed, remove protective paper coverings, and clean and polish hardware.

3.3 PROTECTION

A. Projecting Items Such as Levers, Handles, and Pulls: Reinstall wrappings furnished by the manufacturer.

B. Remove protection just prior to final acceptance of each building or as instructed.

END OF SECTION

SECTION 08 8000

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for glass, and factory and field glazing of doors, entrances, and windows.
   2. Unframed mirrors.
   3. Glass Type Schedule.

B. Related Requirements:
   1. Hollow Metal Doors and Frames: Section 08 1113.
   2. Wood Doors: Section 08 1400.
   3. Aluminum-Framed Entrances: Section 08 4213.
   4. Aluminum Windows: Section 08 5113.
   5. Door and Window Schedules and Notes on the Drawings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Attendance by Contractor’s glazier is required at preconstruction meetings specified in related Sections.

1.3 ACTION SUBMITTALS

A. Shop Drawings: As specified in related sections for systems in which glazing is installed.

B. Product Data: Manufacturer’s literature substantiating that glass and glazing materials comply with specified requirements.

C. Samples:
   1. Glass Panels:
      a. 12 inches square, of each type specified, except clear single-pane units.
      b. Samples of insulating glass shall be constructed from same material and by method as to be installed in Project.
   2. Samples may be submitted as part of sample submittals required under other Sections.

1.4 INFORMATIONAL SUBMITTALS

A. Statement of fabricator/installer qualifications for exterior glazing, if requested by Architect.

1.5 CLOSEOUT SUBMITTALS

A. Extended warranty for insulating glass.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver glass with manufacturer's label indicating type, quality, and thickness on each piece.

B. Protect glass and glazing materials during delivery, storage, and handling so as to comply with manufacturer's directions and as required to prevent face and edge damage to glass and damage to glass and glazing materials from effects of moisture, including condensation and other causes.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.7 QUALITY ASSURANCE

A. Qualifications:
1. Fabricator/Installer of Exterior Glazing: Company specializing in work of this Section, with documentable experience on jobs of similar type and complexity.

B. Where safety glass is indicated or required, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of the U.S. Consumer Product Safety Commission "Safety Standard for Architectural Glazing Materials" 16 CFR Part 1201 for Category I materials.

C. Insulating glass to be certified under IGMA-approved program and meet Test Class CBA requirements.

1.8 WARRANTY

A. Manufacturers:
1. Insulating Glass: Furnish Owner with manufacturer’s written warranty for sealed insulating glass unit in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period.
a. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions
b. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
c. Warranty Period at Vertical Glazing: 10 years.

B. In addition, warranty requirements of related Sections for systems in which glazing is installed shall apply to work of this Section.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Regulatory Requirements:
1. Comply with CBC Chapter 24, Section 2406.

2. Where safety glass is indicated or required, provide type of products indicated that comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category I or II materials, as applicable.
3. Mirrors shall meet CPSC or ANSI safety glazing requirements and shall be certified by the Safety Glazing Certification Council (SGCC).

B. Industry Standards:
1. Comply with GANA "Glazing Manual," except where more stringent requirements are indicated.
2. Comply with applicable provisions of the AAMA "Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual."

C. Minimum Wind Load for Exterior Glass and Glazing Assemblies: In accordance with CBC Chapter 16.

2.2 GLASS MATERIALS

A. Annealed Float Glass: ASTM C1036, Type I, Class 1, Quality q3 or better.

B. Heat-Strengthened and Tempered Float Glass: ASTM C1036, Type I float glass as specified above and conforming to requirements of ASTM C1048 and as specified.
1. Tempered glass shall meet ANSI Z97.1 test requirements.
2. Glass shall be tempered using the roller hearth method.
3. Heat-strengthened glass shall have surface compression levels between 3500 and 7000 psi.

C. Insulating Glass:
1. Units shall be fabricated from float glass as specified herein.
2. Provide tempered glass for both lights of glass where indicated or required by code.

D. Fire-Rated Glass: UL and WHI listed, visually clear ceramic, with polished surfaces; 1/4 inch thick "SuperLite I" as distributed by SAFTI*First* Division of O'Keeffe's Inc., San Francisco, CA, 415-822-4222.
1. Rating: 20 minutes.

E. Clear Mirror Glass: ASTM C1503, Select quality, 6.0 mm thick.
1. Provide silver coating, copper-protective coating, and 1-mil-thick mirror backing paint.
2. Comply with CS 27.

2.3 GLAZING MATERIALS

A. Sealants for Glazing:
1. Interior Locations, If Not Dry Glazed: One-part, gun grade; Tremco "Mono," Pecora "60 Plus," or accepted equal.
2. Exterior Locations: One-part, gun-grade silicone; Momentive Performance Materials "SCS-1200, Dow "DOWSILI 999A Building and Glazing Sealant," or accepted equal.
a. Color: Black.

B. Joint Backer: Diameter size at least 25 percent larger than joint width; type and material as recommended, in writing, by glass and sealant manufacturer.

C. Glazing Blocks and Spacers: Closed-cell neoprene complying with ASTM C509, in black color.

D. Glazing Gaskets: As standard and provided by aluminum frame manufacturer.

E. Silicone Glazing Materials: Provide silicone setting blocks, jamb blocks, and sealant joint backer or spacers in lieu of neoprene, if recommended by sealant manufacturer, for compatibility with sealant. Corners, sizes, profiles, and color as specified for neoprene glazing materials.

F. Glazing Tape: Butyl rubber type, black color; Pecora "Extru-Seal Tape G-66," Tremco "440 Tape," or accepted equal.

G. Mirror Channels: Stainless steel, width to match glass thickness, satin or polished finish as selected by Architect.

H. Mirror Adhesive: "Mirro-Mastic" by Palmer Products Corp. or accepted equal.

I. Accessory Materials: Miscellaneous clips and fastenings as required and as standard with window or door manufacturer.

2.4 FABRICATION

A. Glazing framing dimensions shall provide for necessary minimum bite on glass, minimum edge clearance, and adequate sealant thicknesses, with reasonable tolerances. Provide correct glass size for each opening, within tolerances and necessary dimensions established.

B. Factory-label each pane of glass. Do not remove labels until final acceptance is obtained.

C. Tempered glass shall be horizontally tempered with roller ripples in horizontal direction.
   1. Where required, include an inconspicuous but visible permanent identifying label on each pane in accordance with ANSI Z97.1.
      a. Fused to glass and located in a lower corner.
      b. Include manufacturer's name or trademark, glass type, thickness, and designation of treatment.
   2. Maximum warpage in accordance with Pilkington or Vitro Architectural Glass standards.
   3. Provide fireman's tempered-glass marker where required by local fire department.

D. Dimensional Tolerances: Glass shall comply with referenced standards.

PART 3 - EXECUTION

3.1 GLAZING

A. Comply with combined printed recommendations of glass manufacturers and manufacturers of sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.

B. Tempered Glass: Provide at locations where indicated and required in accordance with CBC.

C. Protect glass from edge damage during handling and installation.
   1. Use a rolling block in rotating glass units to prevent damage to glass corners.
   2. Use suction cups to shift glass units within openings.

3. Do not raise or drift glass with a pry bar.
4. When glass has flares or bevels along one horizontal edge that would occur in vicinity of setting blocks, install with flares or bevels at top of opening.
5. Use glazing tape and shims to position glass properly.

D. Remove and dispose of glass with edge damage or other imperfections of any kind that, when installed, would weaken glass and impair performance and appearance.

E. Install setting blocks of proper size at sill, located one-quarter of glass width from each corner, unless otherwise required. Set blocks in sealant acceptable for heel bead use.

F. Provide edge blocking to comply with requirements of GANA "Glazing Manual," except where otherwise required by glass fabricator.

G. Set units in each series with uniformity of pattern, draw, bow, and similar characteristics.

H. Compression Gaskets: Provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.
1. Miter-cut at corners. Install as recommended by gasket manufacturer to prevent pull-away at corners.
2. Seal corner joints and butt joints with sealant recommended by gasket manufacturer.
3. Install gaskets to protrude slightly out of channel so as to eliminate dirt and moisture pockets.

I. Mirror Adhesive: Apply in accordance with manufacturer's recommendations over primer/sealer on substrate.
1. Do not apply over water-resistant gypsum board that has not been primed.
2. Install to allow 1/8-inch space between back of mirror and surface of wall.
3. Use metal clips to support unframed mirrors at lower and top edge. Do not rest mirrors directly on countertop backsplashes or tile.

3.2 PROTECTION AND CLEANING

A. Do not apply markers to surfaces of glass.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

D. Remove nonpermanent labels, and wash glass on both faces by method recommended by glass manufacturer.

3.3 GLASS SCHEDULE (TYPES)

A. GL-1: Insulating at Exterior Vertical Glazing.
1. Thickness:
   a. Exterior Light: 1/4-inch (6mm) thick, clear float, heat strengthened, with low-E coating on the #2 surface; “Solarban 90” by Virtro Architectural Glass, or equal.
   b. Space: 1/2-inch, Argon filled.
   c. Interior Light: Clear, 1/4-inch (6mm) thick, clear float, heat strengthened.
2. Overall Unit Thickness: 1 inch.

3. Provide tempered glass for both lights were required by code and where noted on the Drawings.

B. GL-2: Insulating at Interior Vertical Glazing between Conditioned and Unconditioned Spaces.
   1. Thickness:
      a. Exterior Light: 1/4-inch (6mm) thick, clear float, tempered.
      b. Space: 1/2-inch, Argon filled.
      c. Interior Light: Clear, 1/4-inch (6mm) thick, clear float, tempered.
   2. Overall Unit Thickness: 1 inch.

C. GL-3: Clear, float, 1/4-inch (6mm) thick unless otherwise noted or specified, tempered where noted and required by code.

D. GL-4: Specified mirror glass.

END OF SECTION

SECTION 09 2216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Non-load bearing metal framing at interior partitions.
2. Flat strap and backing plate for support of wall mounted equipment and fixtures not provided under other Sections.

B. Related Requirements:
1. Hollow Metal Doors and Frames: Section 08 1113.
2. Gypsum Board: Section 09 2900.
3. Acoustic Insulation and Sealants: Section 09 8200; acoustic batts.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.3 ACTION SUBMITTALS

A. Product Data:
1. Specifications and installation instructions for each type of steel stud required to show compliance with specified requirements.
2. Manufactured top track for deflection relief, with UL approval data for each required condition and fire rating.
3. ICC-ES Report of framing system for stud gage and spacing for all wall conditions.

B. Delegated-Design: Engineering data prepared, signed, and sealed by the design engineer in responsible charge for framing systems verifying stud gage and conformance with specified design and performance requirements for field conditions not covered by manufacturer’s product data.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification data for design engineer.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Installer: Company specializing in work of this Section with minimum 3 years' documented experience.
2. Design Engineer: Professional structural or civil engineer registered in the State of California. Design engineer shall be experienced in providing engineering services for the installations of metal framing systems similar to those indicated for this Project in material, design, and extent.

B. Regulatory Requirements:

1. Comply with fire-resistance ratings as indicated and as required by governing authorities and CBC.
2. Provide materials, accessories, and application procedures that have been listed by an approved testing agency or tested according to ASTM E119 for the type of construction shown.
3. Framing system shall conform to ICC-ES Report for stud gage and spacing for all wall conditions.

C. Comply with American Welding Society (AWS) D1.1/D1.1M, "Structural Welding Code - Steel" for welding.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect metal studs and related materials from rusting and damage.

B. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Metal Stud Systems: Cemco, ClarkDietrich Building Systems, or equal.

2.2 DESIGN AND PERFORMANCE CRITERIA

A. Seismic Performance: Non-structural metal framing shall withstand the effects of anticipated earthquake motions for the Project. See also the Structural Drawings.

B. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated. Assembly shall be tested in accordance with ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Wall Systems:
1. General: Assemblies must also accommodate, resist, distribute or transfer, as applicable, other loads to which they are subjected, including attachment of any architectural components, non-structural components, casework, equipment, and similar items.
2. Uniformly Distributed Lateral Live Load: Not less than 10 pounds per square foot.
3. Under specified live load, framing shall not deflect more than shown in CBC Table 1604A.3 or the following, whichever is less, measured normal to the assembly plane. Limit asymmetric wall construction deflection to the most stringent requirement that applies to the assembly.
   a. Typical Partitions: L/240.
   b. Partitions to Receive Tiling Extending Over Wainscot Height: L/360 at 10 psf.

D. Steel framing shall be isolated from building structure so as to prevent transfer of loading imposed by structural movement and at locations indicated below.
1. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.
2. Where partition framing abuts overhead structure. Provide slip-type joints as shown on the Drawings.

2.3 COMPONENTS

A. General:
1. Metal studs, track, and sheet metal furring channels shall comply with ASTM C645.
2. Gage identification shall be color coded in accordance with ASTM C955.
3. Metal components used at moist and wet areas shall have a G-60 galvanized coating thickness.

B. Prefabricated, Steel Studs:
1. Fabricate from cold-formed steel; ASTM A653/A653M.
   a. 0.0677 Inch and 0.0538 Inch (14 and 16 Gage): SQ Grade 50.
   b. 0.0428 Inch (18 Gage): CQ Grade 33.
   c. 0.0329 Inch and 0.0179 Inch (20 and 25 Gage): CQ Grade 33 or in equivalent metal thickness using “UltraSTEEL” EQ or equivalent dimpled sheet metal.
2. Width: As indicated on the Drawings.
3. Shape: Roll-formed channel with punched openings along web and knurled flanges.
4. Finish: Galvanized, minimum G-40 coating meeting ASTM A653/A653M and ASTM C955.

C. Floor and Top Tracks:
1. Fabricate from cold-formed steel; ASTM A653/A653M.
2. Grade to match stud used.
3. Minimum Thickness: Gage equal to or heavier than stud used.
4. Width: Acceptable stud manufacturer's regular type or proper width for stud specified.
5. Shape: Snap-in type, formed with slots or prongs so as to hold stud securely in place. Where required for fire rating, use shape formed for use with stud shoes and wire ties in order to hold studs securely in place.
6. Top Track for Deflection Relief: "MaxTrak 2D (SLP/H)”, slotted deflection and drift track by Clark Dietrich Framing Systems, or equal.
   a. Rated Partitions: When tested in accordance with UL 2079 for cyclical movement and subsequently tested in accordance with the time temperature curve of ASTM E119 and ASTM E814, system shall meet requirements for fire resistance rating of partition and to requirements of hose steam resistance.
   b. Provide sliding clips and other accessories as required for a complete installation.
7. Finish: As specified for studs.

D. Channels:
1. Cold-Rolled Channels: 16 gage (minimum 0.053-inch thick), with factory-applied, rust-resistant paint.
2. Furring Channel, Screwable Type: 25 gage (minimum 0.0188 inches), cold-formed galvanized steel, hat shaped, 7/8 inch deep, with plain or knurled face to receive screws.

E. Partition Stiffeners or Bridging: Specified cold-rolled channels or stud; manufacturer's standard bridging for approved stud.

F. Partition Strapping: 2-inch-wide metal strap, same gage as studs.

G. Wire: ASTM A641, Class 1 zinc coating, soft temper.
1. Bracing Wire: Minimum 0.106-inch nominal diameter (12-gage).
2. Tie Wire:
   a. Single Strand: Minimum 0.062-inch nominal diameter (16-gage).
   b. Double Strand: Minimum 0.048-inch nominal diameter (18-gage).

H. Fasteners: ASTM C1002; self-drilling and self-tapping, flat pan-head screws.

I. Anchorage Devices:
   1. Low-Velocity, Powder-Driven Fasteners: Hilti Fastening Systems, Impex Tool Corporation, or accepted equal.
   2. Concrete Screws: Heat treated with high-low thread designed to cut threads in predrilled holes in concrete.
   3. Drilled Expansion Bolts: Hilti “Kwik Bolt TZ,” or accepted equal.
   4. Machine Bolts, Nuts, and Washers: Low carbon steel standard fasteners, externally and internally threaded, ASTM A307, with malleable washers.

J. Backing Plates: Comply with the following where backing plate details, to meet scheduled equipment load requirements, are not shown on the Drawings:
   1. Continuous across not fewer than three studs.
   2. Notch channels at studs.
   3. For Loads Less Than 50 Pounds per Foot: 16-gage track channel, 6 inches by 1-1/4 inches, attached to each stud with three No. 8 flat-head sheet metal screws.
   4. For Loads of 51 Pounds per Foot to 100 Pounds per Foot: 16-gage track channel, 6 inches by 1-1/4 inches, welded to each stud.
   5. For Loads of 101 Pounds per Foot to 250 Pounds per Foot: 14-gage steel plate, 6 inches wide, with 16-gage track channel stiffeners, 4 inches by 1-1/4 inches, welded to back and attached to each stud with at least one No. 10 flat-head sheet metal screw.

K. Welding Electrodes: Comply with requirements of AWS.

L. Top Track Gasket: Fire rated, thin profile, intumescent cover consisting of a 0.040 inch (1 mm) thick intumescent matrix in a 3.5 mil thick polyethylene cover; “SpeedFlex Track Top Gasket (TTG)” by Specified Technologies, Inc., 800-992-1180, or equal complying with the following.
   1. ASTM E1966 and ANSI/UL2079 for one hour rating,
   2. Tested for use in Perimeter Fire Barrier Systems in accordance with ASTM E2307.

M. Furnish miscellaneous components as required for completion of installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structure and conditions under which metal support systems will be installed.

3.2 GENERAL REQUIREMENTS

A. Comply with requirements of ASTM C754.

B. Wire Tying:
   1. Use single-strand 16-gage or double-strand 18-gage tie wire.
   2. Splicing: Double-wrap-tie.
   3. Horizontal Stiffeners to Channel Brackets: Figure-eight tie.
   4. Framing Members Perpendicular to Each Other: Saddle tie.

C. Deflection Relief at Non-Load-Bearing Walls and Partitions: Provide specified manufactured system for top track for deflection relief unless otherwise shown.
   1. Cut studs short where abutting underside of steel construction.
   2. Do not abut end studs to steel walls.

3. Secure ends of horizontal stiffeners to abutting steel or walls and columns.

3.3 INSTALLATION OF FIRE-RATED ASSEMBLIES

A. Install studs that are components of fire-rated partition in accordance with the requirements of governing authorities and codes.

B. Provide manufactured top track designed for deflection relief at top of fire-rated partitions.

3.4 ERECTION OF NON-STRUCTURAL STUDS

A. Tracks:
1. Align floor and top tracks.
2. Where studs run to structure, attach tracks to structure at maximum of 24 inches on center for powder-driven fasteners and 48 inches on center for expansion bolts, unless otherwise indicated.
3. Where studs run to a point just above ceiling line, anchor and/or brace as required to meet the design criteria.

B. Studs:
1. Plumb and align studs.
2. Space studs 16 inches on center, unless otherwise indicated on the Drawings or required for rated construction.
3. Attach studs to tracks by method recommended by stud manufacturer.
4. Do not splice studs.
5. At wall-mounted fixtures, equipment, handrails, and grab bars, provide 16-gage or heavier studs at least 3-5/8 inches wide.

C. Horizontal Strapping: Place straps both sides of studs where unsupported height of studs exceeds 4 feet.

D. Horizontal Stiffeners: Brace studs with steel channel stiffeners placed horizontally at midpoint of the stud slot on inside of partition, if indicated on the Drawings or if recommended by the stud manufacturer. Secure as recommended by the stud manufacturer.

E. Weld Connections: Resistance-spot or projection-weld, fillet-weld, or plug-weld in accordance with recommended procedures and practices of AWS.

F. Framing Around Metal Frames for Doors, Sidelights, and Glazed Framing:
1. Install double stud at each jamb of metal frame, continuous for full height of partition.
2. Secure stud to jamb anchors with screws.

G. Wall Intersections and Ends:
1. Form corners and intersections of partitions with three studs.
2. Place studs forming internal corners 2 inches from point of partition intersection.

H. Provide backing plates in walls to support wall-mounted items, including but not limited to wall-mounted fixtures, scheduled equipment, handrails, grab bars, toilet accessories, and at other locations as required by the various Sections of the Work.

1. Attach backing plates as specified and to carry loads required by CBC.
2. Provide supplemental studs as required.

3.5 HORIZONTAL FRAMED SURFACES

A. Frame with specified joists, minimum 6-inch size, at 16 inches on center and as required to limit deflection as specified in Part 1 above.

B. Provide runner channels to receive framing at ceiling and walls of same gage as studs. Secure with mechanical fasteners at 24 inches on center maximum. Secure studs to channels with screws.

END OF SECTION

SECTION 09 2900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gypsum board.
   2. Gypsum board finishing.

B. Related Requirements:
   1. Thermal Board and Blanket Insulation: Section 07 2117.
   2. Firestopping: Section 07 8400; firestopping sealants.
   3. Access Doors and Frames: Section 08 3113.
   4. Joint Sealants: Section 07 9200.
   5. Non-Structural Metal Framing: Section 09 2216.
   6. Tiling: Section 09 3000; cementitious backing board at tile.
   7. Acoustic Insulation and Sealants: Section 09 8200; acoustical sealants and sound control requirements.
   8. Painting and Coating: Section 09 9000.

1.2 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C11 and GA-505 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's product data for the following system materials suitable to show compliance with requirements.
   1. Each type of board material.
   2. Metal accessories, if other than listed products are to be provided.

B. Quality Control: Statement of installer qualifications if requested by Architect.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire-Resistance Ratings:
      a. Comply with fire-resistance ratings as indicated and required by governing authorities and codes.
      b. Provide materials, accessories, and application procedures that have been listed by a nationally recognized testing agency or tested according to ASTM E119 for type of construction shown.

2. Comply with the CBC.

B. Industry Standards: Work shall comply with the applicable requirements of GA publication GA-216 and GA-214.

C. Installer Qualifications: Company specializing in work similar to that required on this Project, with not less than 5 years of documented experience.

D. Notify Architect prior to covering or enclosing framing, ducts, and pipes in sound-rated construction in order to allow for on-site review and correction as required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials in dry location, fully protected from weather, direct exposure to sunlight, and damage from other construction activity.

B. Stack gypsum board products flat and level, properly supported in such a manner as to prevent sagging or damage to ends and edges.

C. Store metal and plastic accessories so as to prevent bending, sagging, distortion, or other mechanical damage.

D. Do not store or stack gypsum board on floors of new work with an equivalent loading in excess of 50 pounds per square foot.

E. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

1.7 FIELD CONDITIONS

A. Maintain ambient conditions in installation area in accordance with GA-216 requirements. Provide supplemental heat as required to maintain minimum temperatures specified in GA-216.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Fire-Resistance Ratings:
1. Comply with fire-resistance ratings as indicated and required by governing authorities and codes.
2. Provide materials, accessories, and application procedures that have been listed by a nationally recognized testing agency or tested according to ASTM E119 for type of construction shown.

2.2 MATERIALS

A. General:
1. Products of specific manufacturers, when listed, are for quality and performance identification only. The listing is not intended to limit selection of similar products from other manufacturers.
2. Provide products manufactured by or recommended by manufacturer of gypsum board in order to maintain single-source responsibility.
3. Provide materials in accordance with ASTM C840.

B. Fire Rated Gypsum Board: ASTM C1396/C1396M, Type X, unless more stringent required by code; USG “Sheetrock Firecode Core,” or equal.
   1. Thickness: 5/8 inch, unless otherwise noted.
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Fire-Rated Moisture and Mold Resistant Board: ASTM C1396/C1396M, Type X, unless more stringent required by code; USG “Sheetrock Mold Tough Firecode Core,” or equal.
   1. Thickness: 5/8 inch, unless otherwise noted.
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
   3. Mold Resistance: 10 on scale of 10 when tested in accordance with ASTM D3273.
   4. Moisture Resistance: The average water absorption for panels shall not exceed 5 percent by weight after two-hour immersion when tested in accordance with ASTM C473.Fire Rated Abuse Resistant Gypsum Board: ASTM C1629/C1629M, Type X abuse resistant gypsum board; USG “Sheetrock Abuse-Resistant Gypsum Panels,” National Gypsum “Hi-Impact Brand Wallboard,” or equal complying with the following.
   1. Surface Abrasion Resistance: Classification Level 3 in accordance with ASTM C1629/C1629M.
   2. Indentation Resistance: Classification Level 1 in accordance with ASTM C1629/C1629M.
   3. Soft Body Impact Resistance: Classification Level 3 in accordance with ASTM C1629/C1629M
   4. Hard Body Impact Resistance: Classification Level 3 in accordance with ASTM C1629/C1629M.
   5. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D3273.

2.3 ACCESSORIES

A. Adhesives:
   1. Laminating Adhesive: As recommended by gypsum board manufacturer for laminating gypsum board together in fire-rated construction.
   2. Adhesives shall comply with required VOC regulations.

B. Fasteners:
   1. Screws: Phillips head with bugle shape, Type S, conforming to ASTM C1002. Use Type W for fastening to wood blocking or backing.
   2. Sizes of fasteners shall be as required by code and as recommended by wallboard manufacturer.

C. Exposed Reveals and Moldings:
   1. Manufacturer: Fry Reglet Corp., Gordon, or equal.
   2. Material: Extruded aluminum with manufacturer's factory-applied silicone polyester finish applied over conversion coating and primer.
      a. Colors: White, unless otherwise noted.
   3. Profiles: As shown on the Drawings.

D. Concealed Metal Reinforcements and Casing: Electrogalvanized, conforming to ASTM C1047.
   1. Exterior Corner: United States Gypsum (USG) "Dur-A-Bead," or equal.
   2. Intersection of Gypsum Board with Dissimilar Material: USG No. 200-B "L" shaped trim and 200-A "J" shaped trim, or equal.
   3. Control Joint: USG No. 093, or equal.

E. Joint-Treatment Materials:
   1. Manufacturer: Same as gypsum board.

2. Comply with ASTM C475/C475M and with manufacturer's recommendations for specific project conditions.
3. Joint Tape: Manufacturer's standard paper type. If recommended by manufacturer, provide open-weave fiberglass tape for joint treatment of gypsum backing board.
4. Joint Compound: Vinyl-based, ready-mixed type for interior use and as follows:
   a. Taping Compound: Specifically formulated for embedding tape and accessories and for prefilling.
   b. Topping Compound: Specifically formulated for finishing drywall over taping compound.
   c. At joints and fasteners in moisture-and-mold-resistant gypsum backing board intended for tile surfacing, provide compound specifically recommended or permitted by manufacturer of backing board.

F. Miscellaneous Items: Furnish components not specified but shown on the Drawings and other items required to complete the installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check framing for accurate spacing and alignment.

B. Verify that spacing of installed framing does not exceed maximum allowable for thickness of gypsum board to be used.

C. Do not proceed with installation of gypsum board until deficiencies are corrected and surfaces to receive gypsum board are acceptable.

D. Repair protrusions of framing, twisted framing members, or unaligned members before starting installation of gypsum board.

3.2 APPLICATION OF GYPSUM BOARD

A. General: Comply with ASTM C840, GA-216, and CBC. Where UL designs are indicated on the Drawings for fire-rated partitions, comply with UL requirements, except where exceeded by other requirements.
   1. Wherever possible, install gypsum board in such a manner as to minimize butt end joints.
   2. Apply ceiling boards prior to installation of wall boards. Arrange so as to minimize butt end joints near center of ceiling area.
   3. Install wall boards in such a manner as will minimize butt end joints in center of wall area. Stagger vertical joints on opposite sides of walls. Stagger horizontal joints where required by governing code.
   4. Butt all joints loosely, with maximum of 1/16 inch between boards.
   5. Place wrapped edges adjacent to one another. Do not place cut edges or butt ends adjacent to wrapped edges.
   6. Support all edges and ends of each board on framing or by solid substrate, except that long edges at right angles to framing members in non-fire-rated construction may be left unsupported, unless required by governing code.

B. Single-Layer Application:
   1. Install gypsum board by means of screw attachment.
   2. On walls and partitions, plan installation so that leading edge or end of gypsum board is attached to open end of stud flange first.

C. Double-Layer Application:
   1. Apply base layer vertically, offsetting vertical joints at least one stud space between layers.
      a. Install base layer by means of screw attachment.
      b. Provide fire taping only.
   2. Precut and fit face layer by laminating to base layer with adhesive.
   3. Provide temporary support for face layer, by fasteners or shoring, until adhesive is dry.
   4. At Contractor's option, provide permanent support by attaching face layer to base layer with screws in accordance with manufacturer's instructions.

D. Install specified moisture-and-mold-resistant board at dry areas in Restrooms and Bathrooms, painted or tiled, complying with manufacturer's recommendations for installation, including minimum clearances and sealing of penetrations and edges.

E. Metal Trim, Reveals, and Moldings:
   1. Apply trim at all exterior corners and at interior corners where gypsum board intersects metal or other dissimilar material.
   2. Install in longest lengths practicable.
   3. Run trim straight and square with all planes.
   4. Edges:
      a. Apply applicable shape of metal edge trim at exposed edges of wallboard and where otherwise shown.
      b. Gypsum Board Abutting Other Materials: Install edge trim with 1/8-inch clearance to allow for sealant.
      c. Apply neoprene tape where shown to assure sealed joints at abutting surfaces.
         1) Install in longest lengths practicable.
         2) Adhere to edge trim prior to installation of trim.
         3) Coordinate application of tape with installation of metal framing as specified in Section 09 2216 "Non-Structural Metal Framing."
   5. External Corners: Apply metal corner beads at external corners in single lengths, unless details clearly indicate its omission at specific locations.

F. Control Joints:
   1. General: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
   2. Ceilings: Back with continuous furring channels each side, spaced 2-1/4 inches apart, centered on break.
   3. Fire-Rated Ceilings: Install 2-inch wide continuous strip of wallboard between channels of same thickness as ceiling board.
      a. Butt strip against one channel in order to permit 1/4-inch clearance.
      b. Secure butted side to ceiling wallboard with adhesive.
   4. Partitions: Back with double studs.

G. Remove and replace sheets damaged in handling or installation.

H. For conditions not specified or shown on the Drawings, follow procedures recommended by the gypsum board manufacturer.

I. Leave gypsum board in a clean condition, ready for taping and painting.

3.3 SOUND-RATED CONSTRUCTION

A. Comply with requirements for sealing penetrations at sound-rated construction as specified in Section 07 9200 "Joint Sealants."

3.4 FIELD QUALITY CONTROL

A. Construction Tolerances:
1. Gypsum board surfaces to be painted shall have no measurable variation in any 2-foot direction and a maximum variation of 1/8 inch in 10 feet 0 inches when a straightedge is laid on the surface in any direction.
2. See Section 09 3000 "Tiling" for tolerances required for surfaces to receive tile.
3. Shim work as required to comply with specified tolerances.
4. Do not exceed 1/16-inch offset between planes of abutting sheets at edges or ends.

3.5 TAPING AND FINISHING

A. Gypsum board partitions shall be appropriately prepared for finish indicated on the Drawings.

B. General Requirements:
1. Apply finishing compounds in accordance with manufacturer's directions and within 9 months of expiration date on manufacturer’s container. Do not apply tape and joint compound over joints containing acoustical sealant until the sealant has completely cured.
2. Center tape over joint, and embed in uniform layer of joint compound of sufficient width and depth to provide firm and complete bond.
a. Apply skim coat while embedding tape.
b. Apply finish coat, and sand smooth, flush with adjacent surfaces.
c. Use appropriate water-resistant compound at moisture and mold resistant gypsum board filling all fastener heads, penetrations, and joints.
3. Treat angles with reinforcing tape, folded to conform to adjacent surfaces and with straight, true angles.
4. Provide minimum 24 hours' drying time between applications of compounds.
5. Conceal flanges of metal reinforcement with minimum two coats compound. Compound shall extend 8 to 10 inches each side of metal nosing.

3.6 APPLICATION OF GYPSUM BOARD

A. Level of Finishes: In accordance with GA-214 and the following.
1. Locations to Receive "Fire-Taping" and at Unexposed Gypsum Board Applications: Level 1.
2. Wall Surfaces to Receive Tile: Level 3.
3. All Other Locations: Level 4.

3.7 PROTECTION OF FINISHED WORK

A. Provide proper procedures for protection of completed gypsum board from damage or deterioration until final acceptance of the Project.

END OF SECTION

SECTION 09 3000

TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior coved base and wall and floor tile.
2. Cementitious backer and underlayment board.
3. Grouting.
4. Waterproofing and other membranes under tile.
5. Metal edge and transition trim.

B. Related Requirements:
1. Joint Sealants: Section 07 9200.
2. Gypsum Board: Section 09 2900; moisture and mold-resistant gypsum backing board.
3. Toilet Accessories: Section 10 2813.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.3 ACTION SUBMITTALS

A. Shop Drawings: Submit for custom tile patterns and layouts.

B. Product Data:
1. Manufacturer's product literature for all manufactured products.
2. Installation instructions for cement backer board, trim, and accessories.
3. Installation instructions for manufactured setting, grouting and waterproofing products.

C. Samples:
1. Each color, size, and type of tile and grout specified and selected, mounted on plywood or hardboard backing, grouted, and not less than 24 inches square. For products with color and texture variation, submit sets showing full range of variations expected.
2. Samples of each type of edge trim and accessory, 6 inches long, in each color.

1.4 INFORMATIONAL SUBMITTALS

A. Statement of installer qualifications. Include list of completed projects with project names, addresses, and names of architects and owners.

B. Certified laboratory or field tests for slip resistance as specified if not included with product data submittal.

C. Master grade certificates for each shipment of ceramic tile, type, and composition of tile, signed by the manufacturer and installer.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Material: 5 percent of each color, size, and type of tile installed for Owner's use in future.
   1. Package in sealed, clean, marked cartons of the tile manufacturer.
   2. Deliver to Owner as directed.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance materials as specified.

B. Warranty for setting and grouting products.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Successful completion of tile installations similar in material, design, and extent to that required for this Project.

B. Except where more stringent requirements are specified, conform to applicable ANSI Standards as follows:
   1. Ceramic Tile: ANSI A137.1 "Standard Grade."
   2. Tile Installation Materials: Comply with ANSI standard referenced with products and materials specified for setting and grouting.

C. Within any given tile setting system, use the products of a single manufacturer to insure compatibility, single source responsibility, and manufacturer’s warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Ceramic Tile cartons shall be grade sealed by manufacturer in accordance with ANSI A137.1. Grade seals shall be unbroken.

B. Manufactured setting and grouting materials shall contain hallmarks certifying compliance with reference standards.

C. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

1.9 FIELD CONDITIONS

A. Ambient Conditions: Comply with minimum temperature recommendations of manufacturers for bonding and grouting materials. If manufacturer has no recommendations, maintain temperature at not less than 50 degrees F during tile installation and for at least 7 days after completion of installation.

1.10 WARRANTY

A. Manufacturer: Furnish the following manufacturer warranties.
   1. Setting and Grouting Materials: 5-year warranty for the installation, covering replacement of materials and labor.
   2. Waterproofing: Not less than 10-year warranty against defects in materials and workmanship including water leakage.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Slip Resistance:
   1. Floor tile shall provide a value equal to or greater than 0.42 when tested in accordance under dry conditions with DCOF AcuTest procedure contained in ANSI A137.1, Section 9.6, and under wet conditions with DCOF AcuTest procedure of ANSI B101.3. Laboratory tests shall be made on a minimum of three tiles of each material and finish proposed for use.
   2. If manufacturer of selected surfacing does not have test data to substantiate compliance with PTV value, provide alternative testing to verify compliance as acceptable to governing authorities, such as use of a BOT-3000E digital tribometer, that will provide results for both wet and dry conditions.

2.2 TILE PRODUCTS

A. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory, and package accordingly so that tile units taken from one package will show the same range of colors as those taken from other packages and will match accepted samples.

B. Wall Tile (“TL-1”, “TL-2”): Daltile, “Panoramic Porcelain Series;” as scheduled on the Drawings.
   1. Color: Industrial Selection, Hearth Smoke CM08 – Matte.
   2. Thickness: 6mm.

C. Floor Tile (“TL-3”): Daltile, “Panoramic Porcelain Series;” as scheduled on the Drawings.
   1. Color: Industrial Selection, Hearth Smoke CM08 – Matte.
   2. Thickness: 6mm.
   3. Size: 15-1/2 inches x 31 inches.

D. Trim Shapes and Bases:
   1. Provide cove base, surface bullnose, returns, trimmers, and other shapes, as standard from manufacturer for specified tiles, to finish installation and as shown on the Drawings.
   2. Provide surface bullnose at outside corners and along tile edges where gypsum wallboard continues beyond field of tile whether indicated in Drawings or not.
   3. Color and finish of trim shapes shall match adjacent tile unless otherwise indicated.

2.3 WATERPROOFING AND CRACK ISOLATION MATERIALS

A. Waterproofing Membrane at Shower Walls: Pliable, 0.008 inch thick, bonded orange polyethylene membrane with polypropylene fleece laminated on both sides meeting or exceeding requirements of ANSI A118.10 for load bearing, bonded, waterproof membranes at thin-set tile installation, and is evaluated by ICC-ES; “Schlüter KERDI” by Schlüter Systems complete with manufacturer’s recommended installation accessories, including strips for sealing butt sheet joints and sealing mixing valve and pipe penetrations.

B. Liquid-Applied Waterproofing and Crack Isolation Membrane at Floors: “Hydro Ban” by Laticrete, or accepted equal meeting ANSI A118.12 for crack isolation membranes and ANSI 118.10 for waterproofing membranes.

2.4 UNDERLAYMENT MATERIALS

A. Cementitious Backer Board: ANSI A118.9; "Durock" by U.S. Gypsum, or equal.
1. Thickness: 5/8 inch.
2. Fasteners: Rust-resistant drywall screws.
3. Joint Tape: 2-inch wide, 10 by 10 glass mesh.

2.5 SETTING MATERIALS

A. Un-Modified Portland Cement Mortar: “272 Premium Floor & Wall” mortar by Laticrete, or accepted equal un-modified premium thin-set mortar.

B. Thinset Latex Portland Cement Mortar: ANSI A118.4; “254 Platinum" by Laticrete, or accepted equal.

C. Provide primers, levelers, and other products recommended by manufacturers of setting materials or required for a complete installation.

2.6 GROUTING MATERIALS

A. Epoxy Grout: Water cleanable, ANSI A118.3; "SpectraLOCK PRO" by Laticrete, or equal.

B. Grout Colors: As selected by the Design Builder from manufacturer’s standard color range.

2.7 ADDITIONAL MATERIALS

A. Precast Terrazzo Shower Receptors: Polished terrazzo; “Terrazzo-Ware” by Acorn Engineering Company as specified, or equal.
1. Typical: “Institutional” Series Model SBR-7236-3F with tiling flanges on long side, right and left.
2. Accessible: “ADA” Series Model SBADA-6036-3F; rectangular roll-in type flanged on 3 sides.

B. Sealant: As provided by grout manufacturer; Laticrete “Latasil,” or equal.
1. Color: To match color of grout in adjacent joints.
2. Provide sanded or non-sanded type as required to match type of grout.

C. Stainless Steel Cove Base:
1. Manufacturer: Schluter as specified, or equal.
2. Style: “Inside Coved Corner Trim.”
3. Size: 9/16 inch radius.

D. Metal Edge Protection and Transition Strips: Extruded anodized aluminum.
1. Product and Manufacturer: “RENO-U” by Schlüter Systems, or equal.
2. Height: As required by tile installation.

E. Water: Clean and potable.

F. Cleaners and Sealers: DuPont Stone Tech, HMK Stone Care Products, Aqua-Mix, Miracle Sealants, or equal to be selected as recommended by manufacturer for each type of tile.

G. Floor Protection: Flexible, heavy-duty, non-staining, vapor permeable, and FSC Certified; “Ram Board,” or equal.

2.8 MIXING MORTAR AND GROUT

A. Prepare and proportion premixed setting beds and grout materials in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive ceramic tile, setting beds, or accessories for defects or conditions adversely affecting quality and execution of tile installation.
   1. Surfaces shall be firm, dry, clean, and free of oily or waxy films.
   2. Grounds, anchors, plugs, hangers, bucks, and electrical and mechanical work in or behind tile shall be installed prior to proceeding with tile work.

B. Allowable Tolerances of Surfaces to Receive Tile:
   1. Maximum Variation in Vertical Surfaces: 1/8 inch in 8 feet.
   2. Maximum Variation in Horizontal Surfaces: 1/8 inch in 10 feet.

3.2 PREPARATION

A. Protect adjoining work surfaces before tile work begins. Close spaces in which tile is being set to traffic and other work. Keep closed until firmly set.

3.3 INSTALLATION OF RUBBER WATERPROOF/CRACK ISOLATION MEMBRANE

A. Install membrane in accordance with ANSI A108.13, manufacturer's instructions for a crack isolation and waterproofing membrane, and to effect specified warranty.

B. Apply a liberal coat liquid membrane to assure a uniform minimum 30 mils wet-film thickness.

C. Periodically check the film thickness with a wet-film gauge. Apply a second coat at right angles to the first if required.

D. Provide fabric reinforcing at drains, changes of plane, and at gaps 1/8 inch and greater.

E. Installation shall be reviewed by Architect before installation of overlying materials.

3.4 TILE INSTALLATION - GENERAL

A. Except as otherwise specified, work shall conform to the recommendations and listed installation methods included in the “Handbook for Ceramic Tile Installation” published by the Tile Council of North America, Inc.

B. Laying Out Tile Work:
   1. Lay out tile work so that, insofar as possible, no tile less than half full size occurs.
   2. Lay floor areas out from center lines so that all major adjustments are made at walls and perimeter of tiled areas.
   3. Lay out wall tiles so that fields and patterns center exactly on individual wall areas.
      a. Exterior angles shall be bullnose.
      b. Cap shall be bullnose, same size as wall tile.
   4. Align joints vertically and horizontally.

5. When floor and wall tiles are the same size, align joints. If it is not possible, based on configuration of walls and spaces, to comply with requirement that no tile less than half full size occurs while, at the same time, aligning wall and floor joints, confer with Architect to arrive at an acceptable solution prior to installing the tile.

C. Cutting of Tiles:
1. Cut and drill without marring tile.
2. Rub cuts smooth with a fine abrasive stone.
3. Set no cut edge against any fixture, cabinet, or other tile without a joint at least 1/16 inch wide.
4. Whenever possible, turn cut to inside corner.
5. Fit tile around electric outlets, plumbing pipes, fixtures, and fittings close enough to permit standard plates and collars to overlap tile.

D. Sound tile after setting. Remove and replace hollow-sounding units.

E. Allow tile to set at least 48 hours prior to grouting.

F. Grout tile to comply with requirements of ANSI A108.10.

G. Joint Sealants:
1. Install sealant at perimeter, control joints, around floor drains and pipes.
2. Comply with installation requirements for sealants specified in Section 07 9200, "Joint Sealants."
3. After curing, remove spacers, and dry and clean all joints requiring sealant.
4. Prefabricated movement joints may be used in lieu of sealant joints where acceptable to Architect.

3.5 INSTALLATION METHODS

A. Prepare surface, fit, set or bond, grout, and clean in accordance with applicable requirements of ANSI standards for setting method specified.

B. Wall Tile at Dry Areas: TCNA Method W242.
1. Thin-set tile over moisture- and mold-resistant gypsum board specified in Section 09 2900, "Gypsum Board," or backer board where shown, with latex Portland cement mortar in accordance with ANSI A108.5.
2. Install grout as specified.

C. Walls – Showers: Similar to TCNA Method B415.
1. Install backer board over framing in accordance with ANSI A108.11 and manufacturer’s recommendations.
a. Horizontal and vertical joints shall have a 1/8-inch space filled with latex portland cement mortar.
b. Embed 2-inch glass-fiber-mesh tape in skim coat of mortar used to set tile at joints.
2. Install specified sheet waterproofing membrane in bond coat over cement backer board in accordance with manufacturer’s installation instructions. Membrane shall overlap shower floor waterproofing that has been turned up wall onto cement backer board.
3. Thin-set tile over membrane using specified unmodified portland cement mortar in accordance with ANSI A108.5.
4. Install grout as specified.

D. Control and Isolation Joints:
   1. Locate joints, and install in accordance with TCNA Method EJ171 and where tile abuts restraining surfaces in such locations as perimeter walls, dissimilar floors, curbs, columns, pipes, and ceilings and where changes occur in backing materials.
   2. Joint width, unless otherwise shown or where larger width is required to match typical tile grout joint width:
      a. 1/4-inch expansion joint at junction of floor tile with wall.
      b. 1/8-inch space between wall tile and floor.
   3. In addition to locations specified for control and isolation, provide expansion joints in accordance with TCNA recommendations at each location.

3.6 ADJUSTMENT AND CLEANING

A. Remove cracked, stained, discolored, broken, or damaged tile. Replace with new tile.

B. Clean tile surfaces as thoroughly as possible on completion of grouting.

C. Remove grout haze, observing grout manufacturers' recommendations as to use of acid and chemical cleaners.

D. Rinse tile work thoroughly with clean water before and after using chemical cleaners.

E. Use no acids or abrasive soaps on tile, except as approved by tile manufacturer.

3.7 CURING, PROTECTION AND FINISHING

A. Do not permit cement grouts to dry out until cured at least 72 hours.

B. Apply protective paper over floor tile as soon as pointing and grouting and cleaning are completed.
   1. Lap sheets at least 4 inches, and seal laps against escape of moisture.
   2. Leave curing paper in place until job is ready for final cleaning.
   3. Keep traffic off floors during the curing period (7 days).

C. Final Cleaning of Tile:
   1. Remove protective paper, and clean tiles with a neutral cleaner solution.
   2. After cleaning, apply specified sealer in accordance with manufacturer's application instructions.
      a. Provide three coats of sealer at stone surfaces.
      b. Re-cover tile with paper to protect from construction dirt.
   3. Just before final acceptance of tile work, remove paper and reclean surfaces with neutral cleaner as needed.

D. Finishing of Wall Tile: Just before final acceptance of tile work, clean with neutral cleaner, and rinse tile surfaces.

END OF SECTION

SECTION 09 5113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Suspended acoustical ceiling panels.
   2. Ceiling suspension system.

B. Related Requirements:
   1. Heating, Ventilating, and Air-Conditioning (HVAC): Division 23; air diffusers.
   2. Electrical: Division 26; lighting fixtures.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Shop Drawings: Layout of suspension system grid in each room showing locations of light fixtures, supply, and exhaust grilles and diffusers, sprinkler heads, speakers, detection devices, and all other items to be installed in suspended acoustical ceilings.

B. Product Data: Manufacturer's catalog cuts for suspension system components and acoustical panels.
   1. Data sheets shall be marked to identify specific products proposed for use.
   2. Include ICC-ES Report for seismic clips.

C. Samples:
   1. 6-inch x 6-inch sample of each type of acoustical panel required.
   2. 8-inch-long sample of each type of exposed suspension member and trim, showing profile and finish.

D. Delegated Design: Seismic and structural design engineering calculations prepared by the engineer in responsible charge submitted to demonstrate compliance with CBC and adequacy of suspension system to withstand specified seismic and structural loading. Engineer shall be a California licensed civil or structural engineer.

1.4 CLOSEOUT SUBMITTALS

A. Acoustical Units: Furnish extra material equal to two full cases from the material manufacturer for each acoustical panel product provided on the Project.
   1. Match products installed and package with protective covering for storage, and identify with labels describing contents.
   2. Deliver and store in accordance with instructions provided by the Owner.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Installer Qualifications: Minimum of three installations of extent comparable to Project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect system components from excessive moisture in shipment, storage, and handling.

B. Deliver in unopened bundles and store in a dry place with adequate air circulation.

C. Comply with requirements specified in Section 01 6000, “Product Requirements.”

1.7 FIELD CONDITIONS

A. Ambient Conditions, Unless Otherwise Acceptable to Material Manufacturer:
1. Do not install acoustical ceilings until sufficient heat is provided, and dust-generating activities have been terminated.
2. Maintain a uniform temperature between 55 and 70 degrees F prior to and during installation of materials.

B. Do not install acoustical ceilings until work above ceilings is completed, including testing and approval of mechanical work.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Seismic Requirements:
1. Ceilings shall comply with CBC requirements for seismic bracing of ceiling suspension system.
2. Ceiling Compression Struts:
a. Provide struts as shown on Drawings and as required by CBC, placed maximum 12 feet on center in both directions and within 6 feet of each wall.
b. Bracing system shall be adequate to support nonbearing ceiling-height partitions spaced at 10 feet on center.

B. Tolerances:
1. Deflection, ASTM C635/C635M: Maximum 1/360 of span. Applies to suspension system components, hangers, and fastening devices supporting light fixtures, ceiling grilles, and to acoustical panels.
2. Allowable Tolerance of Finished Acoustical Ceiling System: Level within 1/8 inch in 12 feet.

C. Fire Performance Characteristics: Provide products complying with ASTM E1264 for Class A products and meeting the following when tested in accordance with ASTM E84.
1. Flame Spread: 25 or less.
2. Smoke Developed: 50 or less.

2.2 SUSPENSION SYSTEMS

A. Comply with ASTM C635/C635M.

B. Structural Classification: Heavy-duty.

C. Main and Cross Members: Hot-dip galvanized, cold-rolled steel, double-web design with rolled-steel cap.

D. Edge Moldings: Hot-dip galvanized, cold-rolled steel, minimum 0.020-inch-thick steel.
1. Typical Profile: Channel or angle, minimum flange width of 15/16 inch.

E. Splices, End Connections, Clips, and Other Accessories: Hot-dip galvanized steel.
1. Hold-Down Clips: Concealed, spring-loaded, fully accessible.
2. Design to provide strong, rigid, lock-type connections preventing movement or displacement of joined components and permitting disassembly without damage to component parts.
3. Perimeter Seismic Clips: Armstrong “Berc2 Clip” at perimeter, or equal, and in accordance with ICC-ES Evaluation Report.

F. Suspension Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
1. Hanger Wire: 0.106-inch nominal diameter (12-gage).
2. Bracing Wire: 0.120-inch nominal diameter (10-gage).

G. Attachment Devices: Size for five times design load required by ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.

H. Compression Struts: Unless otherwise shown and approved by governing authorities, provide Donn "Seismic Compression Post" or equal manufactured proprietary product.

I. Finishes:
1. Steel components shall be Bonderized and given a coat of rust-inhibitive paint.
2. Exposed surfaces of components shall have factory-applied semi-gloss white enamel finish, unless otherwise noted.
3. Grid Color: White, unless otherwise specified.

J. Suspension and Grid Types: As specified under Article 2.04.

2.3 ACOUSTICAL PANELS

A. ACT-1:
1. Grid: Direct-hung, 15/16 inch wide; Chicago Metallic 1200, or equal.
a. Color: White.
2. Panels: Stone wool, 24 inches x 24 inches x 1-1/2 inches; “Rockfon Sonar Activity,” by Rockfon, or equal.
a. Edge: Square tegular.
b. Texture: Fine texture.
c. Finish: Factory-applied latex paint.
1) Color: White.
d. Acoustical Performance: ASTM E413.
1) NRC: 0.9.
e. Light Reflectance: 0.85.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine suspension assemblies, with installer present, for compliance with requirements specified in this and other Sections affecting ceiling panel installation and with requirements for installation tolerances and other conditions affecting performance of acoustic ceiling assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION – GENERAL

A. The requirements specified in this Section are intended to supplement the information included on the Drawings. When in conflict, comply with the most stringent.

B. Pattern at each location and Room shall be approved by Design-Builder before installation of suspension system.

C. Install suspension system including necessary hangers, grillage, and other supporting hardware in accordance with CBC, ASTM C636/C636M and ASTM E580/E580M, manufacturer's written instructions, CISCA's "Ceiling Systems Handbook," and as specified. The most stringent requirements shall govern.

3.3 INSTALLATION OF GRID SYSTEM

A. Hangers:
1. Coordinate hanger locations with other work. Hanger wire attachment devices shall be capable of supporting 100 pounds.
2. Ensure that hangers and carrying channels are located to accommodate fittings and equipment that are to be placed after installation of ceiling grid system.
3. Space hanger wire as required by CBC for specified wire gage.
4. Install additional hangers at ends of each suspension member, at light fixtures, and 6 inches from vertical surfaces.
5. Do not splay wires more than 5 inches in a 4 foot vertical drop.
6. Wrap wire at shown on the Drawings.
7. Provide trapeze suspension or other appropriate system for suspension of ceiling system and light fixtures at large ductwork.
8. Provide two extra tie wires at each light fixture and HVAC register for use in tying off opposite corners at fixtures and registers.
9. Kinks and bends are not permitted in hanger wires to level carrying channels.

B. Main Runners:
1. Space main runners at 4 feet on center.
2. Level and square to adjacent walls.
3. Use standard "Tee" section at grid change in direction.
4. Independently support a maximum of 8 inches from each wall.
5. Secure to structure above with four-way, bracing wire splays as specified and shown on the Drawings.

C. Cross Runners:
1. Space cross runners at 2 feet on center.
2. Independently support if 8 inches or more from wall.

D. Wall and Perimeter Moldings:
   1. Install wall molding at intersection of suspended ceiling and vertical surfaces.
   2. Miter corners where wall moldings intersect.
   3. Fasteners shall be concealed.

E. Seismic Bracing Assembly: Comply with requirements shown on the Drawings and the following.
   1. Horizontal Restraints: 4 splayed wires oriented 90 degrees from each other.
      a. Splices in bracing wires are not permitted.
      b. Angle of wires shall not exceed 45 degrees from the plane of the ceiling.
   2. Vertical Restraints:
      a. Comply with requirements shown on the Drawings.
      b. Compression struts shall not replace hanger wires.
   3. Lateral force bracing is not required at ceiling areas less than 144 square feet that are surrounded by walls extending to structure above.
   4. Ceiling areas exceeding 2,500 square feet shall have a seismic separation joint with each area provided with closure angles.
   5. Seismic perimeter clips shall have current and approved ICC-ES Report and shall be installed in accordance with the details and recommendations of the Report.
   6. Provide spreader bars at all main and perimeter runners.

3.4 LAY-IN ACOUSTICAL PANELS:

A. Install in grid system in accordance with manufacturer's recommendations and procedures in CISCA publication "Acoustical Ceiling Use and Practice." CBC shall govern if in conflict or more restrictive than CISCA publication.

B. Install in level plane in straight line courses.

C. Apply with grain, if any, in same direction, not checkerboard.

D. Minimum Width of Border Panel: One-half panel dimension, unless indicated on the Drawings or approved submittals.

E. Provide trim molding at recessed troffer lights as required.

F. Hold-Down Clips:
   1. Acoustical panels surrounding recessed troffer lights shall be installed with hold-down clips to prevent movement or displacement of panels.
   2. Provide hold-down clips at perimeter where grid meets wall molding.
   3. Exposed fasteners are not acceptable.

G. Trim or rout tegular-edge panels to provide tegular edge at perimeter moldings.
   1. Field or factory cut edges shall be sealed as specified in Section 09 9000, “Painting and Coating,” with coating color matched to tile surface.

H. Coordinate lay-in system with electrical fixtures and mechanical work that will be integrated with the ceiling.

3.5 CEILING MOUNTED LIGHT FIXTURES AND HVAC TERMINALS

A. Secure with mechanical fasteners to the ceiling grid runners to resist a horizontal force equal to the weight of the fixture.

B. Independently support with wires to structure above as follows:
   1. Fixtures less than 10 Pounds: One 12-gage wire from the fixture housing. This wire may be slack.
   2. Fixtures between 11 and 55 Pounds: Two 12-gage wires attached to fixture and structure above. These wires may be slack.
   3. Fixtures 56 pounds and more shall be independently supported using 9-gage wire:

C. Fasteners shall be concealed in completed installation.

3.6 REPAIR

A. Remove and replace damaged, compromised, or improperly installed work; replace with undamaged components.

3.7 CLEANING

A. Clean exposed surfaces after installation, in accordance with manufacturer's written instructions.

B. Touch up scratches, abrasions, voids, and other defects in painted surfaces.

END OF SECTION

SECTION 09 6120

CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Clear sealer applied to cured concrete at interior concrete flatwork not scheduled to receive an applied floor covering or coating.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s descriptive literature for sealer and application instructions.

1.4 FIELD CONDITIONS

A. Protect exposed surfaces, both new concrete flat work and concrete where surface treatment is completed, to prevent damage by impact or stains from rubbish and the work of other trades.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Dry or Wet Slip Resistance:
   1. Concrete, after application of sealer, shall be tested using ASTM E303 Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
      a. Pendulum Test Value (PTV) shall be 45 or greater under dry and wet conditions.
      b. Individual tests shall be made for each concrete substrate texture.
      c. Test results shall be reported in writing.
   2. Alternative test method, such as use of a BOT-3000E digital tribometer, if proposed, shall provide results for both wet and dry conditions.

2.2 MATERIALS

A. Sealing Compound at Exposed Concrete Flatwork (“SC-1”): VOC compliant, water-based fluoropolymers, providing water and oil repellency; Curecrete "RetroPel,” or equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Concrete surface shall be examined and prepared in accordance with the surface preparation requirements included in the specified manufacturer's printed application instructions and as follows.

B. Sealer shall not be applied over stains, layout markings, oils, grease, wax, and other contamination caused by construction activities subsequent to installation of concrete.
   1. Stains, layout markings, and contamination shall be thoroughly removed by the use of detergent scrubbing with a heavy duty cleaner/degreaser, low pressure water cleaning (less than 5,000 psi), steam cleaning, or chemical cleaning.
   2. If cleaning does not achieve an acceptable surface and remove contamination, surfaces shall be profiled using a shot blaster or hydro-blaster if necessary to provide a clean surface prior to application of sealer.
   3. If profiling is required, comply with International Concrete Repair Institute (ICRI) "Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays."

C. After surface has been prepared, apply sealer to a trial test area and verify that sealed surface meets specified slip-resistance and uniformity of appearance.
   1. Test area shall be approximately 5 feet by 5 feet.
   2. Document application rate and number of coats used for test area.
   3. Allow sealer to completely cure before evaluating test area.

3.2 APPLICATION OF CLEAR SEALER

A. Apply specified sealer in minimum two thin coats using a low-pressure, non-atomizing spray applicator or by pouring followed by a squeegee or a broom for even distribution in accordance with manufacturer's instructions and as specified.

B. Allow first coat to dry minimum 2 hours before application of second coat.

C. If prepared surface is extremely porous, and if required to achieve a uniform appearing hard durable finish, apply a third coat after the second coat has dried a minimum of two hours.

D. Apply subsequent coats in a direction 90 degrees from the previous coat.

E. A lambswool applicator should be used for small areas.

F. Allow material to cure, 8 to 24 hours depending upon ambient temperature and humidity conditions, before allowing any traffic on surface.

3.3 PROTECTION

A. Protect exposed surfaces, including flat work, as required to prevent damage by impact or stains from rubbish and work of other trades.

END OF SECTION

SECTION 09 6500

RESILIENT FLOORING AND BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The following resilient flooring:
      a. Rubber interlocking fitness flooring.
      b. Rubber stair treads.
      c. Resilient planks.
      d. Static dissipative tile.
   2. Resilient base, edge trim, and accessories.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical data for each resilient product required. Include profiles of resilient edge strips and reducers, and laboratory tests reports for flooring products showing compliance with specified slip resistance.

B. Samples:
   1. Flooring: 12-inch square for each type, color, and pattern.
   2. Base: 12-inch long by full dimension, in selected color.
   3. Accessories: 9 inches long by full dimension.

1.4 INFORMATIONAL SUBMITTALS

A. Verification that flooring meets specified requirements for slip-resistance.

B. Results of substrate moisture content tests.

C. Sample copy of manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.

1.5 CLOSEOUT SUBMITTALS

A. Extra Stock:
   1. Furnish additional floor-covering materials for replacement and maintenance. Furnish, in factory-packaged and –labeled cartons.
      a. Flooring: 5 percent of square footage of each size, color, pattern, and type of material included in the work.
   2. Supply extra materials from same production lots and color runs as used in work.

3. Deliver the extra material to Project just prior to Substantial Completion, and store as directed by City Representative.

B. Maintenance data, including list of manufacturer's recommended maintenance products and procedures for each type of resilient flooring material.

C. Extra materials as specified.

D. Manufacturer's extended product warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: At least three installations of extent comparable to this Project using resilient flooring products similar to those specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.

B. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F.

C. Sheet Floor Covering: Store rolls upright.

D. Comply with requirements specified in Section 01 6000, "Product Requirements."

1.8 FIELD CONDITIONS

A. Ambient Conditions:
1. Maintain temperature in spaces to receive resilient flooring, within temperature and humidity limits recommended by the respective floor and base manufacturer, for at least 24 hours before installation, during installation, and 48 hours after installation.
2. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation.

B. Install resilient flooring products after other finishing operations, including painting, have been completed.

C. Close spaces to traffic during resilient flooring installation until the installer is satisfied the adhesive has set.

1.9 WARRANTY

A. Manufacturer: Furnish manufacturer's written warranties as available for each of the resilient flooring products installed.

PART 2 - PRODUCTS

2.1 RESILIENT FLOORING

A. Resilient Athletic Flooring (“RR-1”): As scheduled on the Drawings, or equal.

B. Resilient Flooring (“RF-1”): As scheduled on the Drawings, or equal.

C. Resilient Stair Treads, Risers, and Landings (“RF-2”): As scheduled on the Drawings, or equal.

D. Static Dissipative Tile (“SDT-1”): As scheduled on the Drawings, or equal.

2.2 RESILIENT BASE AND TRIM

A. Resilient Base (“RB-1”): As scheduled on the Drawings, or equal.

B. Resilient Base – Coved (“RB-2”): As scheduled on the Drawings, or equal.

2.3 ACCESSORIES

A. Stair Filler: VOC compliant, two-component, solvent-free, non-flammable, high-performance epoxy; EN-610 “Epoxy Nose Filler Adhesive” by Roppe, or equal acceptable to resilient stair accessory manufacturer.

B. Adhesives:
1. General: Provide type and brands of water-resistant adhesive as recommended by manufacturer of each type of resilient flooring and base material for conditions of installation.
2. Athletic Flooring: Solvent-Free Moisture-Cured Polyurethane; Roppe #635, or equal.
3. Static Dissipative Tile: Armstrong “S-202,” or equal.

C. Floor Patch-and-Leveling Compound: Latex cementitious paste for patching, leveling, and ramping; Ardex "SD-P Instantpatch," Raeco "Level Flex Latex Underlayment," or equal acceptable to manufacturer of resilient flooring material furnished.

D. Reducer Strip: Extruded anodized aluminum.
1. Manufacturer: Schlüter Systems, or accepted equal.
2. Height and Profile: As shown on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect substrate in order to verify that it is satisfactory. Substrate shall be:
1. Free of excess moisture, as determined by testing.
2. Smooth and free of cracks, holes, ridges, coatings preventing adhesive bond.
3. Free of other defects impairing performance or appearance.

B. Suitability of Substrate:
1. Concrete surfaces shall be subject to moisture content and humidity testing to confirm substrate is within limits allowed by flooring material manufacturer.

2. Substrate shall be flat to within 3/16 inch in 10 feet and shall be such that finish floor will not show "telegraphing" of irregularities.
3. Perform bond tests to ascertain presence of substances detrimental to obtaining adhesive bond.
4. Concrete substrate that does not meet the suitability requirements shall be brought to the attention of the Design-Builder. Do not process with installation until measures to meet suitability requirements of substrate are resolved.

C. Flooring material shall be visually inspected prior to installation.
1. Do not use material with visual defects.
2. Verify flooring material is from the same batch number (dye lot).

3.2 PREPARATION

A. Comply with ASTM F710 and manufacturer's recommendations for surface preparation.
1. Remove protrusions, and grind smooth.
2. Remove coatings that might prevent adhesive bond, including curing compounds incompatible with resilient flooring adhesives.
3. Steel troweled concrete shall be properly roughened-up to ICRI (International Concrete Repair Institute) CSP (Concrete Surface Profile) #3 or #4 by sanding or shot blasting to ensure suitable adhesion.
4. Vacuum surfaces to be covered.

B. Apply leveling and patching compounds, as specified or recommended by flooring manufacturer, for filling small cracks, holes, and depressions to bring substrate within required tolerances and criteria, or to cover compounds incompatible with flooring adhesive. Provide a thin coat over entire floor surface if necessary. If cementitious leveling and patching materials are used, specified moisture and alkalinity testing shall be performed after their application.
1. Remove bumps and ridges to produce a uniform and smooth substrate.

C. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

D. Prepared substrate shall be such that finish floor will not show “telegraphing” of irregularities.

E. Subfloor must be free of wax, paint, oil, sealers, adhesives, and other debris.

3.3 APPLICATION OF ADHESIVES

A. Mix and apply adhesives in accordance with manufacturer's instructions. Prime surfaces if recommended by adhesive manufacturer.

B. Apply uniformly over substrates.
1. Cover only that amount of area that can be covered by flooring material within the recommended working time of adhesive.
2. Remove any adhesive that dries or films over.
3. Do not soil walls, bases, or adjacent areas with adhesive.
4. Promptly remove any spillage.

C. Apply adhesives with notched trowel or other suitable tool.

D. Clean trowel, and rework notches as necessary to ensure proper application of adhesive.

3.4 INSTALLATION OF RUBBER TILE FLOORING

A. Lay tile from center of room or space, working toward perimeter.
   1. Lay tile parallel to room axis in straight courses, with cross joints perpendicular and straight.
   2. Lay tile with grain or pattern running in checkerboard pattern or in same direction, as selected by Architect.
   3. Do not lay tile less than one-half width of a field tile, except where accepted by Architect for irregularly shaped rooms or spaces.

B. Fit tile neatly and tightly into breaks and recesses, against bases, around pipes and penetrations, under saddles or thresholds, and around permanent cabinets and equipment. Cut tile neatly and accurately to fit within 1/64 inch of abutting surfaces.

C. Leave perimeter tile fitting for the end, providing the corresponding perimeter gap 1/4 to 3/8 inches around the complete perimeter, columns and all construction-related elements.

D. Review the final appearance of the installation, checking for anomalies and make adjustments if necessary.

3.5 CONDUCTIVE RESILIENT TILE

A. General:
   1. Install with specified conductive adhesive and copper grounding strips in accordance with manufacturer's electrostatic installation instructions, summarized as follows, for actual site conditions and to achieve specified static dissipative performance.
   2. Exercise care to assure batch numbers of tile are not mixed during installation.
   3. Use grounding strips supplied with adhesive by manufacturer.

B. Apply conductive tile adhesive and allow to dry to the touch.

C. Grounding Strips:
   1. Verify SDT adhesive is dry-to-touch as determined by testing method recommended by adhesive manufacturer.
   2. Cut copper grounding strips into two-foot strips.
   3. Provide one strip for each 1000 square feet of area unless additional strips are required to achieve static dissipative requirements. Locate strips at perimeter of space and at locations that will facilitate grounding.
   4. Place 18-inches of strip over the dry-to-touch floor adhesive with the remaining 6 inches turning up the wall.
   5. Apply an additional coat of SDT adhesive over the section of strip on the floor and allow adhesive to dry-to-the touch before proceeding with installation of tile.
   6. Grounding connection shall be provided under Division 26, "Electrical," by connecting to steel support columns or by connection to ground bus by #12 or #14 wire.

D. Tile Layout:
   1. Lay tile from center of room or space, working toward perimeter.
   2. Lay tile parallel to room axis in straight courses, with cross joints perpendicular and straight.
   3. Do not lay tile less than one-half width of a field tile, except where accepted by Design-Builder for irregularly shaped rooms or spaces.
   4. Fit tile neatly and tightly into breaks and recesses, against bases, around pipes and penetrations, under saddles or thresholds, and around permanent cabinets and equipment. Cut tile neatly and accurately to fit within 1/64 inch of abutting surfaces.

E. After tiles are laid, roll in both direction with a 100-pound three-section roller using a hand roller only at inaccessible areas.

3.6 INSTALLATION OF VINYL PLANK FLOORING

A. Follow manufacturer's printed installation instructions, summarized in this Article, including specific requirements related to cutting the vinyl planks and short end tongue and groove connection.

B. Verify room dimensions to assure starting location will result in border planks of not less than 1/2 width and the width of the first row of planks is the same as the last row. Do not lay tile less than one-half width of a field tile, except where accepted by Architect for irregularly shaped rooms or spaces.

C. Lay planks parallel to room axis in straight courses, with cross joints perpendicular and straight. Provide a 6 to 8-inch seam stagger.

D. Fit tile neatly and tightly into breaks and recesses, against bases, around pipes and penetrations, under saddles or thresholds, and around permanent cabinets and equipment. Cut tile neatly and accurately to fit within 1/64 inch of abutting surfaces.

E. Roll with a 3-section coated 100 pound roller immediately after the flooring is placed, ensuring complete contact with the adhesive. Re-roll within working time of the adhesive and to ensure proper bond.

3.7 INSTALLATION OF STAIR TREADS AND LANDING TILE

A. Install treads and risers in accordance with the manufacturer's printed installation instructions adhering to the specific installation conditions applicable to this Project.

B. Install into adhesive when the adhesive has completely dried according to the adhesive manufacturer's guidelines.

C. Treads:
1. Trim both sides of the tread where required to obtain proper fit and pattern match to adjacent steps.
2. Dry fit prior to adhesive installation to ensure proper pattern alignment at wide staircases, which require butting multiple lengths.
3. Use manufacturer's recommended cove filler strip where the tread and riser intersect on the step.
4. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contour limits of the manufacturer.
5. Tread pattern shall visually align on each stair run.
6. Tightly adhere to substrates throughout length of each piece.

D. Lay landing tiles from center of stair landing working toward perimeter.
1. Do not lay tile less than one-half width of a field tile.
2. Lay tile parallel to room axis in straight courses, with cross joints perpendicular and straight.
3. Tread pattern shall visually align on each stair run.
4. Align dimensional coin pattern with pattern of stair treads.

E. Apply epoxy caulking nose filler provided by tread manufacturer to ensure a tight fit and eliminate any open space between step edge and stair tread nosing.

F. Fit tile neatly and tightly into breaks and recesses, against bases, around pipes and penetrations, and under thresholds. Cut tile neatly and accurately to fit within 1/64 inch of abutting surfaces.

G. Roll with a coated 100 pound roller immediately after the flooring is placed, ensuring complete contact with the adhesive. Roll nosing area with a hand roller.

H. Do not allow traffic on stairs until epoxy filler has set, approximately 24 hours.

3.8 INSTALLATION OF BASE AND EDGE STRIPS

A. General:
1. Match edges at seams, or double-cut adjoining lengths.
2. Install with tight butt joints.
3. Maintain minimum measurement of 18 inches between joints.
4. Do not stretch resilient base during installation.

B. Top-Set Base:
1. Install base around perimeter of room or space at base of partitions, columns, pilasters, and other permanent fixtures where scheduled.
2. Unroll base material, and let relax.
3. Cut into accurate lengths as required for minimum number of joints.
4. Apply adhesive, and firmly adhere to wall surfaces.
5. Press down so that bottom cove edge follows floor profile.
6. Corners:
a. Standard Base: Use premolded corners for internal and external corners.
b. Millwork Base: Miter internal corners.
1) Outside corners: Use straight pieces of maximum lengths possible and miter corners to fit.
2) Inside corners: Butt one piece to corner then scribe next piece to fit.
7. Scribe base accurately to abutting materials.

C. Edge Strips:
1. Apply adhesives, and bond securely to substrates in straight, true lines.
2. Provide where resilient flooring terminates, exposing edge of covering.
3. Center edge strips under doors where resilient flooring terminates at a door opening.
4. Top of strips shall be flush with top of resilient flooring.
5. Install reducer strips where required to provide smooth transition between resilient flooring and other finish.

3.9 FIELD QUALITY CONTROL

A. Dry or Wet Slip Resistance:
1. Flooring shall be tested, after cleaning and application of any site-applied finishers, using ASTM E303 “Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.”
a. Pendulum Test Value (PTV) shall be 45 or greater under dry and wet conditions.
b. Test results shall be reported in writing.
2. Alternative test method, such as use of a BOT-3000E digital tribometer, if proposed, shall provide results for both wet and dry conditions.

3.10 PROTECTION AND CLEANING

A. Prohibit foot traffic on completed flooring for a period of 24 hours after the installation and for a longer period of time if the temperature is below 72 degrees F.

B. Prohibit heavy traffic, rolling loads, or furniture placement for a period of 72 hours after the installation.

C. Clean approximately 72 hours after installation, or after adhesives have cured and after completion of adjacent work, as recommended by manufacturer for type of flooring installed.
   1. Sweep or vacuum floor thoroughly.
   2. Clean surfaces with a neutral cleaner.
   3. Follow manufacturer's recommended procedure for cleaning and polishing.
   4. Remove excess adhesive and other surface blemishes, using appropriate recommended cleaner.

D. Protect flooring against damage and from normal wear and tear during construction period, in accordance with flooring manufacturer's directions, so that flooring will remain without indication of use or damage.
   1. Protect flooring by covering with non-staining building paper.
   2. Protect flooring against rolling loads by covering with plywood or hardboard. Use dollies to move stationary equipment or furnishings across floors.

END OF SECTION

SECTION 09 8200

ACOUSTIC INSULATION AND SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Acoustic batt insulation.
   2. Acoustical sealants and accessories.
   3. Sound isolation requirements.

B. Related Requirements:
   1. Firestopping: Section 07 8400; mineral fiber firesafing; firestopping sealants.
   2. Joint Sealants: Section 07 9200.
   3. Gypsum Board: Section 09 2900.
   4. Plumbing: Division 22; pluming pipe insulation.
   5. Heating, Ventilating, and Air Conditioning: Division 23; mechanical pipe and duct insulation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications for each type of insulation and sealant.

B. Samples: Each type of pipe isolation system or product.

1.4 QUALITY ASSURANCE

A. Contractor shall be responsible for providing its workers and subcontractors with the requirements specified in this Section and for subcontractors securing submittal data from vendors.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Clearly identify manufacturer, contents, brand name, and applicable standard.

B. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

C. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

PART 2 - PRODUCTS

2.1 ACOUSTICAL BLANKETS

A. Sound-Control Batt: Unfaced, friction fit, preformed slag mineral or glass fiber with thermosetting resin binders, formaldehyde-free, and conforming to ASTM C665, Type I; “Sound Control Batts” by Johns Manville, “Greenguard” by Knauf, or equal.
   1. Thicknesses at Wall Cavity: Full thickness, unless otherwise indicated.
   2. Surface Burning Characteristics: ASTM E84.
      a. Smoke Developed: 50 or less.
      b. Flame Spread: 25 or less.
   3. Combustibility: Pass ASTM E136.

2.2 ACOUSTICAL SEALANTS AND SOUND ISOLATION ACCESSORIES

A. Acoustical Sealants:
   1. Non-Rated Conditions: USG "Sheetrock Acoustical Sealant," Tremco “Acoustical Sealant,” Henry's "Sound Control Sealant" No. 413, or equal conforming to ASTM C919 or equivalent.
   2. Fire-Rated Partition Perimeter Conditions: USG "Sheetrock Acoustical Sealant," Jaco “Fire and Draft Sealer,” or equal.

B. Acoustical Tape: Low-density PVC foam; "Norseal" V-730 Series by Norton Performance Plastics Corp., or equal.

C. Pipe Isolation Systems: Coordinate with Divisions 22 - Plumbing and 23 - HVAC.

D. Electrical Box Treatment:
   1. Outlet Box Pads: Polybutene-butyl with inert fillers, minimum 1/8-inch thick; Lowry's "Outlet Box Pads," Sound Pad #68 by LH Dottie Co., 323-725-1000, or equal.
   2. Sealant: Lowry's "Electrical Box Sealer," or equal.
   3. See Section 07 8400 “Firestopping” for pads and sealant at fire-rated assemblies.

E. Putty Pads: As specified above for outlet box pads.

F. Sealant Backer Rod: Compressible, rod-stock, polyethylene foam; nongassing, polyethylene-jacketed polyurethane foam; butyl-rubber foam; neoprene foam; or other flexible, permanent, durable, nonabsorptive, closed-cell material as recommended for compatibility with sealant by sealant manufacturer.

G. Miscellaneous Fastenings and Accessories: As acceptable to insulation manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas scheduled to receive insulation so as to ensure protection against inclement weather and other hazards and to verify that work of preceding trades is completed.

B. Examine space allocated for insulation for proper depth to receive material.

3.2 INSTALLATION OF ACOUSTICAL BLANKETS

A. Install to fill completely all typical and odd spaces in framing where required.

B. Install snugly between framing members. Fit ends snugly between units and against adjacent construction.

C. Carefully cut and fit insulation around pipes, conduit, and other obstructions and penetrations.

D. At doorframes, cut additional strips of insulation, and hand-pack as necessary to fill voids thoroughly.

E. Install glass fiber blanket in otherwise uninsulated walls containing plumbing pipes.

3.3 SOUND ISOLATION

A. Sound-insulated partitions are indicated on the Drawings.

B. Seal sound-insulated partitions airtight with acoustical sealant, in accordance with ASTM C919 and manufacturer's recommendations.

C. Intersections: Hold gypsum board back a maximum of 1/4 inch from intersecting gypsum board with floor or other surfaces, and apply a bead of acoustical sealant. Caulk void full and airtight with acoustical sealant.

D. Penetrations: Penetrations by conduits, ducts, and pipes shall be sealed airtight.
1. Holes smaller than 1 inch but too large to seal with sealant shall first be packed with mineral fiber and then sealed airtight.
2. Holes larger than 1 inch shall first be packed with glass or mineral fiber, then sealed over with acoustical putty pads, and then sealed airtight.

E. Utility Boxes: Back and sides of all electrical, telephone and CATV boxes in sound-insulated walls shall be sealed airtight with specified pads.
1. Verify that all unused knockouts are plugged before installing the pads.
2. Mold pads tightly to the boxes and to the adjacent surfaces

F. Install pipe isolation system wherever a pipe penetrates a stud or framing member.

G. Coordinate sealing with requirements of Section 09 2900 “Gypsum Board.”

H. Where sound-insulated walls are fire rated, follow requirements of Section 07 8400 “Firestopping.”

I. Prior to closing walls, insulation installation shall be made available for review by the City’s Representative.

END OF SECTION

SECTION 09 9000

PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Painting and painter's finish on exposed exterior and interior surfaces to complete the finishing of the Work.

B. Items Not Included in This Section:
   1. Factory-prefinished items as specified in various Sections.
   2. Painting specified elsewhere and included in respective Sections, including but not necessarily limited to, shop priming.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Coordination: Perform painting work in proper sequence with work of other trades so as to avoid damage to finished work.

1.3 ACTION SUBMITTALS

A. Schedule: Proposed manufacturers products grouped by System using same System identification included in these Specifications.

B. Product Data: Manufacturer's technical information for each product scheduled including paint label analysis and application instructions.

C. Color Samples:
   1. Appropriately label and identify each sample, including location and application. Include Architect's color identifier, manufacturer's name, color number, and gloss units.
   2. Gypsum Board: Prepare on gypsum board with specified level of finish, 18 inches square.
   3. Wood: Prepare on type and quality of wood specified, 12 inches square or long as applicable.
   4. Other Surfaces: Prepare on hardboard, 8 inches square.
   5. Each sample shall have stepped finish, clearly showing each coat and build-up of specified finish. Submit separate samples for each required gloss level.
   6. Resubmit samples as requested until required sheen, color, and texture are achieved.

1.4 INFORMATIONAL SUBMITTALS

A. Statement of applicator qualifications.

1.5 CLOSEOUT SUBMITTALS

A. At completion of the Work, deliver to Owner extra stock of paint of each color used in each coating material used.
   1. Containers shall be full, tightly sealed, and clearly marked.
   2. Provide the following quantities:
      a. Field Colors: One 5-gallon container.
      b. Accent Colors: One 1-gallon container.

1.6 QUALITY ASSURANCE

A. Unsuitability of Specified Products: Claims concerning unsuitability of any material specified (or inability satisfactorily to produce the Work) will not be entertained, unless such claim is made, in writing, to Architect before beginning of application.

B. Single-Source Responsibility:
   1. To the maximum extent practicable, select a single manufacturer to provide all materials required by this Section, using additional manufacturers to provide systems not offered by the selected principal manufacturer.
   2. For each individual system:
      a. Provide primer and other undercoat paint produced by same manufacturer as finish coat.
      b. Use thinner within manufacturer's recommended limits.

C. Applicator Qualifications:
   1. Not less than 5 years of documented experience in painting work similar in scope to work of this Project.
   2. Maintain a crew of painters who are fully qualified to satisfy requirements of this Section.
   3. Provide field test reports verifying that floor paint and striping meet specified requirements for slip resistance.

D. Field Samples:
   1. Request review, by the Architect, of first finished area, room, space, or item of each finish type or color scheme required for color, texture, and workmanship.
   2. Except as otherwise specified, finish a 10-foot length of partition and ceiling for each color scheme required, at locations selected by Architect.
   3. Finish a portion of other items as directed by Architect.
   4. Request review by Architect for color, texture, and workmanship.
   5. Modify selected colors, if requested by Architect, to achieve desired effect.
   6. Use accepted surface as the Project standard for each color scheme.
   7. Comply with additional requirements of Section 01 4339, “Mockup Requirements.”

E. Primers:
   1. Provide finish coats that are compatible with prime paints used.
   2. Review other Sections of these Specifications in which prime paints are to be provided in order to ensure compatibility of total coatings system for various substrates.
   3. Upon request, furnish information to other Sections regarding characteristics of finish materials proposed for use.
   4. Provide barrier coats over incompatible primers, or remove and re-prime as required.
   5. Notify Architect, in writing, of any anticipated problems arising from using specified coating systems with substrates primed by other Sections.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original, new, unopened packages and containers bearing the manufacturer's name and label with the following information:
   1. Name or title of material.
   2. Manufacturer's stock number and date of manufacture.
   3. Manufacturer's name.
   4. Contents by volume for major pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.

B. Store materials in tightly covered containers. Maintain containers in a clean condition, free of foreign materials and residue.

C. Store materials at ambient temperature of between 45 degrees F minimum and 90 degrees F maximum, in a well-ventilated area.

D. Ensure that storage area is neat and orderly.

E. Take precautionary measures to prevent fire and health hazards.

F. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.8 FIELD CONDITIONS

A. Ambient Conditions:
   1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be stored and applied.
   2. Do not apply finish in areas where dust is being generated.
   3. Provide adequate lighting.

B. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

1.9 WARRANTY

A. Color and Life of Film:
   1. At the end of 1 year, colors of surfaces shall have remained free from serious fading. Variations (if any) shall be uniform.
   2. Materials shall have their original adherence at end of 1 year. There shall be no evidence of blisters, running, peeling, scaling, chalking, streaks, or stains at end of this period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Products are specified under "Paint Systems" in Part 3 below and are manufactured by Sherwin-Williams Company, unless otherwise indicated. Equivalent products manufactured by Kelly-Moore, Benjamin Moore, PPG, Dunn-Edwards, Vista, or equal shall be approved by the Architect.

B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer or shall be acceptable to manufacturer of finish coating for system.

C. If more than one quality level of product type is marketed, use material of highest quality.

2.2 ACCESSORY MATERIALS

A. Spackling Compound: Standard gypsum board compound.

B. Thinner: As recommended by each manufacturer for the respective product.

2.3 COLORS

A. Paint Colors: As scheduled. Refer to Drawing A503, “Finish Schedule.”

B. Colors scheduled may have manufacturer identifications other than the acceptable manufacturers listed above. The listing is solely for the purpose of conveying color information and does not imply manufacturer's approval or waiver of the requirement that all coatings be from the same manufacturer, unless a specific system is not available from the primary manufacturer.

C. Submit samples of selected colors as specified in Part 1 above.

2.4 MIXING AND TINTING

A. Deliver coatings ready mixed to jobsite.

B. Accomplish job mixing and job tinting only if required for multi-component coatings and for adjustment to finish applied to field test areas to achieve color acceptable to Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence, or quality of work and that cannot be put into acceptable condition through preparatory work as included in Article "Preparation."

B. Do not proceed with surface preparation or coating application until conditions are suitable.

3.2 PREPARATION

A. General:
   1. Broom-clean rooms and spaces before commencement of the work.
   2. Verify that surfaces to be painted are dry, clean, smooth, and free from deleterious materials.
   3. Protect hardware, nameplates, switch plates, lighting fixtures, stainless steel, aluminum, and other surfaces that are not to be painted by masking, removal, or by other means to ensure a neat job.
   4. Locate and install scaffolding and staging so as not to interfere with the work specified in other Sections.

B. Wood - General:
   1. Cleaning and Sanding:
      a. Remove handling marks and effects of exposure to moisture with a thorough, final sanding over all exposed surfaces, using 150-grit or finer sandpaper.
      b. Clean and vacuum before applying sealer or finish.
   2. Wood to Receive Opaque Finish: Fill nail holes, cracks, open joints, and other defects with filler after priming coat has dried. Color shall match finish color.

C. Gypsum board shall be prepared and finished for painting as specified in Section 09 2900, “Gypsum Board."

D. Metals:
   1. Remove mill scale, rust, and corrosion.
   2. Clean oils, grease, and dust from surfaces.
   3. Touch up chipped or abraded areas in shop coatings, using appropriate primer.
   4. Soluble Salts: Removal of soluble salts from bare metal and galvanized metal surfaces, both interior and exterior, is required prior to application of primer coats to preclude premature coating failure and accelerated corrosion.
      a. Removal shall be in accordance with SSPC-Guide 15, “Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.”
      b. Abrasive blasting, where specified as a required surface preparation procedure, shall be performed after removal of soluble salts. Abrasive blasting is not an acceptable procedure for removal of soluble salts.

E. Ductwork: Clean visible galvanized portion of ductwork interiors with solvent, and wipe clean.

F. Surfaces that cannot be prepared or painted as specified shall be immediately brought to the attention of the Architect, in writing.
   1. Starting of work without such notification will be considered acceptance by the Contractor of surfaces involved.
   2. Replace unsatisfactory work caused by improper or defective surfaces, as directed by Architect.

3.3 FACTORY FINISHING AND PRIMING

A. Pertinent Work and Requirements Specified Elsewhere: Review all Sections for products that are to be factory finished or factory (shop) primed.

B. Touch-up: Touch up abrasions in prime coat immediately after products arrive on jobsite and as required prior to application of finish coats.

3.4 APPLICATION

A. Shop-fabricated and finished metal and millwork items shall be shop spray finished to the greatest extent possible.

B. Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.

C. Application:
   1. Apply paint with suitable brushes, rollers, or spraying equipment.
   2. Stairs, guardrails, steel doorframes, and other exposed metal requiring field finish painting shall be sprayed to the fullest extent conditions will permit. If brush or roller

application is used, surface finish shall be subject to review by the Architect for complying with the appearance requirements specified herein.
3. Apply coatings in accordance with manufacturer's recommendations.
4. Rate of application shall be within limits recommended by paint manufacturer for surface involved.

D. Spray-Gun Application - Standard Coatings:
1. Spray-apply standard paints only with airless sprayer.
2. Apply in fine, even spray, without addition of thinner, using nozzle pattern suitable to surface being painted.
3. When necessary, follow by brushing to ensure uniform coverage and to eliminate wrinkling, blistering, and air holes.
4. If spraying becomes detrimental to equipment or objectionable to personnel, brush painting will be required.

E. Comply with recommendation of product manufacturer for drying time between succeeding coats.

F. Finish coats shall be smooth and free from brush marks, streaks, laps or pileup of paints, and skipped or missed areas.

G. Leave all parts of moldings and trim clean and true to details with no undue amount of paint in corners and depressions.

H. Make edges of paint adjoining other materials or colors clean and sharp, with no overlapping.

I. Refinish whole area where portion of finish is not acceptable.

J. Equipment adjacent to walls shall be disconnected, using workmen skilled in appropriate trades, and moved to permit wall surfaces to be painted. Following completion of painting, they shall be expertly replaced and reconnected.

K. Top and bottom edges of all doors shall receive same paint system finish required for door faces.

L. Paint visible surfaces behind vents, registers, or grilles flat black.
1. Prepare exposed metal as specified, then prime and paint as scheduled.
2. Spray-paint wherever practicable.

M. Do not paint over fire-rating labels, fusible links, or sprinkler heads.

N. Exposed Plumbing and Mechanical Items: Items without factory finish such as conduits, pipes, access panels, and items of similar nature shall be finished to match adjacent wall and ceiling surfaces, unless otherwise directed.

3.5 CLEANING

A. Touch up and restore finish where damaged.

B. Remove spilled, splashed, or spattered paint from all surfaces.

C. Do not mar surface finish of item being cleaned.

D. Leave storage space clean and in condition required for equivalent spaces in Project.

3.6 PAINT SYSTEMS

A. General:
1. Only major areas are scheduled, but miscellaneous and similar items and areas within room or space shall be treated with suitable system.
2. This Specification shall serve as guide and is meant to establish procedure and quality. Confer with the Architect to determine exact finish desired.
3. Number of coats scheduled is minimum. Additional coats shall be applied at no additional cost as required to hide base material completely, produce uniform color, and provide required and satisfactory finish.

B. Surfaces Not to Be Painted:
1. Prefinished wall, ceiling, and floor coverings.
2. Items with factory-applied final finish.
3. Concealed ducts, pipes, and conduit.
4. Surfaces specifically scheduled or noted on the Drawings as not to be painted.

C. Acceptance of Final Colors: Final coat of paint for both exterior and interior shall not be applied until colors have been accepted by the Architect.

D. Gloss and Sheen Ratings: Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following limits in conformance with Master Painters Institute, Inc. (MPI) Standards according to ASTM D523. Not all of the Gloss Levels are scheduled or used on this Project.
1. Gloss Level 1: Matte or Flat; not more than 5 units at 60 degrees and 10 units at 85 degrees.
2. Gloss Level 2: Velvet or Low Sheen; not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. Gloss Level 3: Eggshell; 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
4. Gloss Level 4: Satin; 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
5. Gloss Level 5: Semi-gloss; 35 to 70 units at 60 degrees.
6. Gloss Level 6: Gloss; 70 to 85 units at 60 degrees.
7. Gloss Level 7: High Gloss; more than 85 units at 60 degrees.

E. Clarification of System Terminology:
1. Interior paint Systems are specified and identified herein by initial letters “INT.”
2. Exterior paint Systems are specified and identified herein by initial letters “EXT.”
3. Initial numbers for each System identify the substrate to be coated summarized as follows with further clarification included with the System description:

CODE	DESCRIPTION
5	Metal
6	Wood
9	Gypsum Board

4. Letter following substrate numbers identify the general finish coat chemistry summarized as follows:

CODE	DESCRIPTION
A	Standard acrylic
H	Aliphatic Polyurethane
M	Premium Performance Acrylic

5. Hyphenated suffix identifies the topcoat gloss levels.

F. Interior Painting Systems:

INT 5.1A-5
Acrylic on Shop-Primed Metal Including Hollow Metal Doors and Frames - Gloss Level 5

2 coats	“ProMar 200” B31-2600 Series	Acrylic Latex Semi-Gloss

Note: Modify scheduled finish coat if higher or lower gloss level is selected by Architect.

INT 5.3A-5
Acrylic on Galvanized Metal - Gloss Level 5

1 coat	"Pro-Cryl" Universal Primer" B66 Series	Red Oxide Acrylic
2 coats	“ProMar 200” B31-2600 Series	Acrylic Latex Semi-Gloss

Note: Modify scheduled finish coat if higher or lower gloss level is selected by Architect.

INT 5.3M-5
Premium Performance Acrylic on Architectural Metal - Gloss Level 5
Coating Manufacturer: Products specified to establish required level of performance, quality, and appearance are by Carboline.

	Surface Preparation prior to Priming	Comply with requirements specified in Section 05 7000, “Decorative Metal”
1 coat	"Carboguard 3358"	Waterborne acrylic
1 coat	"Carboguard 3359"	Waterborne acrylic

Note: Provide additional topcoat if required to achieve complete hiding.
Modify scheduled topcoat if other than specified gloss level is selected by Architect.

INT 6.3A-5
Acrylic on Millwork and Wood Doors - Gloss Level 5

1 coat	“Premium Wall & Wood” B28W08111	Vinyl Acrylic Latex
2 coats	“ProMar 200” B31-2600 Series	Acrylic Latex Semi-Gloss

INT 9.2A-1
Acrylic on Gypsum Board - Gloss Level 1

1 coat	“ProMar 200” B28W2600	Latex Primer
2 coats	“ProMar 200” B30-2600 Series	Acrylic Latex Flat

INT 9.2A-3
Acrylic on Gypsum Board - Gloss Level 3

1 coat	“ProMar 200” B28W2600	Latex Primer
2 coats	“ProMar 200” B200-2600 Series	Acrylic Latex Eggshell

G. Exterior Painting Systems:

EXT 3.1A-3
Acrylic on Cement Board Siding - Gloss Level 3

1 coat	“Loxon” Concrete & Masonry Primer/ Sealer A24W8300	Acrylic Primer sealer
2 coats	"A-100" A82-Series	100% Acrylic Satin

Note: Modify gloss level of finish coats to match approved sample

EXT 5.1A-3
Acrylic on Shop Primed Hollow Metal Doors and Frames - Gloss Level 3

2 coats	"A-100" A82-Series	100% Acrylic Satin

EXT 5.3H-5
High-Performance Acrylic Polymer on Galvanized and Metalized Metal - Gloss Level 5
Coating Manufacturer: Products specified to establish required level of performance, quality, and appearance are by Carboline.

	Surface Preparation prior to Priming	Comply with requirements specified in Section 05 7000, "Decorative Metal"
1 coat	"Carboguard 893 Series"	Epoxy Mastic at 3.0 DFT.
1 coat	"Carbothane" 133 VOC"	Aliphatic Acrylic-Polyester Polyurethane 3.0 – 5.0 DFT.

Note: Provide additional topcoat if required to achieve manufacturer's recommended total DFT (primer plus finish coats), or to achieve complete hiding for selected color. Modify gloss level of topcoat if other than semi-gloss level is selected by Architect.

END OF SECTION

SECTION 10 1100

VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall-mounted liquid marker type whiteboards.
   2. Wall-mounted tack boards.
   3. Hardware and accessories for complete installation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittals.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Shop Drawings:
   1. Provide dimensioned elevations showing layout and configuration of each board.
   2. Show sections of trim members; key to elevations.
   3. Show anchors, grounds, reinforcement, and accessories.

B. Product Data: Manufacturer's technical data for boards and accessories.

C. Samples:
   1. Boards: 5 by 8 inches, full thickness, illustrating each color and finish.
   2. Trim and Accessory: Each profile, minimum 8 inches long.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's certification that materials furnished comply with specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturer's breaking-in instructions, and cleaning and maintenance instructions for markerboards covering both routine (daily or weekly) and long-term (yearly or longer) operations.

B. Warranty as specified.

1.6 FIELD CONDITIONS

A. Environmental Requirements: Install boards only when interior air and substrates have reached equilibrium moisture and temperature approximating that of normal occupied conditions.

B. Take field measurements prior to shop fabrication where necessary in order to ensure proper fitting of work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Wrap or otherwise package boards and components for protection against damage during shipment and storage.

B. Store porcelain enameled steel panels on edge in a manner to prevent bowing, warping, or other irregularities.

C. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

1.8 WARRANTY

A. Manufacturer: Furnish manufacturer's written warranty agreeing to replace marker boards that do not retain their original writing and erasing qualities, that become slick and shiny, or that exhibit crazing, cracking, or flaking, provided manufacturer's instructions with regard to handling, installation, protection, and maintenance have been followed.
   1. Replacement may be limited to material replacement only.
   2. Labor for removal and reinstallation may be excluded.

PART 2 - PRODUCTS

2.1 MARKERBOARDS

A. White Markerboards: Magnetic porcelain writing surface manufactured specifically for use with liquid marker systems; N106-2A Series by AJW Architectural Products, 845-562-3332, or equal.
   1. Color: Low Gloss White.
   2. Layout and Sizes: Custom and standard, as shown.

B. Construction: Balanced, high-pressure-laminated, 3-ply construction with facing sheet, core, and backing.
   1. Facing Sheet: Enameling grade steel, minimum 24 gage.
   2. Core: Particle board complying with ANSI A208.1, Grade 1-M-1, 1/2 inch thick, manufactured with no added urea-formaldehyde resins.
   3. Balance porcelain writing surface with aluminum foil.
   4. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

C. Aluminum Trim: Manufacturer’s 1-1/2 inch box trim.
   1. Fabricate from minimum 0.062 inch thick extruded aluminum alloy of proper size and shape to suit installation.
   2. Minimize joints.
   3. Miter corners to neat, hairline closure.

D. Accessories:
   1. Tray: Manufacturer’s standard continuous, box type aluminum tray with slanted front and cast aluminum end closures.
   2. Map Rail: Full length, 2-inch, aluminum map rail with cork insert furnished with one combination hook and clip for each 48 inch length of map rail. Provide with end stops.
   3. Fasteners: As recommended by markerboard manufacturer for type of wall backing.

2.2 METAL-FRAMED TACK BOARDS

A. Tack Boards: Natural fine-grained, dense, self-healing cork at least 1/4 inch thick; N21B-1N Series by AJW Architectural Products, 845-562-3332, or equal.

B. Tackboard: Fine grain sheet bulletin board cork with burlap back reinforcing, 1/4 inch thick with a flame spread rating of 25 and smoke density of 450, and laminated to a 1/4 inch thick hardboard backing; N21B-1N Series by AJW Architectural Products, 845-562-3332, or equal.
1. Color: To be selected by Architect from manufacturer's standards.
2. Sizes and Layout: As shown.

C. Aluminum Trim: Manufacturer’s 1-1/2 inch box trim.
1. Fabricate from minimum 0.062 inch thick extruded aluminum alloy of proper size and shape to suit installation.
2. Minimize joints.
3. Miter corners to neat, hairline closure.

2.3 ADDITIONAL ACCESSORIES

A. Attachment Hardware: Manufacturer's standard fully concealed attachment system for securing units to wall surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are true and plumb, and that backing is in place. Correct inadequate substrates before installation of boards.

B. Verify that moisture and temperature levels of substrate and environment have stabilized.

3.2 INSTALLATION

A. Install boards in location and at mounting heights shown and in accordance with manufacturer's instructions.

B. Keep perimeter lines straight, plumb, and level.

C. Join parts with a neat, precise fit.

D. Aluminum Trim: Provide as specified and as shown.

3.3 PROTECTION

A. Cover completed work with plastic sheet or other covering recommended by manufacturer.

B. Protect boards and tackable surfacing from damage until acceptance.

END OF SECTION

SECTION 10 1400

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The following Building and code required signage supplementing the information included on the Drawings.
   1. Interior building signage including but not limited to:
      a. Code required signage.
      b. Interior room identification signage.
   2. New and relocated exterior signage.

B. Related Requirements:
   1. Fire Protection Specialties: Section 10 4400; fire extinguisher cabinet graphics.
   2. Elevator: Section 14 2600; elevator fire signage.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

C. Coordination:
   1. Prior to production of shop drawings and samples, coordinate a pre-submittal conference with Architect and Owner’s Project Manager to confirm submittal requirements, schedule, and sign review process.
   2. Prior to installation, fabricator shall provide a taping pattern for all sign plaques, and pin-mounting or stud patterns for all individual letter signs components.

1.3 ACTION SUBMITTALS

A. Shop Drawings:
   1. Full-scale drawings for each sign indicating materials, lettering layout, and colors.
   2. Large-scale drawing and details of custom graphics and lettering. Include mounting details.
      a. Include plans, elevations, and large-scale sections of typical members and other components.
      b. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
   3. Building Floor Plans showing signage location keyed to Sign Schedule.

B. Product Data: Submit list and complete descriptive data of products proposed for use for each sign type, style, and color. Include manufacturer's specifications, documentation

verifying compliance with specified performance criteria, published warranty or guarantee, installation instructions including method of attachment, and maintenance instructions.

C. Samples:
1. Appropriately label and identify each sample.
2. Color Verification:
a. Size: Not less than 6 inches square.
b. Samples shall be prepared on same base material to be used in fabrication.
3. Submit one sample of each sign type.
a. Interior signs shall be full size.
b. Plaques may be 6 inches x 6 inches with lettering from prior similar work.
c. Acceptable full-size samples may be installed as part of the work.
4. Dimensional Letters: Provide one full-size representative samples of each dimensional letter type required, showing letter style, color, and material finish and method of attachment.

D. Sign Schedule: Use same designations specified or indicated on Drawings and coordinated with shop drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Verification of Braille approval from Lighthouse for the Blind.

1.5 CLOSEOUT SUBMITTALS

A. Extended warranty.

B. Maintenance data for signs and sign types including maintenance manuals.

1.6 QUALITY ASSURANCE

A. Contractor shall assure that the vendor shall be responsible for the quality of materials and workmanship of any firm acting as the vendor's subcontractor.

B. Furnish products of a single manufacturer for all sign types and graphic image processes indicated.

C. Mockups:
1. Prior to installation, install pre-installation paper mockup signs for review at locations designated by the Architect. The job-site review is to confirm compliance with the information included on the Drawings, typical installation conditions, and determine installation locations for non-typical conditions.
2. Comply with additional requirements of Section 01 4339, “Mockup Requirements.”

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver signs safely packed to prevent damage during shipment. Package separately or in like groups of types, labeled as to names enclosed; include installation template, attachment system and installation instructions.

B. Comply with requirements specified in Section 01 6000, "Product Requirements."

1.8 FIELD CONDITIONS

A. Make and be responsible for all field dimensions necessary for proper fitting and completion of work. Report discrepancies in writing to Architect before proceeding.

1.9 WARRANTY

A. Manufacturer:
1. In addition to the Contractor's Standard Guarantee, furnish, as available, manufacturer's fully executed written warranty for signage against defects in materials and workmanship, including without limitation against yellowing, cracking, crazing, and other visible and performance defects for a period of 5 years.
2. Text, pictograms or symbols that can be removed from the sign face utilizing a sharp object or other conventional methods will be considered a manufacturing defect.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Unless otherwise specified or shown, signage shall conform to the following standards and publications:
1. ANSI A-117.1 and the Americans with Disabilities Act (ADA).
2. ATBCB Design Guidelines for Signage in relation to the Americans with Disabilities Act.
3. 2010 Americans with Disabilities Act (ADA) Standards.
4. California Code of Regulations, Titles 19 and 24. California Grade 2 Braille shall be used whenever Braille symbols are specifically required. All signage shall conform to Chapter 11B of the CBC, Division 7, Section 11B-703.
5. Uniform Sign Code.

2.2 MATERIALS

A. General:
1. Not all materials required for fabrication of signage are specified and not all specified materials will necessarily be required.
2. Metal Finishes:
a. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
b. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
c. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples and are assembled or installed to minimize contrast.
3. Screen printing: Inks shall have a light fastness rating of 7-8 on the din 16525 or industry standard. Ink type shall be acceptable to the manufacturer of the substrate used. Screens shall be 254 polyester monofilament, mesh tensioned to no less than 18 newtons. Ink coverage shall be even, uniform and opaque.

B. Aluminum:
   1. Sheet and Plate: ASTM B209/B209M, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
   2. Castings: ASTM B 26, of alloy and temper recommended by sign manufacturer for casting process used and for use and specified finish.
   3. Finish: To provide a non-glare background; clear anodized, AA-M12C22A41, Class I, AAMA 607.1.

C. Magnesium Board: Magnesium oxide composite.

D. Acrylic Sheet: ASTM D702, Type III.

E. High Molecular Acrylic Sheet: “Nuvacor,” or equal.

F. Engravable Plastic: Polymer capped impact acrylic; Rowmark, or equal.

G. Colored Coatings for Acrylic Sheet: Non-fading, including inks and paints for copy and background colors, as recommended by acrylic manufacturer for optimum adherence to surface.

H. Paint Coatings: Matthews Acrylic Polyurethane ("MAP") by Matthews Paint Company (MPC), or equal. Provide primer as recommended by coating manufacturer for each type of substrate.
   1. Colors: To match colors scheduled and selected by Airport Project Manager.

I. Vinyl: Opaque non-reflective film, nominal 3 mils thick, with pressure-sensitive adhesive backing, and suitable for exterior applications where applicable.

J. Mounting Tape: Double sided acrylic adhesive closed cell urethane; 3M Series “VMB” #4016, or equal.

K. Stainless Steel: Sheet, Strip, Plate, and Flat Bar: ASTM A666, Type 304 at interior and Type 316 at exterior.
   1. Finish: Dull Satin Finish: No. 6.

L. Fasteners at Exterior Signage: Provide countersunk, tamper-resistant, flush stainless steel screws, painted to match adjacent surfaces, unless otherwise specified on Drawings.
   1. If unpainted, finish shall match sign finish.
   2. Fasteners and hardware used for securing signs to structural backing shall be engineered to meet code requirements and compliance with design intents.

2.3 GRAPHIC LAYOUTS

A. Text and Layouts: As shown and scheduled on the Drawings. Where not shown, to be provided by Architect.

2.4 INTERIOR SIGNS

A. . Toilet Room Identification:

   1. General:
      a. Fabrication: Laminated colored plastic, 1/4 inch thick, core color contrasting with exterior face color and texture; or acrylic plastic with inset symbols..

2. Plaques:
   a. Unisex Toilet:
      1) Door: Equilateral triangle mounted on a 12-inch circle
      2) Wall Adjacent to Door: Both international male and female figures, wheelchair figure, and both upper case and Grade 2 Braille lettering. Text and braille shall not be located in pictogram field

B. Elevator Fire Safety Sign: If not provided under Division 14.

1. Sign Panel Size: 36 square inches in proportion specified by Architect.

2. Layout: Three lines of copy to read as follows:

"In Case of Fire
Do Not Use Elevators
Use Stairs"

C. Maximum Occupancy Signs at Assembly Areas: Minimum 8 inches high x 12 inches wide, larger if required to accommodate text.

1. Fabrication: Laminated colored plastic, 1/4 inch thick, core color contrasting with exterior face color and texture; or acrylic plastic with inset symbols.

2. Layout: Copy as indicated on the Drawings, with numbers to be provided by Architect.

D. Floor Identification in Stairway:

1. Fabrication: Laminated colored plastic, 1/4 inch thick, core color contrasting with exterior face color and texture; or acrylic plastic with inset symbols.

2. Panel Size: As shown on the Drawings.

3. Layout: In conformance with CBC 1133B.4.3.

4. Text: To be provided by Architect.

5. Locate at the landing of each Floor level, placed adjacent to the door on the latch side.

E. Exit Signs:

1. Fabrication: Laminated colored plastic, 1/4 inch thick, core color contrasting with exterior face color and texture; or acrylic plastic with inset symbols.

2. Panel Size: As shown on the Drawings.

3. Layout: In conformance with comply with Section 1117B.5.1 Item 1 Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5.

4. Text: To be provided by Architect.

F. Accessible Means of Egress Signs:

1. Text: To be provided by Architect.

2. Layout: In conformance with CBC Section 1117B.5.1, Items 2 and 3, 11B-703.5 requirements for visual characters. Include the International Symbol of Accessibility complying with Section 11B-703.7.2.1.

3. Locate at each door to an area of refuge and exterior area for assisted rescue in accordance with Section 1011.4.

4. Is used in conjunction with a tactile “Exit Stair” sign, the tactile exit sign shall be located closest to the door and the two signs placed side by side.

G. Illuminated Exit Signs: As shown on Drawings and specified in Division 16.

H. Electrical, Mechanical and Other Code Required Room Identification Signs: As indicated on the Drawings or as provided by Architect.

2.5 FABRICATION

A. General:
1. Fabricate signage to remain flat under installed conditions.
2. Fabricate with smooth, mechanically finished edges. Ease corners slightly for plastic signs.
3. Graphic Elements for Plaques: All text and symbols shall be thermoformed acrylic panels with integrally raised text, braille and other graphics. Applied elements are not acceptable.

B. Tactile Copy and Braille:
1. Proofread Braille applications before signs are fabricated and installed.
a. All Braille shall match adjacent surfaces.
b. Braille is required to be approved by Lighthouse for the Blind and Contractor shall procure this approval prior to fabrication.
c. Contractor is responsible for setting correct Braille.
2. Tactile character shall be laser cut into engravable plastic.
a. Edges shall be crisp, and letterforms setting solid on a baseline, as in the Drawings
b. Tactile characters shall be raised 1/32 inch minimum from the background.
3. Contracted Grade 2 Braille shall be used whenever Braille symbols are specifically required.
a. All Braille shall be fabricated with a rounded or domed dot shape and shall meet all current applicable standards.
b. Dots shall be spaced 1/10 inch on center within each cell with 2/10 inch space between cells.
c. Dots shall be raised 1/40 inches (0.635) above background.
d. Comply with additional requirement of CBC Section 1117B.5.2.

C. Digital printing shall have an underlying white color to optimize the evacuation plan’s graphics when digitally printed. Resolution shall be a minimum of 1200 dpi and match color samples provided for actual color and quality of graphics and type.

D. No uncemented plastic seams will be accepted. Finish exposed edges of plastics so that no saw marks are visible. Eased square corners and edges all around. Fill and fine-sand seams.

E. Painting:
1. Apply additional finish coats when undercoats, stains or other conditions show through final coat of paint, until paint is of uniform finish, color and appearance.

F. Graphic Application:
1. Sign colors or materials for both message and background colors shall match specified and approved samples.
2. Sign colors shall be consistent in chroma, value and coverage, shall maintain proper opacity or translucency, and shall be free of blistering, bleeding, fading and imperfections.
3. Sign color restrictions shall be crisp, sharp and free of ticks, line waver, overlap and other imperfections.

G. Copy Application:
1. The Project alphabets shown on the Drawings shall be used for all copy applications, except as otherwise noted. Letterforms shall follow these alphabets, and the size and placement of copy shall follow the dimensions and spacing indicated on the Drawings and approved copy patterns.
2. Letter spacing shall conform to standards shown and kerned optically to the acceptance of the Owner's Project Manager.
3. Lines of copy shall be straight and parallel to the sign format, unless otherwise specified or shown.
4. Edges of letters, numbers and symbols shall be smooth and continuous, with straight and curved portions reproducing the original forms exactly, with corners sharp and true.
5. Particular attention shall be addressed to rounded letterforms that extend slightly above and below the normal line of copy.
6. All forms shall be free of ticks, line waiver, discontinuous curves and other imperfections.

H. Cutting & Routing:
1. Execute cutting and routing in such a manner that all edges of finished characters are true and clean.
2. Characters with rounded positive or negative corners, nicked, cut or ragged edges, will not be accepted.
3. Align characters to maintain a base line parallel to the sign format.
4. Vertical strokes shall be plumb.
5. Margins shall be maintained as indicated on the Drawings and approved shop drawings.

I. Individual Cutout Characters:
1. Provide individual cutout characters from material, thickness, and color as noted on the Drawings. Laser-cut or water-jet-cut, execute cutting and routing in such a manner that all edged of finished characters are true and clean.
2. Characters with rounded positive or negative corners, nicked, cut or ragged edges will not be accepted.
3. Align all characters to maintain a base line parallel to the sign format.
4. Vertical strokes shall be plumb. Margins and letter spacing shall be maintained as indicated on the Drawings and approved shop drawings.

J. Illuminated Signs:
1. Provide crisp dimensional characters fitted with appropriate lighting fittings, to achieve a soft glow around the letter edges.
2. Electrical wiring shall be concealed to create a neat, clean illuminated lighting effect.

3. Contractor is responsible for ensuring that shop drawings, lighting and wiring solutions meet requirements to earn Underwriters Laboratory sticker.

2.6 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.

C. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples and are assembled or installed to minimize contrast.

EXECUTION

2.7 EXAMINATION

A. Examine areas and conditions under which signage is to be installed.

B. Beginning installation signifies acceptance of substrates and conditions.

2.8 INSTALLATION

A. General:
1. Interior signage and plaques shall be mounted with mechanical fasteners in compliance with manufacturer's written recommendations.
2. Exterior signage shall be mechanically fastened as specified and noted on the Drawings.
3. Install signs level and plumb at height indicated, with sign surfaces free from distortion or other defects in appearance.
4. Locate signage where shown and scheduled. Where location is not shown, location shall be reviewed and approved by the Architect.
5. Follow typical mounting elevations as indicated in the Drawings. Subcontractor shall also field measure selected locations and note dimensions on shop drawings.

B. Applied Copy Signs and Graphics:
1. Apply signage and graphics centered and level, in line, in accordance with manufacturer's recommendations.
2. Job site applied vinyl graphics shall be applied and pre-spaced on application tape prior to installation.

2.9 FIELD QUALITY CONTROL

A. Inspection: Check all items installed for correct placement and alignment before notifying the Airport Project Manager that installation in any area is complete.
1. Installed signs shall be clean, properly aligned, level and true to line and dimension, flush to surface or as detailed and specified, free of excess visible adhesive, if used.
2. Damage to sign or surrounding surface or other imperfections will not be accepted.
3. No labels shall be adhered to the signs.

2.10 CLEANING AND PROTECTION

A. At completion of installation, remove all dust, dirt, finger marks, etc. from signs and letters using cleaning methods as recommended by manufacturer.

B. Protect signage from damage until acceptance by Owner.

C. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost.

2.11 SIGNAGE SCHEDULE

A. Refer to information on the Drawings.

END OF SECTION

SECTION 10 2613

CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stainless steel corner guards.

B. Related Requirements:
   1. Gypsum Board: Section 09 2900.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”

B. Coordinate with Sections 09 2216, "Non-Structural Metal Framing," for installation of framing or backing plates to receive fasteners. Securing only through gypsum board is not acceptable.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Show location and extent of corner guards.

B. Product Data: Manufacturer's catalog cuts and data sheets, including installation details and instructions, for each item specified.

C. Samples: 6-inch section of corner guard in specified material and finish.

1.4 QUALITY ASSURANCE

A. Mockups:
   1. First installed example of each type of corner guard, shall serve as mockups for review by Architect of installation workmanship, visual effect, and interface with adjacent construction.
   2. Comply with additional requirements of Section 01 4339, "Mockup Requirements."

PART 2 - PRODUCTS

2.1 MANUFACTURED SYSTEMS

A. Stainless Steel Corner Guards: IPC, Pawling, Wilkinson, or accepted equal.
   1. Wing Size: 1-1/2 inches by 1-1/2 inches.
   2. Length: 4 feet.
   3. Fasteners: Screws as provided by corner guard manufacturer.
   4. Finish: NAAMM No. 4 satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. After finish painting of walls is complete, examine areas and conditions under which guards are to be installed.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's installation instructions and as shown on the Drawings, to match accepted mockups.

B. Install corner guards with bottom at top of base.

3.1 ADJUSTMENT AND CLEANING

A. Prior to time of final acceptance, strip guards of protective coverings, and clean in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 2623

PROTECTIVE WALL COVERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiber reinforced wall protection panels.

B. Related Requirements:
   1. Section 09 2900: Gypsum Board.
   2. Section 09 6500: Resilient Flooring and Base.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300 “Submittal Procedures.”

B. Coordinate with Section 09 2900 "Gypsum Board" for scheduling of installation and interface with supporting and adjoining system.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's catalog cuts and data sheets of products and accessories, including installation details and instructions, for each item specified.

B. Samples:
   1. Initial Samples: Complete chart of manufacturer's available colors for selection by Architect.
   2. Verification Samples:
      a. 6-inch-square samples of solid surfacing in each selected color.

1.4 INFORMATIONAL SUBMITTALS

A. Quality Control:
   1. Manufacturer's certification that PETG products meet specified physical and performance requirements. Results of tests specified shall accompany certification.
   2. Industry Certifications and Standards: Submit copy of documentation indicating compliance.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

B. Manufacturer: Minimum of 5 years’ experience manufacturing similar products.

C. Mockups: First installed example of each product shall serve as a mockup for review by Architect of workmanship, installation, and visual effect.
   1. Coordinate location of mockup with Architect.
   2. Make modifications when requested.
   3. Accepted mockups may remain as part of completed work.
   4. Comply with additional requirements of Section 01 4339 “Mockups.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store materials in manufacturer's original, unopened factory labeled packages, clearly identified with manufacturer's name, brand name, quality or grade, and fire hazard classification.

B. Store and handle materials in strict compliance with manufacturer’s instructions and recommendations.

C. Comply with additional requirements specified in Section 01 6000 "Product Requirements."

1.7 FIELD CONDITIONS

A. Store materials in area of application; allow three days for material to reach same temperature as area.

PART 2 - PRODUCTS

2.1 FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

A. Fiberglass Reinforced Plastic Wall Protection Panels: “Panolam FRP” by Panolam Industries International, Inc., Shelton CT, 877-726-6526, as specified and the basis of design, or equal. Panels shall comply with the following:
   1. Classic Collection: Color as selected by Architect from manufacturer’s full range.
   2. Surface Texture: Smooth.
   3. Fire Rating: ASTM E84, Class A.
   4. Thickness: 0.090 inches (2.3 mm).
   5. Barcol Hardness: ASTM D2583, 35 typical.
   6. Water Absorption: ASTM D570, 0.2 percent typical.
   7. Accessories: Color matched dividers, outside corners, inside corners, end caps and fastening rivets.
   8. Adhesive: As recommended by manufacturer.

2.2 FIBER REINFORCED LAMINATE (FRL) PANELS

A. Fiber Reinforced Laminate Wall Protection Panels: “Panolam FRL” by Panolam Industries International, Inc., as specified and the basis of design, or equal. Panels shall comply with the following:
   1. Color and Finish: As selected by Architect from manufacturer’s full range.
   2. Surface Burning Characteristics: US Standard UL-723/ASTM E84, Class A.
   3. Thickness: 0.075 inches (2 mm).
   4. Chemical resistant compliant with SEFA 8 requirements.
   5. Wear Resistance (Cycles): NEMA 3.13, 3500 typical.
   6. Flexural Strength: ASTM D790, 20,148 psi typical.
   7. Molding Profiles: Outside corners flat, outside corners round, division bars, inside corners, standard end caps.

8. Adhesive: Construction Adhesive #4319 by Franklin Adhesives and Polymers or equal approved by panel manufacturer.
9. Joint Caulking: 100 percent silicone based colored caulking; “Color Sil” by Color Rite, or equal approved by panel manufacturer.

2.3 PRIMER AND ADHESIVE

A. Vermin, mildew resistant and germicidal inhibiting type recommended by wall covering manufacturer for use on substrate to receive wall covering.

2.4 EDGE GUARDS OR WAINSCOT CAP TRIM:

A. "J" shape with groove to receive the wall covering.

B. Concealed edge feathered, not less than 19 mm (3/4 inch) wide.

C. Designed for adhesive attachment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. After finish painting of walls is complete, examine areas and conditions under which wall protection and guards are to be installed.
1. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
2. Beginning installation signifies acceptance of substrates and conditions.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer’s instructions and approved submittals.
1. Clean substrate of dirt, dust, waxes, and other bond breaking substances prior to beginning installation.
2. Install panels with bottom edge located to clear top of base.
3. Apply adhesive uniformly using adhesive manufacturer’s recommended trowel to the entire back of panels, completely to the edge (100 percent coverage).
4. Lay FRP and FRL panels in place leaving approximately 1/8 inch between panels, and 1/4 inch space top and bottom.
5. Follow adhesive manufacturer’s recommendations for set and application times.
6. Apply pressure to entire panel face with laminate type roller removing trapped air, and ensure proper adhesion between surfaces.
7. If no trim is used at panels, seal panel joints and top, side, and bottom edges with colored 100 percent silicone caulking to match panel color. Wipe smooth and remove excess caulk from panel face.

3.3 PATCHING:

A. Replace surface damaged wall covering in a space as specified for new work:
1. Replace full height of surface.
2. Replace from break in plane to break in plane when same batch or run is not used.
3. Double cut seams.
4. Adjoining differential colors from separate batches or runs is not acceptable.

B. Correct loose or raised seams with adhesives to lay flat with tight bonded joint as specified for new work.

3.4 ADJUSTING AND CLEANING

A. Replace installations out of plumb and not aligned with adjacent panels and construction.

B. Prior to time of final acceptance, strip protective coverings, and clean panel face to remove soiling, stains, dust, and dirt using clean rags and cleaning agents as instructed by manufacturer.

C. Leave installation clean, free of residue and debris resulting from work of this Section.

END OF SECTION

SECTION 10 2800

TOILET, BATH AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Contractor furnished and installed toilet, shower, and laundry accessories.

B. Related Requirements:
   1. Joint Sealers: Section 07 9200.
   2. Non-Structural Metal Framing: Section 09 2216; metal backing plates.
   3. Tiling: Section 09 3000.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittals.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Coordination:
   1. Coordinate submission of installation instructions so backing, blocking, and framing can be properly installed and work of other trades will not be delayed.
   2. Coordinate accessory locations with other work to avoid interference and to ensure proper operation and servicing of accessory units.

1.3 ACTION SUBMITTALS

A. Schedule and Shop Drawings:
   1. Schedule:
      a. Indicate type, quantities, sizes, and locations for accessories.
      b. Label manufactured items by product name.
   2. Drawings:
      a. Project-specific dimensioned details drawn to scale showing toilet accessories attachment to supporting construction, and other project specific conditions not detailed on the product data. Cross-reference details to plans and elevations.
      b. If requested by Architect, prepare and submit dimensioned plans and elevations drawn to scale and showing layout of toilet and shower accessories.

B. Samples: Full size of an accessory, if requested by Architect. Samples, if submitted, will be returned, and acceptable samples may be used in the work.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data and operating instructions.

B. Keys for each locking unit.

C. Warranties as specified.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Meet applicable requirements of Americans with Disabilities Act (ADA) and CBC for accessibility. When in conflict, comply with the most stringent.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials in original packaging to prevent soiling, physical damage, or wetting.

B. Protection:
1. Maintain protective covers until installation is complete.
2. Remove protective covers at final cleanup of installation.

C. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

1.7 WARRANTY

A. Manufacturer: Furnish a manufacturer’s written guarantee for mirrors against silver spoilage and all other defects in materials for 5-years from date of acceptance.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. General:
1. Except for the listed Bobrick items, products of other accessories by American Specialties Inc. (ASI), Bradley, or equal are acceptable subject to the requirement that products be of a single manufacturer and are compatible with the existing paper and soap products being used by the Public Safety Building. Accessories as follows and as shown on the Drawings.

B. Clothes / Coat Hook: Bobrick B-682.
1. Provide at Restroom, Bathroom, and Laundry doors.

C. Recessed Toilet Seat-Cover Dispenser, Waste Disposal, and Toilet Tissue Dispenser: Bobrick “ClassicSeries” B-3091.

D. Surface-Mounted Towel Pin: Bobrick B-6777.

E. Extra-Heavy-Duty Towel Bars with Concealed Mounting and Snap Flange: Bobrick B-530.

F. Grab Bars: Bobrick Series B-6806.
1. Size and Configuration: As shown on the Drawings.

G. Utility Shelf with Mop/Broom Holders and Rag Hooks: Bobrick B-224.
1. Provide at mop sink locations.

H. Framed Mirror: Bobrick B-2906.
1. Size: As indicated on the Drawings.

I. Automatic Wall-Mounted Foam Soap Dispenser: Bobrick B-2013.

J. Extra-Heavy-Duty Towel Bars with Concealed Mounting and Snap Flange: Bobrick B-530.
   1. Length: As shown on the Drawings.

K. Semi-Recessed Convertible Paper Towel Dispenser and Waste Receptacle: Bobrick B-3942.

L. Recessed Medicine Cabinet: Bobrick B-397.
   1. Mirror: No. 1 quality, 1/4" (6mm) thick, select float glass guaranteed for 15-years against silver spoilage.

M. Shower Accessories:
   1. Heav-Duty Shower Curtain Rod: Bobrick “ClassicSeries” B-6107, length as required for opening.
   2. Curtain Hooks: Bradley No. 9536.
      a. Provide one hook for each 6 inches of shower curtain.
   3. Vinyl Shower Curtain: Bobrick Part No. 204.
      a. Width: To match curtain rod at each location.
   4. Folding Shower Seat: ADA compliant; Bobrick B-5193.
      a. Length: Custom, as shown on the Drawings.
      b. Color: As selected by Architect.

2.2 ADDITIONAL PRODUCTS AND MATERIALS

A. Exposed Plumbing Insulation at Lavatories: ADA compliant, molded closed cell vinyl P-trap and angle valve under sink protective pipe covers; "Lav-Guard 2" by Truebro, Inc., 800-340-5969, or equal.
   1. Finish: Standard white.
   2. Provide with required accessories.

B. Fastenings: As standard with the accessory item manufacturer and as recommended by manufacturer for each substrate.
   1. Provide concealed unless otherwise shown or specified.
   2. If not concealed, provide theft-proof type to match accessory item finish.
   3. Hot-dip galvanize ferrous metal anchors and fastening devices.

C. Adhesive: Epoxy type contact cement meeting specified sustainable design requirements.

D. Concealed Anchor Plates: Anchor plates for grab bars to be installed at stud walls; Bobrick "Series 256,” or equal.

2.3 FABRICATION

A. Shop-assemble components and package complete with anchors and fittings.

B. Fabricate recessed units with seamless one-piece flange on exposed face.

C. Locked Dispensing Units: Key alike for all accessories using key number coordinated with City Representative.

D. Weld corners, leaving no open miters.

E. Provide mounting hardware appropriate to substrate.

F. Typical Metal Finish: Satin stainless steel.

G. Back paint components where contact is made with building finishes, to prevent electrolysis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check substrates and recesses for correct dimensions, plumbness of blocking or frames, preparation and other conditions that would affect installation of accessories.

B. Verify spacing of plumbing fixtures that affect installation of accessories.

3.2 INSTALLATION

A. Install accessories in locations and at heights indicated on the Drawings.

B. Install accessories in accordance with manufacturer's recommendations and code accessibility requirements, plumb, true to line, complete with all required fasteners and accessories, securely anchored to backing, blocking, or building structure.

C. Drill holes to correct size. Cut openings for recessed items with 1/4-inch tolerance so that cut is concealed by flange after application of item.

D. Mount recessed accessories into wall openings with wood screws through cabinet side into wood blocking or sheet metal screws into metal blocking or backing.

E. Mount surface-mounted accessories to solid backing or blocking; plumb and align.

F. Trademarks shall not be visible in the finished installation.

G. Sealants: Comply with requirements of Section 07 9200, “Joint Sealants.”
   1. Apply behind toilet accessories as necessary to ensure sanitary and watertight integrity of surfaces.
   2. Conceal sealants.

H. Framed Mirrors: Secure to concealed wall hanger in accordance with manufacturer's instructions for theft-resistant mounting.

I. Attach grab bars to backing installed in walls to withstand loads prescribed by CBC.

3.3 ADJUSTMENT AND CLEANING

A. Remove protective coverings in accordance with manufacturer's instructions.

B. Adjust accessories for proper operation.

C. After completion of installation, clean and polish exposed surfaces.

D. Deliver keys and instruction sheets in accordance with instructions provided by the Design-Builder.

END OF SECTION

SECTION 10 4400

FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire extinguishers, hangers and cabinets.
   2. Fire extinguisher signs.

B. Related Requirements:
   1. Painting and Coating: Section 09 9000; finishing of fire extinguisher cabinets.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for fire extinguishers and cabinets to be used.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data for fire extinguishers to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

B. Meet ADA and CBC requirements for mounting height and projection from wall.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Fire Extinguishers:
   1. Typical: Multipurpose dry chemical type, 5-pound capacity, UL Rating 2A-10B:C.
   2. Mechanical, Electrical Rooms, and Other Utility Spaces: Multipurpose dry chemical type, UL Rating 4A:20BC.

B. Fire Extinguisher Cabinets – Recessed: Larsen's "Architectural" Series, or accepted equal.
   1. Mounting: Fully-recessed.
   2. Size: To fit specified extinguishers.
   3. Cabinet Trim: Square, 5/16-inch, flat.
   4. Door Style: "Vertical Duo," with acrylic panel.
   5. Latching Device: Zinc-plated pull handle with self-adjusting roller catch.
   6. Material: Steel with white baked enamel finish suitable to receive topcoat in custom color selected by District's Representative.
   7. Provide mounting clips, suitable for extinguishers being provided, in each cabinet.
   8. Lettering: Die cut in vertical layout and color approved by Architect and acceptable to the local Fire Department.
   9. At Rated Partitions: Where continuity of fire-rated wall assembly is not shown, provide cabinet as above, but provide rated box; "Flame-Shield" by Larsen's, or equal.

C. Fire Extinguisher Cabinets – Surface Mounted: Larsen's "Architectural" Series or accepted equal.
   1. Mounting: Surface mounted.
   2. Size: To fit specified extinguishers.
   3. Door Style: "Vertical Duo," with acrylic panel.
   4. Latching Device: Zinc-plated pull handle with self-adjusting roller catch.
   5. Material: Steel with white baked enamel finish.
   6. Lettering: Die cut in vertical layout and color approved by Architect and acceptable to the local Fire Department.
   7. Provide mounting clips, suitable for extinguishers being provided, in each cabinet.

D. Fire Extinguisher Signs, if Required:
   1. Manufacturer: Larsen's #PTD-108.
   2. Material: Plastic, red background with white lettering and symbols.
   3. Configuration: 3D tent shape.
   4. Wording: "FIRE EXTINGUISHER", with symbol of extinguisher and down arrow.

E. Mounting Brackets for Surface-Mounted Extinguishers at Utility Areas: Larsen's 821, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRE EXTINGUISHERS AND CABINETS

A. Install cabinets and extinguishers where indicated on the Drawings and as required by the local Fire Department.
   1. Assume one extinguisher per 75 foot radius (maximum 75-foot travel distance from any given point to an extinguisher).
   2. Provide bracket-mounted extinguishers for surface-mounted extinguishers.
   3. Provide fire extinguisher in each cabinet.

B. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

C. Wherever exact location of units is not shown, locate as selected by Architect.

END OF SECTION

SECTION 10 5113

WIRE MESH STORAGE UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed, open-mesh gear lockers at Apparatus Bay.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal storage units can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Submit for each bank of lockers.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Show trim and accessories.

B. Product Data: Manufacturer's catalog cuts and data sheets for each type of metal locker and storage unit. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and cabinet.

C. Samples:
   1. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available in manufacturer's standard size.

D. Qualification data for installers.

E. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data and manuals for adjusting, repairing and replacing storage unit doors and latching mechanism.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal storage units until spaces to receive them are clean, dry, and ready for their installation.

B. Deliver materials to site in manufacturer's original, unopened containers with labels identifying product and manufacturer's name.

1.6 WARRANTY

A. Manufacturer: Furnish Owner with manufacturer's available warranty agreeing to repair or replace components of metal storage units that fail in materials or workmanship, excluding finish, within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Faulty operation of latches and other door hardware.
   2. Damage from deliberate destruction and vandalism is excluded.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Accessibility Requirements: For storage units indicated to be accessible, comply with applicable provisions of the ADA and CBC. When in conflict, comply with the most stringent.

2.2 GRID STORAGE UNITS AND STORAGE CABINETS

A. Manufacturer: GearGrid Corporation, Forest Lake, MN, 888-643-6694, as specified, or equal.

2.3 LOCKERS AND STORAGE UNITS

A. Wall-Mounted and Concrete Base Anchored Turnout Gear Lockers:
   1. Size: "Jumbo," 24 inches wide x 20 inches deep x 74-1/2 inches high.
   2. Shelves/Hooks: Two adjustable shelves with 3 minimum 0.192 wire adjustable apparel hooks per locker.
   3. Construction:
      a. Side and Back Grids: High-strength, 1/4-inch cold-rolled wire, with 3-inch overall grid.
      b. Shelves/Hooks: Two adjustable shelves constructed of high-strength 1/4 inch wire and with 3 adjustable apparel hooks of minimum 0.192 thick wire per locker.
      c. Mounting Brackets: 11 gage cold-rolled steel.
      d. Lockers shall be shipped knocked-down for field assembly and installation.
   4. Accessories:
      a. "GearDryer" coat/jacket drying hanger.
      b. "Helmet Holder."
      c. "Gearhanger" hanging rod.
      d. "SecureBox."
   5. Door Locks: 1-1/4 inch heavy-duty tubing with high-strength 1/4 inch wire with manufacturer built in deadlock as specified.

2.4 LOCKS

A. Provide manufacturer's built-in jimmy-resistant deadlock, Segal Lock #SE19361*1WK. Keying schedule to be provided by Owner.

2.5 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors:
1. Material, type, and size required for secure anchorage to each substrate.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Seismic Brace: Coordinate fabrication of all required attachment for structural brace at lockers with locker manufacturer.

2.6 FABRICATION

A. Construction: Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface, and on applicable accessories.

B. Fabricate metal storage units square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

C. Fabricate each unit with an individual door, shelf, and common intermediate uprights separating compartments.

2.7 FINISH

A. System components, excluding assembly and mounting hardware and stainless steel components are to be electro-statically coated with a durable TGIC powder coating with each metal surface prepared prior to coating in accordance with requirements of coating manufacturer.

B. Color: As selected by Architect from manufacturer’s full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install storage units at locations shown in accordance with manufacturer's instructions, plumb, level, and true; shim as required, using concealed shims.

B. Anchor single rows of storage units to walls. Anchor within 3 inches of vertical dividers, on both sides of intermediate dividers, and one side of end dividers.

C. Bolt adjoining locker units together to provide rigid installation.

D. Assemble knocked-down storage units with standard fasteners.

E. Attach door locks on doors using security-type fasteners.

F. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.

G. Adjust built-in locks to prevent binding of dial or key and ensure smooth operation prior to substantial completion.

3.3 PROTECTION

A. Protect installed products from damage, abuse, dust, dirt, stain, and paint. Do not permit use during construction.

B. Touch up marred finishes with factory supplied finish, or replace metal storage units that cannot be restored to factory finished appearance, prior to Substantial Completion. Use only materials and procedures recommended or furnished by storage unit manufacturer.

END OF SECTION

SECTION 11 3013

APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Residential grade appliances.
   2. Appliance options and accessories as required for complete finished operational installation.

B. Related Requirements:
   1. Architectural Wood Casework: Section 06 4100.
   2. Rough-in and Connection of Mechanical and Electrical Services as Required for Operation: Divisions 22 and 26.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittals.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Coordination:
   1. Coordinate sequence of installation with work of other Sections including casework and placement of utility stub-outs and shut-off valves.
   2. Coordinate fabrication of custom face panels with cabinetwork specified in Section 06 4100, “Architectural Wood Casework.”

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's catalog cuts of appliances with model numbers and optional accessories to be provided clearly marked.

1.4 CLOSEOUT SUBMITTALS

A. Manufacturer's warranty certificates, manufacturer's Owner’s Manuals including operating and maintenance instructions, and all other documentation included in packaging by manufacturer.

B. Test and inspection report of installed appliances.

1.5 QUALITY ASSURANCE

A. Certification Labels: Provide appliances which bear appropriate labels as follows:
   1. Energy Ratings: Provide energy guide labels with energy cost analysis (annual operating costs) and efficiency information as required by Federal Trade Commission.
   2. UL Standards: UL labels required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver appliances in manufacturer's undamaged protective containers, after spaces are ready to receive them.

B. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

1.7 WARRANTY

A. Manufacturers:
1. Provide manufacturers written warranties as available for the specified appliances in which manufacturer agrees to repair or replace appliances or components that fail in materials or workmanship within specified warranty period:

B. Service: Provide any required servicing on appliances for period of 12 months after installation during regular working days at no cost.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Seismic Performance:
1. Appliances weighing over 300 pounds shall be anchored to primary and/or secondary structure to withstand the effects of anticipated earthquake motions for the Project.
2. Seismic bracing and restraint shall be designed to meet the more stringent of the manufacturer's installation instructions and loading requirements from the CBC/ASCE 7-10, Chapter 13.

2.2 APPLIANCES

A. General:
1. Dimensions specified, and utility requirements, shall be verified with manufacturer for each Model.
2. Additional utility requirements for each item are shown on the Drawings and specified in Division 22, “Plumbing,” Division 23, “Heating, Ventilating and Air Conditioning,” and Division 26, “Electrical.”

B. French Door Refrigerator with Bottom Freezer: GE Model GFE28GSKSS, or equal.
1. Exterior Finish: Stainless steel.
2. Capacity: 27.7 cubic feet.
3. Dimensions (Less Door): 35-3/4 inches wide, 69 inches high, 29-3/8 inches deep.
4. In-door water and ice with water filtration system.

C. French Door Refrigerator with Bottom Freezer: GE Model GNE29GSKSS, or equal.
1. Exterior Finish: Stainless steel.
2. Capacity: 28.7 cubic feet.
3. Dimensions (Less Door): 35-3/4 inches wide, 69 inches high, 29-3/8 inches deep.
4. Factory-installed ice maker with water filtration system.

D. Dishwasher: Stainless steel interior dishwasher with hidden controls, integral food processer, and removable filter; GE Model No. GDT225SSLSS, or equal.
1. Width: 23-3/4 inches.
2. Depth: 23-1/2 inches.

3. Power: 120-volt, 15-amp circuit having 2-wire service with a separate ground wire.
4. Exterior Finish: Stainless steel.
5. Options: High temperature sanitizer.
6. Sound Rating: 51 dBA.

E. Slide-in Range: Slide-in front-control induction and convection range; GE Profile Model No. PHS930SLSS, or equal.
1. Width: 30 inches.
2. Capacity: 5.3 cubic feet.
3. WiFi connection.
4. Power: 120/208 VAC or 120/240 VAC, 60 hertz.

F. Hood: Wall mounted with integral lighting; “30 Inch Smart Designer Wall Mount Hood with Premier Venting,” Model No. UVW93642PSS, or equal.
1. Width: 36 inches.
2. Depth: 21 inches.
3. Rectangular ducting.
4. Fan: 4-speed.
5. Removable grease filters.

G. Font Load Washer: GE Model GFW550SSNWW, or equal.
1. Finish: White.
2. Capacity: 4.8 cubic feet.
3. Width: 28 inches.
4. Depth: 32 inches.
5. Power: 120V, 11.0A, 60 Hz.

H. Font Load Electric Dryer with Steam and Sanitize Cycle: GE Model No. GFD85ESSN with GE Pedestal Model No. GFP1528SNWW, or equal.
1. Finish: White.
2. Capacity: 7.8 cubic feet.
3. Power: 120V/240V, 5600W, 24A, 60Hz / 120V/208V, 4400W, 22A, 60Hz.

I. Microwave Oven: Built-in with turntable and glass-touch controls; Monogram Model No. ZEB1227SLSS, or equal.
1. Finish: Stainless steel.
2. Dimensions: 24-1/2 inches wide, 13-5/8 inches high and 19-3/4 inches deep.
3. Capacity: 2.2 cubic feet.
4. Optional Accessory: Trim kit.
5. Power: 1100W; 120V, 13.9A, 60 Hz.

J. Ice Machine: Self-cleaning, with water filter; KitchenAid Model No. KUID308H, or equal.
1. Finish: Stainless steel.
2. Dimensions: 26-3/4 inches high, 17-3/4 inches wide, 24 inches deep (less handle).
3. Capacity: 35 pounds of ice.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Locate utilities in accordance with appliance layout shown and connection locations on each appliance and item of equipment.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Built-in Equipment:
1. Securely anchor units to supporting cabinets or countertops with concealed fasteners.
2. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment:
1. Place units in final locations after finishes have been completed in each area.
2. Verify that clearances are adequate to properly operate equipment.
3. Securely anchor units, as required per Article 2.01.B above, to withstand the effects of anticipated earthquake motions for the Project.

D. Utilities: Comply with plumbing and electrical requirements.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

C. An appliance will be considered defective if it does not pass tests and inspections.

D. Prepare and submit a test and inspection report.

END OF SECTION

SECTION 12 2413

ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manually-operated window shades with single light filtering fabric at windows except at Apparatus Bays and Dorm Rooms.
   2. Manually-operated dual window shades with light filtering and blackout fabric at Dorm Rooms.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittals.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Shop Drawings:
   1. Submit for each mounting condition and each location, showing brackets, anchorage to substrate, and relationship to adjacent materials.
   2. Show seams, and multi-shade lengths.
   3. Show field-measured dimensions of openings scheduled to receive shades.

B. Product Data: Manufacturer's descriptive literature of controls, accessories, attachment brackets, and installation instructions. Include test reports from a qualified testing agency for each shade cloth verifying compliance with specified performance criteria.

C. Samples:
   1. Shadecloth: Minimum 12-inch square of each shade material. Mark face of material to indicate interior faces.
   2. Aluminum finish as selected.

D. Shades Schedule:
   1. Use same designations for openings or Room as indicated on Drawings.
   2. Show field-measured dimensions of openings scheduled to receive shades.
   3. Indicate chain location.

1.4 INFORMATIONAL SUBMITTALS

A. Installer qualifications.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturers’ recommended maintenance procedures for each type of shade, and two sets of any special tools that are required for inclusion in Owner’s Operations and Maintenance Manual.

B. Warranties as specified.

C. Maintenance materials as specified.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish the following extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shade cloth material, but no fewer than two units.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Installer: Employee of shade manufacturer or certified in writing by manufacturer as an acceptable installer of shade system.
   2. Manufacturer: Continuously engaged in manufacturing commercial window shades of the types required for not less than 10 years prior to date of this Contract.

B. Source Limitations:
   1. The system shall be furnished by a single-source supplier with a certification that all components including shade fabrics, have been designed and tested as a compatible system and will be available in the future for either replacement or add-on requirements.
   2. Each type of shadecloth shall be woven of the same yarns, have similar weaves, and shall be color matched by dye lot.
   3. Furnish shadecloth from the same dye lot at each Room.

C. Mockup:
   1. Install window shade mockup at one location for each type of shade to show full operation and appearance. Coordinate locations with Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

B. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on shop drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.10 WARRANTY

A. Manufacturer: Furnish the following manufacturer written warranties.
   1. Tracks, gear-and-sprocket mechanism, and accessories for shades shall be warranted for 5 years against defects in materials and workmanship which inhibit proper and intended functioning of products.
   2. Ten year warranty for shadecloth with the provision that it will not deteriorate, sag or warp and will remain fit for use for the full warranty period.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE REQUIREMENTS

A. Removal of shade shall not require disassembly of shade unit.

B. Drive Assembly:
   1. Shall be factory set for size and travel of shades.
   2. Shall be adjustable from exterior of shade unit without disassembly of hardware.
   3. Shall have a built-in shock absorber system to prevent chain breakage under normal usage conditions.

C. Shade Cloth:
   1. Shade cloth shall hang flat, without buckling or distortion.
   2. Edge, when trimmed, shall hang straight without raveling.
   3. An unguided roller shade cloth shall hang true and straight, without shifting sideways more than 1/8 inch in either direction due to warp distortion or weave design.
   4. Flame Retardance: Shade fabric shall be certified by an independent testing laboratory to pass NFPA 701 and applicable code requirements.

D. Each shade shall fully cover the opening where it occurs.

E. Shades shall have no seams, except where approved in advance in writing by Architect.

F. Provide a system which has been designed, developed, and manufactured as a totally integrated unit. The system shall be furnished by a single-source supplier with a certification that all components including shade fabrics have been designed and tested as a compatible system and will be available in the future for either replacement or add-on requirements.

G. Where more than one shade occurs in a pocket, locate chains for shades on same side of pocket.

2.2 SHADES

A. Manufacturer: MechoShades Systems Inc. as specified, or equal.

B. Type: Hand chain operated.

C. Configurations:
   1. Single shade, top down.
   2. Dual shade, top down.

2.3 MATERIALS AND COMPONENTS

A. Shade Materials:
1. Light Filtering, GreenGuard certified yarn system; “EcoVeil Screens” 0950 Series, or equal.
a. 3 percent open.
b. Color: To be selected by Architect.
2. Blackout: 75 percent vinyl (coating), 25 percent fiberglass (yarn); “Classic Blackout” 0700 Series.
a. Color: To be selected by Architect.

B. Fascia: Extruded aluminum with specified custom paint finish. Secure without exposed fasteners.

C. Hembar:
1. Concealed (sealed) hemtube at bottom.

D. Drive Assembly: Factory set for size and travel of shades.
1. Capable of field adjustment from the exterior of the shade unit without disassembling the hardware.
2. Provided with a built-in shock absorber system to prevent chain breakage under normal use conditions.

E. Chain: No. 10 stainless steel bead chain formed in a continuous loop.
1. Chain shall have a 90 pound test.
2. Retainer at Sloped Conditions, if Used: 1-inch x 7/8-inch x 3-inch plastic in standard color selected by Architect.

F. Miscellaneous Brackets, Fastenings, and Accessories: As detailed, or if not detailed, as recommended by shade manufacturer for conditions indicated on the Drawings or encountered.

2.4 FABRICATION

A. Workmanship: Fabricate shades in accordance with manufacturer's specifications and as detailed, complete with accessories necessary for specified operation.

B. Coordinate special pocket closure trim as shown on the Drawings with fabrication of aluminum curtain wall and window framing.

C. Factory Finish on Exposed Aluminum: Manufacturer’s standard coating.
1. Color: Custom, to match adjacent window framing, unless otherwise selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and openings to receive shades and conditions under which they are to be installed.

3.2 INSTALLATION

A. Install shades in accordance with manufacturer's installation instructions.
   1. Mount in pockets and enclosures as shown on the Drawings.
   2. Assure adequate clearance to permit unencumbered operation.
   3. Position units plumb and true, and securely anchor in place with brackets, clips, and fasteners.
   4. Allow for proper alignment of shade cloth and height of pocket to ensure bottom of shade cloth will align with bottom of pocket when shade cloth is fully retracted.

B. Each shade shall extend the full height and width of the window opening where it occurs.

3.3 ADJUSTING AND CLEANING

A. Verify operation. Adjust clearances to ensure free operation.

B. Remove protective coverings and devices.

C. Clean soiled shade surfaces and components in accordance with manufacturer’s written instructions and recommendations.

D. Replace damaged items with new material.

END OF SECTION

SECTION 12 3619

BUTCHER BLOCK COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Butcher block style wood countertops (“CT-3”).

B. Related Requirements:
   1. Architectural Wood Casework: Section 06 4100; casework to receive countertops.
   2. Joint Sealants: Section 07 9200.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action Submittals shall be submitted in accordance with Section 01 3300, “Submittals.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Shop Drawings: Prepare for each countertop in accordance with Section 1 Article entitled “Submittals” of the NAAWS document referenced in Article 1.06, “Quality Assurance.”
   1. Show items interfacing with countertops including relationship to supporting casework.
   2. Identify materials to be used, method of fastening, and fastener locations.

B. Samples: 8-inch x 8-inch piece of butcher block in specified wood and construction, and showing edge profile.

1.4 CLOSEOUT SUBMITTALS

A. WI Certified Compliance Certificate.

B. Manufacturer’s “Butcher Block: Care & Maintenance” instructions.

1.5 MAINTENANCE SUBMITTALS

A. One full size container of Oil and Conditioner, as used by manufacturer, for Owner’s future re-treatment.

B. One full size container of the following care and maintenance products for Owner’s future use, or equal by manufacturer of installed butcher block:
   1. “Boos Block Mystery Oil,” a food-grade oil that easily absorbs and penetrates deeply into the grain of the wood to help protect, revitalize and moisturize the wood fibers.
   2. “Boos Block Board Cream,” a natural, unbleached beeswax and food-grade oil formula, which is denser and thicker than the oil which gives a protective top layer to the wood surface against foods and liquids, and helps keep water out and the oil in.

1.6 QUALITY ASSURANCE

A. Standard for Materials and Workmanship: Comply with the applicable requirements for solid wood countertops of Section 11 - Countertops of the “North American Architectural Woodwork Standards (NAAWS)” published jointly by WI and AWMAC. (hereinafter referred to as "woodworking standard").

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver products until wet work, painting, and similar operations in storage and installation areas that could damage or soil work have been completed.

B. Protect products during transit, delivery, storage, and handling so as to prevent damage, soiling, and deterioration.

C. Store products only in areas where ambient conditions required can be and are maintained.

D. Coordinate delivery with fabrication and installation of custom casework.

E. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

PART 2 - PRODUCTS

2.1 MATERIALS

A. Butcher Block: John Boos & Co., Effingham, IL, 888-431-2667, or equal.
1. Material: Hard Rock Maple kiln-dried to maximum 6 percent moisture content.
2. Construction: Edge grain.
3. Edge Thickness: 3 inches.
4. Edge Profile: As shown.
5. Finish: Manufacturer’s standard penetrating oil.

B. Fasteners: Type and size as required.

2.2 FABRICATION

A. General:
1. Obtain field measurements, and verify dimensions before fabricating work.
2. Comply with NAAWS Custom Grade requirements and ANSI A161.2.

B. Fabricate to dimensions indicated on the Drawings.

C. Complete fabrication and assembly before shipment to site.

D. Precut openings for applied fixtures and fittings where applicable. Field cuts, if required, shall be performed by the fabricator.

E. Conceal fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that supporting casework is complete and ready to receive countertop.

3.2 INSTALLATION

A. Install countertops in accordance with Section 11 of the NAAWS and requirements shown on the Drawings.

B. Install work plumb, level, true, and straight, with no distortions using mechanical fasteners.

C. Shim as required, using concealed shims.

END OF SECTION

SECTION 12 3623

PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic laminate faced countertops (“CT-2”), and splashes.

B. Related Requirements:
   1. Architectural Wood Casework: Section 06 4100; casework to receive countertops.
   2. Joint Sealants: Section 07 9200.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittals.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

1.3 ACTION SUBMITTALS

A. Shop Drawings: Prepare for each countertop in accordance with Section 1 Article entitled “Submittals” of the NAAWS document referenced in Article 1.06, “Quality Assurance.”
   1. Show items interfacing with countertops including relationship to supporting casework.
   2. Identify materials to be used.
   3. Shop drawings for countertops may be submitted as part of shop drawings prepared and submitted under Section 06 4100, “Architectural Wood Casework.”

B. Samples: 8-inch x 10-inch piece of selected pattern and color of plastic laminate.

1.4 INFORMATIONAL SUBMITTALS

A. Fabricator qualifications as specified.

1.5 CLOSEOUT SUBMITTALS

A. WI Certified Compliance Certificate.

1.6 QUALITY ASSURANCE

A. Standard for Materials and Workmanship: Comply with the applicable requirements of Section 11 - Countertops of the “North American Architectural Woodwork Standards (NAAWS)” published jointly by WI and AWMAC. (hereinafter referred to as "woodworking standard").
   1. Where Contract Documents indicate requirements that conflict with or augment the woodworking standard, comply with the requirements approved by the Architect.
   2. Affix Certified Compliance Grade Label to each countertop.

B. Fabricator Qualifications: Active member of WI. Other fabricators will be considered for approval upon submission of at least 5 years of verifiable evidence of experience in successful completion of work similar to work of this Project. This provision does not waive compliance with specified WI certification.

C. WI Certified Compliance Program:
1. Countertops and the installation thereof for this Project shall be certified by fabricator for compliance to the Contract Documents:
a. WI licensees shall issue a Certified Compliance Certificate indicating the countertops being furnished and certifying that these products and their installation will fully meet all the requirement of the WI Grade specified. Certificate shall be submitted prior to delivery of countertops to the jobsite.
b. Non-licensees of the WI shall arrange to have a WI Inspector inspect the countertops after completion of fabrication and installation and furnish a Certified Compliance Certificate. Fabricator shall be responsible for all costs associated with corrections to fabricated or installed work as required to secure the WI Certified Compliance Certificate.
2. Fees charged by WI to either WI licensee or non-licensee are the responsibility of the fabricator.
3. Countertops and/or installation determined to be non-compliant by WI and not corrected will be rejected.
4. Issuance of the WI Certified Compliance Certificate is a prerequisite for final acceptance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver products until wet work, painting, and similar operations in storage and installation areas that could damage or soil work have been completed.

B. Protect products during transit, delivery, storage, and handling so as to prevent damage, soiling, and deterioration.

C. Store products only in areas where ambient conditions required can be and are maintained.

D. Coordinate delivery with fabrication and installation of custom casework.

E. Comply with additional requirements specified in Section 01 6000, “Product Requirements.”

PART 2 - PRODUCTS

2.1 MATERIALS

A. Particle Board: 3/4 inch thick, conforming to ANSI A208.1, Grade M2, made with moisture-resistant resin.

B. Plastic Materials:
1. High-Pressure Plastic Laminate: Conforming to NEMA LD3.1 and ISO 4586-2.
2. Grades:
a. Horizontal Surfaces and Backsplash: ISO 10/HGS; horizontal, general purpose.
b. Postforming: ISO 12/HGP; horizontal, general purpose, postformable.
c. Backing Sheet: ISO 91/BKL; backer, light duty.
3. Manufacturers, Colors and Patterns: As scheduled; Wilsonart, or equal.

2.2 ACCESSORIES

A. Grommets: Doug Mockett & Co. Inc., Manhattan Beach, CA, 310-318-2491, or equal.
1. Type: SG Series, or EPP Series; coordinate with data connection requirements.
2. Material and Color: As selected by Architect.

B. Fasteners: Type and size as required.

C. Adhesives: VOC compliant and passing NAAWS "Heat Resistance Test.". Do not use adhesives that contain urea formaldehyde.

2.3 FABRICATION

A. General:
1. Obtain field measurements, and verify dimensions before fabricating work.
2. Comply with NAAWS Custom Grade requirements and ANSI A161.2.

B. Fabricate to dimensions, profiles, and details indicated on the Drawings.

C. Return substrate and plastic laminate at bottom edge of self-edged countertops.

D. Provide backsplashes and returns where shown.

E. Provide joints only were maximum available lengths or countertop configuration requires a joint and where interfacing with existing. Where joints are required, balance and center.

F. To greatest extent possible, complete fabrication and assembly before shipment to site.
1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide extra borders and edges so as to allow scribing and trimming to fit.

G. Precut openings for applied fixtures and fitting, where possible. Field cuts shall be performed by the fabricator.

H. Conceal fasteners.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that backing has been installed at appropriate locations for anchorage.

B. Examine shop-fabricated work for completion. Complete work as required.

3.2 INSTALLATION

A. Install countertops in accordance with Section 11 of the NAAWS and requirements shown on the Drawings.

B. Make joints neatly, with uniform appearance.

C. Install work plumb, level, true, and straight, with no distortions. Install with no variation in flushness of adjoining surfaces.

D. Shim as required, using concealed shims.

E. Scribe and cut to fit adjoining work.

F. Sealant: Install sealant as specified in Section 07 9200, "Joint Sealants," as required to close any small unavoidable gaps between counter and abutting surfaces. Sealant shall not be a substitute for tightly scribed work.

END OF SECTION

SECTION 12 3662

STAINLESS STEEL COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Stainless steel countertops (“CT-1”), integral sinks, and splashes.

B. Related Requirements:
1. Architectural Wood Casework: Section 06 4100.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action and Informational Submittals shall be made in accordance with Section 01 3300, “Submittal Procedures.”
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Coordination:
1. Coordinate delivery with fabrication and installation of supporting casework, and underlayment.
2. Coordinate openings and penetrations in countertops with information provided under other Sections and as Scheduled.
3. Coordinate the work with plumbing and electrical rough-in and appliances.

1.3 ACTION SUBMITTALS

A. Shop Drawings:
1. Submit top views, elevations and sections showing countertop and backsplash edge profiles. Indicate dimensions, material thickness, location and sizes of cutouts, anchorage provisions and attachment methods. Indicate coordination requirements with adjacent and interfacing work.
2. Prepare in coordination with casework shop drawings specified under Section 06 4100, “Architectural Wood Casework.”

1.4 INFORMATIONAL SUBMITTALS

A. Statement of fabricator qualifications.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: The firm fabricating countertops shall specialize in quality stainless steel food service equipment.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver products until wet work, painting, tiling, and similar operations have been completed.

B. Coordinate delivery with fabrication and installation of casework and countertops provided under other Sections.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A666, Type 304, hardest workable temper, stretcher leveled.
   1. Sheet Thickness: 0.0625-inch (16-gauge) thick.
   2. Sheet Size: Largest size to provide minimum number of joints.
   3. Finish: AISI/SSINA #4.

B. Adhesive: VOC compliant, water-resistant, of type, grade, and class best suited for the intended use.

C. Panel Substrate and Support, if Used: Medium-Density fiberboard (MDF), ANSI A208.2, Grade 155 MR50, moisture resistant using formaldehyde free adhesive system, "Medex" by SierraPine Composite Solutions, Roseville, CA, 800-676-3339, or equal.
   1. Thickness: As shown.
   2. Paint all cuts, edges and surfaces with shop applied primer/sealer. Seal all edges with one coat “B-I-N Shellac-Based Primer/ Sealer” by Zinsser or accepted equal.

D. Backing Sheet, if Used: Conforming to NEMA LD3.1 and ISO 4586-2ISO 91/BKL.
   1. Grade: Backer, Light Duty; ISO 91/BKL.

2.2 FABRICATION

A. General:
   1. Make job measurements for proper fabrication of the work.
   2. Coordinate dimensions and attachment methods of stainless steel countertops with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.
   3. Shop-assemble countertops for delivery to site in units easily handled and to permit passage through building openings and transportation facilities.

B. Design: As indicated on the Drawings.

C. Grain of stainless steel sheets in the same plane shall run in the same direction.

D. Fabricate countertops to conform to NSF "Standard No. 2, Food Service Equipment and Appurtenances."

E. Bond stainless steel to substrate with adhesive.

F. Provide countertop with raised box marine edge profile as shown.

G. Turn up back and end splashes to height, length, and extent noted.

H. Construct with butt-edge joints, welded and ground smooth so no evidence of welding will appear.
   1. Comply with AWS D9.1/D9.1M for recommended practices in shop welding. Make welds continuous on exposed surfaces.
   2. Neither tinning of welds nor soldering of joints will be permitted.

3. Control welding temperature to avoid discoloring adjacent metal.
4. Clamp components in jigs during welding to avoid distortion.
5. Clean exposed welded joints of welding flux, and dress exposed and contact surfaces to be invisible, under normal lighting conditions, from adjacent surfaces.
6. Alligatored, discolored and warped components will be rejected.

I. Provide stainless steel integral drain board, side and back splashes.

J. Do not solder, rivet, or use other visible fasteners in the work.

K. Field Joints: Locate as necessary for convenient shipping and installation.

L. Apply sound-damping compound by trowel or spray to hydrodynamically smooth surface on concealed portions of backsplashes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install work plumb and level and in conformance with NSF Standards and reviewed submittals.

B. Countertops shall be installed plumb, level and rigid. Shim as necessary with concealed shims.

C. Complete equipment assembly where field assembly is required.
1. Provide closed butt and contact joints that do not require a filler.
2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish.

D. Replace material that is scratched or otherwise defective.

E. Neatly scribe to adjoining surfaces. Install sealant as specified in Section 07 9200, “Joint Sealants” as required to close any small unavoidable gaps between counter and splash and abutting surfaces. Sealant shall not be a substitute for tightly scribed work.

3.2 ADJUSTING AND CLEANING

A. After installation, wipe finished surfaces, and leave in clean condition.

B. Touch up, refinish, or replace damaged, stained, scratched, or otherwise disfigured items to the satisfaction of the Architect.

END OF SECTION

SECTION 14 2400

HYDRAULIC ELEVATOR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pre-engineered, machine-room-less hydraulic elevator as shown on the Drawings.

B. Related Requirements:
1. Metal Fabrications: Section 05 5000; miscellaneous steel supports and framing not provided under this Section, pit ladder.
2. Tiling: Section 09 3000; elevator cab floor tile.
3. Heating, Ventilating and Air-Conditioning: Division 23.
4. Electrical: Division 26.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Electrical Coordination:
1. Refer to the electrical Drawings and Specifications, Division 26 for the service voltage, power feed and control wiring for equipment specified under this Section.
2. Verify that the electrical services (power, control, interlock, etc.) provided are adequate and compatible with the elevator equipment requirements.

C. Sequencing and Scheduling: Contractor shall be responsible for coordinating related work with other trades to avoid omissions and delays in job progress.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Include plan and section of hoistway, and pit.
1. Include seismic, static, and dynamic loads imposed on building structure.
2. Show required clearances around equipment.
3. Details of cab, fixtures, and entrances.

B. Product Data: Manufacturer's catalog cuts for:
1. Hall and car buttons and position indicators.
2. Independent control switches in locked service cabinet.

C. Samples: 6-inch square panels and 12-inch lengths of materials and finishes exposed to view. Provide samples of additional materials if specifically requested by Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Letter from the elevator manufacturer attesting to the manufacturer’s responsibility for the “agent” and installation.

B. Certification for each welder.

1.5 CLOSEOUT

A. Closeout:
1. Extended warranty.
2. Maintenance contract.
3. Single-line electrical wiring diagram for elevator system.
a. Wiring diagrams shall be as built, specific for this installation, and reference identification on Drawings shall match points identified on terminals of controller.
4. Operation data. Include description of method of operation and control and special features provided. Provide technical information for servicing operating equipment.
5. Maintenance data including parts catalogs and one copy of master schematic and lubrication chart.
6. Test and approval certificates issued by jurisdictional authorities.
7. Reports of tests conducted under "Field Quality Control" Article of this Section.
8. Certification that installed system meets specified design and performance requirements.
9. Record as-built drawings, same scale and information as specified for shop drawings.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
1. Manufacturer's representative or authorized agent of elevator equipment manufacturer.
2. Minimum 5 years' experience installing elevators.

B. Welder Qualifications: Certified and qualified in accordance with procedures specified in American Welding Society Standard in accordance with AWS D1.1/D1.1M, using procedures, materials, and equipment of the type required for the work.

C. Requirements of Regulatory Agencies:
1. California Title 8, State Elevator Safety Order 3041c, and other applicable state and local codes.
2. "American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks," ANSI A17.1.
3. California Elevator Safety Construction Code.
4. Provide barrier-free access as required by the Americans with Disabilities Act (ADA) and CBC. Comply with most restrictive requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials in original protective packaging; prevent soiling, physical damage, or wetting.

B. Fully protect equipment from time of delivery until installation is completed.
1. Protect equipment and exposed finishes during transportation and erection against damage and stains.
2. Ship in crated sections, sized to permit passing through available spaces.

1.8 FIELD CONDITIONS

A. Space Requirements:
1. Drawings indicate space requirements for installation of elevator equipment and system used as the Basis of Design.
2. If different space is required to accommodate equipment of other manufacturers, submit drawings indicating required revisions.
a. Should changes involve extra cost, either initially or resulting from changes to work in place, pay for such costs, including required design change costs.
b. Owner reserves the right to reject space requirements different than those shown if, in Owner's opinion, they would have a detrimental effect on the Project.

B. Sequencing and Scheduling: Schedule and coordinate related work by other Sections.

C. Temporary Use of Elevator: Only as agreed upon in writing by Contractor and Owner.

1.9 WARRANTY

A. Contractor: 2 year labor and materials warranty for entire system.

1.10 MAINTENANCE

A. Furnish full protective maintenance for elevator system for a period of 12 months after acceptance by the Owner. Maintenance shall consist of monthly systematic examination, adjustment or repair or replacement, and lubrication of all elevator components.
1. Inspect, clean, lubricate, and provide lubricants to door-operator equipment, including linkages, drive motor, speed-reduction unit, safety-shoe and light-ray devices, pumps, pump motors, electromechanical valves, controller equipment, interlocks, coils, contacts, resistors, magnet frames, contact-switch assemblies, braid, springs, controller fuses, insulators, solenoids, resistor grids, and other mechanical parts.
2. Make necessary adjustments that can be made during regular inspections.
3. Examine and make minor adjustments to accessory equipment, including re-lamping signal equipment, as follows:
a. Car stations.
b. Electric door operators.
c. Interlocks.
d. Door hangers.
e. Safety edge and photoelectric cells.
4. Provide, when necessary, carbon and copper-and-silver contacts where contacts are renewable, contact insulations, contact springs, and shunts for controller switches.
5. Repair or replace electrical and mechanical parts of elevator equipment whenever required, using only standard parts produced by original manufacturer of equipment.
6. Replace parts and components as often as necessary to maintain an adequate factor of safety, and provide and maintain normal operation and service.
7. Check operation of fire service during normal daytime working hours.
8. Repairs necessitated by negligence, improper use, vandalism, or misuse of equipment, except ordinary wear and tear, are not a responsibility of this maintenance requirement.

B. Perform maintenance with trained competent personnel under supervision of and in direct employ of elevator installer during regular working hours, unless prior arrangements involving premium overtime work are made.

C. Provide emergency call-back service, 24 hours per day, 7 days a week, at no additional cost.
   1. Response Time for Emergency Callbacks:
      a. Regular Hours: Within 1 hour.
      b. Overtime hours: Within 2 hours.
      c. Trap Call: Within 1/2 hour.

D. Contractor will be paid for overtime portion of labor for repairs performed during overtime hours. A repair is defined as work requiring more than one technician to perform the work.

E. Prior to expiration of maintenance service included in Contract, make a thorough check of:
   1. Car rails.
   2. Car sling.
   3. Car alignment.
   4. Make adjustments as required for smooth car ride.
   5. Demonstrate that all equipment and components are operating in accordance with specified requirements. Provide a written report, showing test reports for performance times, vibration, and sound levels.

1.11 PERMITS, TESTS, AND INSPECTIONS

A. Obtain and pay for all required permits and inspections.

B. The Contractor shall be responsible for coordinating necessary and required inspections with the State Elevator Inspector.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Elevator: “Otis HydroFit 2100 Elevator System” by Otis Elevator Company, Farmington, CT, 800-233-6847, as specified herein and the basis of design, or equivalent system by ThyssenKrupp Elevator Corporation, 844-427-5461, Schindler Elevator Corporation, 973-397-6500, or equal. System of other manufactures meeting the specified quality and performance requirements shall be submitted for consideration in accordance with Section 01 2500, “Substitution Procedures.”

2.2 SYSTEM DESCRIPTION

A. Seismic Zone: Meet requirements for Seismic Zone 4.

B. Performance Criteria:
   1. Speed variation under any loading condition in either direction shall be no more than 20 percent.
   2. Leveling:
      a. Within 1/4 inch under any loading condition.
      b. Car shall level into floor and shall not overrun floor and then level back.
   3. Vibration and Sound Control:
      a. Provide vibration isolation for platform.
      b. Isolate pumping plant from building structure to prevent objectionable noise transmission.
      c. Provide sound isolation coupling in oil line.

d. Provide flexible couplings to reduce pipe-borne noise where hydraulic lines attach to pump capable of withstanding pressures specified by elevator manufacturer and in compliance with code.
e. Provide hydraulic oil heater. Do not allow pump to cycle with the elevator cab remaining stationary.
f. Provide a neoprene pad between the plunger and elevator cab.
g. Provide resilient roller guide tires.

C. Elevator Requirements:
1. Capacity: 2,100 pounds.
2. Car Speed: 100 feet per minute.
3. Stops: 2.
4. Openings: Front
5. Total Rise: 11 feet, 5 inches.
6. Cab Height: 7 feet, 9 inches.
7. Cab Width: 5 feet, 8-5/16 inches.
8. Cab Depth: 4 feet, 3-9/16 inches.
9. Cab and Hoistway Entrances: 3 feet, 6 inches clear, side opening.

D. Signals:
1. Brushed stainless steel standard car operating panel including round illuminated buttons.
2. Hall buttons and lanterns, with flat metal brushed stainless steel faceplates, mounted on wall and brushed stainless steel flat buttons.

E. Mechanical/Electrical:
1. Power Supply: Alternating current, 480 volt, 3 phase, 60 Hz.
2. Lighting Supply: Alternating current, 120 volts, 15 Amp, 60 Hz.
3. Ventilating fan.
4. Wiring to elevator controller for telephone and alarm bell.

F. Emergency and Inspection Features:
1. Alarm bell.
2. Special emergency service (firefighters service Phase 1 and Phase II) as required by governing authorities.
3. Emergency car lighting.
4. Key-operated switch at both Floor Level landing call button stations to shut down elevator.
5. Emergency exits, including emergency top exit, interlocked as required by code.
6. Emergency battery lowering for elevator not connected to an emergency power system.
7. ADA compliant, built-in, flush-mounted, hands free telephone with trail cables. System shall automatically dial preprogrammed number of monitoring service.

G. Door Protection: Multi-beam, infrared, full-screen, electronic sensing device, projecting across entrance to prevent car and hoistway doors from closing if a light ray is interrupted.

H. Other Features:
1. Electronic door edge.
2. Braille floor designations.

2.3 HOISTWAY ENTRANCES

A. Rating: Entrance assembly shall bear a Class B label by UL or other Testing Laboratory acceptable to governing authorities.

B. Brushed stainless steel standard returns, header and car door.

C. Brushed stainless steel flat bar handrails, sides only.

D. Elevator Doors: Flush solid panels; 16 gage stainless steel, finish as scheduled. Inner surface shall be sound deadened.

E. Threshold: Material as specified, with slip resistant surfaces and grooves suitable for guides; no exposed screws.

2.4 CAB MATERIALS AND FINISHES:

A. Side and Rear Walls: Manufacturer's standard stainless steel wall panels.

B. Base: 4 inches high, stainless steel.

C. Front Return Panels: Stainless steel.

D. Ceiling: Manufacturer's standard stainless steel panels.

E. Cab Floor: Plywood, suitable for installation of ceramic tile flooring.

F. Cab Doors: Stainless steel.

G. Cab Door Frame: Stainless steel.

H. Cab Thresholds: Extruded aluminum, mill finish with grooved surface.

2.5 DOOR CONTROL FEATURES:

A. Door control to open doors automatically when car arrives at a landing in response to a normal hall or car call.

B. Elevator doors shall be provided with a reopening device that will stop and reopen the car door and hoistway door automatically should the doors become obstructed by an object or person.

1) Door protection shall consist of a two-dimensional, multi-beam array projecting across the car door opening.

C. Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.

2.6 MATERIALS

A. Structural Steel Shapes and Plates: ASTM A36/A36M.

B. Structural Tubing: ASTM A500/A500M Grade B, or ASTM A501/A501M.

C. Sheet Steel:
   1. Exposed: ASTM A755/A755M; stretcher-leveled, cold-rolled, commercial-quality carbon steel, matte finish.
   2. Unexposed: ASTM A1011/A1011M; hot-rolled, commercial-quality, carbon steel, pickled and oiled.

D. Stainless Steel: 300 Series, with standard tempers and hardness required for fabrication, strength, and durability.

E. Aluminum:
   1. Extrusions or Cast: ASTM B221.
   2. Sheet and Plate: ASTM B209/B209M.
   3. Sills: Extruded aluminum, with grooved surface, 1/4 inch thick, mill finish.

F. Bolts, Nuts, and Washers: ASTM F3125/F3125M..

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Protective Coating for Unexposed Steel and Iron: Manufacturer's standard rust-resistant primer.

2.7 OPERATION REQUIREMENTS

A. Operation: Single car "Selective Collective Automatic Operation" as defined in ASME A17.1 using a microprocessor-based controller, the operation shall be automatic by means of the car and hall buttons.

B. Independent Service: Provide independent service so that, by means of a switch located in car panel, car can be operated with an attendant.
   1. Attendant shall have full control of starting, stopping, and direction of car travel. Car shall respond only to car buttons.
   2. Hall signals shall not operate for cars on independent service.

C. Operation under Fire or Other Emergency Conditions: As defined in ASME A17.1 and CBC, Title 8.
   1. Home Floor: First Floor.

2.8 SIGNAGE AND SIGNAGE ACCESSORIES

A. Braille and Arabic Symbol Plates: Provide ADA compliant stainless steel plaques on both sides of hoistway entrance frames at 60 inches to center line above floor in order to locate entrance and identify floor at which entrance occurs.
   1. Provide 2-inch-high Arabic numerals and Braille numerals raised 1/16 inch, minimum.
   2. Comply with ADA requirements.

B. Engraved fire-exiting instructions as required by governing authorities.

C. Certificate frame in elevator cab.

2.9 ADDITIONAL COMPONENTS AND ACCESSORIES

A. Struts and Closer Angles: Structural steel of sufficient size to accommodate door closers.

B. Angles shall be continuous and securely bolted to sills and building beams above.

C. Hanger Supports or Headers: 3/16-inch-thick formed-steel sections, securely bolted to the strut angles or closer support angles.

D. Hanger Cover Plates: 16 gage steel.
1. Extend full travel of doors.
2. Make covers in sections for access.
3. Sections above door openings shall be removable from within elevator car.

E. Facia Covers: 16 gage steel; reinforce to ensure a flat surface. Securely fasten to hanger supports and sill above.

F. Dust Covers: 16 gage steel; extend over hanger support the width of jamb opening plus jamb flanges at the top landing for which facia plates are not supplied.

G. Toe Guards: 16 gage steel; provide at bottom landing. Extend to wall on a gradual bevel from sill nosing.

H. Pit Ladder: As specified in Section 05 5000, "Metal Fabrications"

2.10 FINISHES

A. Stainless Steel: No. 4 brushed, unless otherwise shown or specified.
1. Follow federal and NAAMM nomenclature for texture and reflectivity required. Protect with adhesive plastic film or paper covering.
2. Finishes specified as "brushed" shall be manufacturer's standard directional polish complying with AISI No. 4 requirements.

B. Hoistway Equipment: One coat machine black. Equipment shall include but not be limited to car slings, pit equipment, and guide rails, except machined surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to commencing installation of elevator equipment, examine the following, and verify that no irregularities exist that would affect quality of execution of work.
1. Hoistway size and plumbness.
2. Sill pocket and supports.
3. Anchor brackets.

3.2 INSTALLATION

A. General:
1. Install elevator in accordance with accepted manufacturer's directions, ANSI A17.1, and CBC.
2. Install items so that they may be removed by portable hoists or other means for easy maintenance.

B. Telescoping Cylinder/Plunger Installation:
1. Set cylinder plumb and at proper elevations. Anchor securely in place, supported at pit floor.
2. Plunger shall be plumb with elevator at any elevation.

C. Welded Construction: Provide welded connections where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards.

D. Install piping above floor, where possible. Where not possible, cover underground piping with permanent protective wrapping before backfilling.

E. Alignment:
1. Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars.
2. Where possible, delay installation of sills and frames until car is operable in shaft.
3. Reduce clearances to minimum, safe, workable dimension at each landing. Provide minimum clearances to comply with ASMR A17.1.

3.3 FIELD QUALITY CONTROL

A. Inspect and test elevator system to verify compliance with specified design and performance requirements, including vibration requirements.

B. Inspections by Regulatory Authorities:
1. Have acceptance inspection required by local authority performed by enforcing agency.
2. In addition to inspections and tests required by local authority, perform all applicable inspections and tests contained in Part I and II of ANSI A17.2.
3. Schedule tests with agencies, Architect and Contractor present.

C. Make a final check of elevator, with Architect present, prior to turning elevator over for use. Verify that control systems and operating devices are functioning properly. Adjust as required.

3.4 ADJUSTING AND CLEANING

A. Adjustments:
1. Adjust equipment to operate within accepted design tolerances.
2. Adjust car-leveling devices.
3. Lubricate all equipment in accordance with accepted manufacturer's written instructions.

B. Cleanup and Touch-up:
1. Remove all materials and filings, rust, and construction debris from hoistway surfaces.

END OF SECTION

SECTION 14 4216

VERTICAL WHEELCHAIR LIFT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Unenclosed, self-contained vertical platform wheelchair lift including all components for proper chair lift operation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:
   1. Action and Informational Submittals shall be submitted in accordance with Section 01 3300, “Submittal Procedures.”
   2. Closeout Submittals shall be submitted in accordance with Section 01 7700, “Closeout Procedures.”

B. Coordinate with Division 26, “Electrical,” for operation of door and electrified hardware in conjunction with lift operation.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Show rough-in requirements, power and wiring requirements, mounting arrangements, and relationship to adjacent construction.
   1. All welds, both shop and field, shall be indicated by AWS "Symbols for Welding, Brazing and Nondestructive Examination," A2.4.

B. Product Data: Manufacturer's catalog cuts for lift and controls.
   1. Catalog cuts and templates where necessary to explain construction and to provide for incorporation into the work.
   2. Specifications and installation recommendations as applicable.

C. Samples: Manufacturer’s sets of color chips representing full range of available colors.

1.4 INFORMATIONAL SUBMITTALS

A. Statement of installer qualifications.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data and Operating Instructions:
   1. Before acceptance of work, furnish job specific manufacturer’s equipment brochures and service manuals. Manuals shall be model/series specific.
   2. Assemble and index printed materials in organized fashion, and provide a complete digital copy on CD or other portable media, consisting of:
      a. Equipment and components, descriptive literature.
      b. Performance data, model number.
      c. Installation instructions.
      d. Operating instructions.
      e. Maintenance and repair instructions.
      f. Spare parts lists.

g. Lubrication instructions.
h. Record layout drawings.
i. Wiring diagrams.

B. Test certificates and permits.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
1. Manufacturer's representative or authorized agent of equipment manufacturer.
2. Minimum 2 years' experience installing lifts.

B. Welder's Qualifications: Welding shall be performed by certified welders qualified in accordance with procedures specified in American Welding Society Standard in accordance with AWS D1.1/D1.1M using procedures, materials, and equipment of the type required for the work.

C. Requirements of Regulatory Agencies:
1. "American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks," ASME/ANSI A17.1.
a. Static Load Test: Load ratings and safety factors shall meet or exceed those specified in ASME/ANSI A17.1 Part XX Section 2001 for public buildings.
2. “Safety Standards for Platform Lifts and Stairway Chairlifts,” ASME/ANSI A18.1.
3. Provide barrier-free access for the physically handicapped as required by California Code of Regulations (CCR) Title 24, Article 7-15, the Americans with Disabilities Act (ADA) requirements and CBC. Comply with most restrictive requirements.

D. Operating Qualities: Architect will judge riding qualities of car and enforce the following requirements. Make necessary adjustments.
1. Starting and stopping shall be smooth and comfortable.
2. Slowdown, stopping, and leveling shall be without jars or bumps.
3. Full Speed: Riding shall be free from vibration and sway.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Machines and controls shall be enclosed in plastic-type bag or equal prior to equipment use. Store materials in original protective packaging; prevent soiling, physical damage, or wetting.

B. Protect equipment and exposed finishes during transportation and erection against damage and stains.

C. Comply with additional requirements specified in Section 01 6000, "Product Requirements."

1.8 PERMITS, TESTS, AND INSPECTIONS

A. Obtain and pay for required permits and inspections.

B. Perform tests as required by legal requirements, regulatory agencies, and District.

1.9 WARRANTY AND MAINTENANCE CONTRACT

A. Manufacturer: Furnish District with manufacturer’s 2-year written warranty for the wheelchair lift materials and factory workmanship.

1. Warranty shall include an agreement for full maintenance during warranty period by skilled employees of gate installer.
2. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation.
3. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
4. Perform maintenance, including emergency callback service, during normal working hours.

PART 2 - PRODUCTS

2.1 VERTICAL PLATFORM LIFT

A. Manufacturer and Product: “Multilift” by Savaria, 1504 Type 2 Platform Lift, 800-661-5112.

B. Lift Characteristics:
1. Capacity: 750 pounds rated capacity.
2. Platform Size and Nominal Clear Platform Dimensions: (Type 2 with platform gate, unenclosed hoistway) 34 inches by 48 inches.
3. Platform Configuration: Straight through, front and rear openings.
4. Landing Openings: Self-closing gates.
   a. Gate Height: 42-1/8 inches.
   b. Platform gate shall travel with platform and opens at lower landing.
   c. Upper Landing Gate: Installed at upper landing.

2.2 FABRICATION AND COMPONENTS

A. Lift Components:
1. Machine Tower: Custom aluminum extrusion.
2. Base Frame: Structural steel.
3. Platform Side Wall Panels: 16 gage galvanized steel sheet.
4. Platform Access Ramp: Automatic folding type, 12 gage galvanized steel plates with slip resistant surfaces.
5. Side Guard Panels: 42-1/8 inches high mounted on platform.

B. Mounting: Base of lift shall be mounted on the floor surface of the lower landing.

C. Drive System:
1. Drive Type: ACME screw.
2. Emergency Operation: Manual device to lower platform and battery auxiliary power to raise or lower platform.
3. Safety Devices:
   a. Slack chain safety device.
   b. Shoring device.
4. Nominal Travel Speed: 8 feet per minute.
5. Motor: 1 hp (0.75 Kw) motor, 110 VAC.
6. Power:
   a. Supply: 120 VAC single phase; 60 Hz on a dedicated 15 amp circuit.
   b. System: Powered by continuously charged battery system.

D. Platform Controls: Electronic-free relay logic controller.
1. Direction Control: Constant pressure rocker switch.

2. Illuminated and audible emergency stop switch shuts off power to lift and activates audio alarm with battery backup.
3. Operation: Keyless.
4. Call/send station at landings.
5. Continuous-pressure type buttons.
6. Operation control buttons on platform.
7. Emergency manual lowering/rasing device.
8. Non-skid platform surface.Call Station Controls: 24 VDC control circuit with the following features.
1. Direction Control: Constant pressure rocker switch.
2. Keyless operation.
3. Call Station Mounting:
   a. Lower: Wall mounted surface.
   b. Upper: Frame mounted.

F. Safety Devices and Features:
1. Grounded electrical system with upper, lower, and final limit switches.
2. Tamper resistant interlock to electrically monitor that the gate is in the closed position and the lock is engaged before lift can move from landing.
3. Pit stop switch mounted on mast wall.
4. Electrical disconnect shall shut off power to the lift.
5. Under platform safety pan with five waterproof safety switches to detect obstruction under platform.

G. Finishes
1. Aluminum Extrusions: Champagne anodized finish.
2. Ferrous Components: Electrostatically applied baked powder finish, fine textured.
   a. Color: Satin Grey, RAL 7030; as selected and confirmed by the Architect from manufacturer’s optional RAL color chart.
3. Lift Finish: Beige electrostatic powder coat paint on all steel surfaces and vacuum-formed plastics.

H. Additional Requirements: As specified on the Drawings. In case of discrepancy, the more rigorous requirement shall govern.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that designated location is satisfactory for proper installation of equipment.

3.2 INSTALLATION

A. Install equipment in locations shown on the Drawings, in accordance with the equipment manufacturer's printed instructions, and applicable regulatory requirements including ASME A17.1 and ASME A18.1.

B. Secure unit rigidly in place and in correct alignment using proper fastening devices.

C. Lubricate equipment in accordance with accepted manufacturer's instructions.

D. Start-up lift in accordance with manufacturers’ instructions.

E. Adjust for smooth operation.

3.3 FIELD QUALITY CONTROL

A. Perform tests in compliance with ASME A17.1 or A18.1 and as required by authorities having jurisdiction.

B. Schedule tests with agencies and Architect, District, and Contractor present.

END OF SECTION

SECTION 21 0300

FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of the Contract Documents, including Division 1 Specifications and Section 23 0050 General Mechanical Requirements, apply to work of this Section.

1.2 SCOPE OF WORK

A. Thoroughly review architectural, structural and mechanical plans to identify all interference's and concealed spaces.

B. Provide labor, material and equipment to design, furnish, and install the fire protection system required by contract documents. Design shall use existing site features.

C. Provide testing of completed system as required for regulatory approvals.

D. Contractor shall be State Fire Marshal licensed.

E. Contractor shall provide all heads required by NFPA 13 and conform with Architect's layout to the fullest extent possible. Contracting Officer shall have opportunity to review and relocate sprinkler heads without increasing contract costs.

1.3 SUBMITTALS

A. Provide manufacturers shop drawings of sprinkler heads and all other purchased components. Submit dimensioned drawings and hydraulic calculations to the Fire Marshal for approval. Submit approved copies to the Contracting Officer in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS, ABOVE GROUND:

A. Plastic Piping: Piping shall be ASTM F442-96, chlorinated polyvinyl chloride (CPVC), UL Listed for working pressure of 175 psi. Pipe shall be specifically listed for sprinkler service.

B. Plastic Pipe Fittings:
1. CPVC fittings UL listed for fire sprinkler service.
2. Threaded ASTM F437-96, Schedule 80.
3. Socket ASTM F439-96, Schedule 80.
4. Solvent cement: Primer and solvent cement manufactured by pipe and fitting manufacturer for joining sprinkler piping.

C. Metallic Piping: Piping shall be black steel ASTM A-53 schedule 40, or seamless hard temper copper, ASTM B-88 Type M where appropriate.
   1. Fittings for steel pipe may be groove, gasket and clamp as manufactured by Victaulic or Sprink, Inc., threaded or flanged cast iron for 175 PSI water working pressure or welded, provided the welding is performed by ASME (Boiler Code-Section IX) qualification welders. Plain end fittings are not acceptable. Copper fittings shall be wrought, solder end, joined with BCUP-3 or 4 brazing filler similar to Handy-Harmon Sil-Fos 5 or 95-5 solder.

D. Hangers and supports and their installation shall be according to NFPA 13.

E. Valves shall be iron body, bronze fitted, 175-PSI water working pressure, U.L. listed.
   1. Main drain valve, angle type, United No. 126S.
   2. Inspect or test valve, globe type, United No. 125S.

2.2 SPRINKLER HEADS

A. Sprinkler heads in areas where piping is exposed shall be upright or pendent, Viking “M”.

B. Sprinklers in finished ceiling areas with acoustic tile ceilings shall be recessed, mounted with trim ring and plate, chrome finish, Viking “M”.

C. Sprinklers in finished ceiling areas with existing concealed pendent heads shall match the existing recessed head with salvaged cover reinstalled, Viking “M”.

D. All sprinkler heads shall be non-color coded (ordinary rating), U.L. listed and F.M. approved. Other manufacturers’ products, if equal in all respects, will be accepted.

PART 3 - EXECUTION

3.1 Workmanship: Experienced sprinkler fitters shall install the work. Make up head connections with double swing joints in finished ceiling areas. Provide auxiliary drains where interference’s make it impossible to drain mains otherwise.

3.2 Coordination: Carefully coordinate piping and head location with other piping, lights, ductwork, diffusers and ceiling grid. Provide offsets where required to maintain uniform ceiling pattern.

3.3 The automatic sprinkler system shall be installed according to NFPA 13. The entire installation shall meet the requirements of the State Fire Marshal and insurance carrier. At completion of the project, Contractor shall operate all control valves and all alarms and devices, clean and lubricate control and alarm valves and fire department hose connections. Instruct Owner in proper care, operation and maintenance of the system and provide with two copies of NFPA 13 on care and maintenance of sprinkler systems, and maintenance and parts lists for all equipment installed in accordance with requirements of Division 1.

3.4 INSPECTION AND TESTING

A. Thoroughly flush fire protection piping to remove dirt, scale or any other debris that could interfere with sprinkler operation.

B. Test the modified or added portions of the system under 200-psig pressure for two hours. If leaks are encountered, repair them and retest until system is right.

C. Arrange for flow and alarm test at a time convenient for interested regulatory personnel and Engineer to witness. Provide certification for success of testing and submit two copies in accordance with requirements of Division 1.

END OF SECTION

SECTION 22 0400

PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of the contract documents form a part of this section.

B. Particular attention is directed to Section 23 0050, General Mechanical Requirements.

1.2 SCOPE OF WORK

A. Provide labor, material and equipment to furnish and install plumbing equipment, trim and accessories required by the contract documents.

B. Provide domestic water, non-potable water, storm drainage, waste and vent services from existing mains as shown on drawings, including pipe, valves, fittings and connection.

1.3 SUBMITTALS

A. Provide manufacturer's shop drawings and product data with detailed dimensions and pictures of all items required by Engineer as determined by provisions of section 23 0050 and in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Interior Water Piping: Copper tube
   1. Type L copper, ASTM B-88, hard drawn temper, ANSI B16.22, wrought copper fittings, lead-free soldered joints.
   2. Copper tube and fittings be installed per ASTM B828-92.
   3. Flux will meet ASTM B813. Using excess or corrosive flux will lead to early pipe failure.
   4. Pipe and fittings shall be California AB 1953 compliant.

B. Above Ground Soil, Waste, and Vent Piping:
   1. All waste, vent, sewer, and storm lines shall be of cast iron soil pipe and fittings and conform to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74 for pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the engineer.
   2. Cast-iron hubless soil pipe: Service weight; cast-iron hubless soil pipe fittings; hubless joints.
   3. Galvanized steel pipe: Schedule 40; Class 125 galvanized cast-iron, drainage pattern fittings for vents only. Screwed or mechanical grooved type fittings.

4. Star, Tyler, AB&I, Charlotte or approved equal. Install per manufactures recommendations.

C. Underground Building Drain Piping:
1. All waste, vent, sewer and storm lines shall be of cast iron soil pipe and fittings and conform to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74 for pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the engineer.
2. Cast-iron hubless soil pipe: Service weight; cast-iron hubless soil pipe fittings. Husky 4000 wide body four band hubless coupling.
3. Cast iron, service weight, plain end with cast iron mechanical couplings similar to MG Couplings.
4. Star, Tyler, AB&I, Charlotte or approved equal. Install per manufactures recommendations.

2.2 DIELECTRIC UNIONS: Use in all connections between copper tube and galvanized pipe, steel or cast iron equipment or items of dissimilar metals.

2.3 VALVES

A. Ball Valves: Full port, 400 PSI W.O.G., -40 to 180 degrees F, all brass, Teflon seat and o-ring seal, similar to Stockham Fig. No. S214, or Milwaukee No. BA-300.

B. Check Valve 2-1/2" and Smaller: 125 pound SWP, W.O.G., horizontal swing, regrinding type, Y-pattern, renewable disc, Buna-N seat disc, bronze construction per ASTM B-26, FS WW-V-51D Class A Type IV. Similar to Stockham Fig. No. B-310, or Milwaukee No. 509(T).

C. Manufacturers: DeZurik, Jenkins, NIBCO, Rockwell, Stockham, Walworth or approved equivalent.

D. All valves shall be California AB 1953 compliant.

2.4 CLEANOUTS

A. All waste piping shall have cleanouts at foot of stacks, at building entry, at every change in the direction of run, at intervals of not more than 50'-0" in straight runs inside building walls and as required by code. All outlets shall be accessible so that drain line may be readily cleaned with a snake or other rodding tool. All cleanouts shall be of the same diameter as the pipe, up to 4" maximum. All cleanout plugs shall be brass or bronze, Zurn, Josam, Smith or Wade.

B. Accessible cleanouts in cast iron shall have a countersunk head bronze plug equal to Zurn Z-1470.

C. Cleanouts installed in pipe in fill under floors shall be provided with long sweep 1/4 bend or two 1/8 bends to an easily accessible place or where indicated on drawings. In floors they shall terminate in Zurn Z-1400-2 floor level cleanout with nickel-bronze cover. In finished walls they shall terminate in Zurn Z-1440-1 or Z-1440-3 or equal, cleanout with nickel bronze or stainless steel access cover. In finished grade they shall terminate in Zurn Z-1420-25.

2.5 SPECIALTIES

A. Water Hammer Arrestors: At each single plumbing fixture or at each group of fixtures piped from the same runout, provide and install manufactured water hammer arrestors; Zurn "Shoktrol" or similar.

B. Trap Primer: Precision Plumbing Products figure PR-500 with DU-X distribution unit or equal. Install per manufacturer's requirements.

C. All products shall be California AB 1953 compliant.

2.6 FIXTURES – See Architectural drawings and Plumbing plans for Plumbing fixture specification.

A. General: Fixtures and trim shall be complete with fittings, supports, fastening devices, faucets, valves, traps, stops and appurtenances required. Trim shall be finished as indicated and of the same design and manufacturer. Fixture color shall be white, unless noted otherwise. Fixtures noted ADA compliant shall be operable with one hand, no tight grasping, pinching or twisting of the wrist and not require more than 5 lbs force to operate. Water closet flush valve handles shall be installed on the "wide side". All fixtures and faucets shall be California AB 1953 compliant.

2.7 PIPE INSULATION

A. Provide 1" thick fiber glass insulation K=.23 (R=4.35) at 75 degrees F, with all service jacket on all domestic hot water and recirculating piping. Insulate exposed trap and exposed hot water piping at handicapped lavatories.

B. Insulation shall be continuous thru pipe supports. Provide insulation shields. Provide "Zeston" type PVC fitting covering. Insulation materials, including adhesives and jackets shall be UL approved and shall have maximum flame spread rating of 25 and smoke developed rating of 50 per ASTM E-84.

C. Acceptable Manufacturers: Armstrong, Knauf, Johns-Manville, Owens-Corning.

PART 3 – EXECUTION

3.1 WORKMANSHIP

A. All work shall be performed by skilled tradesman licensed as journeyman plumbers or under their direct supervision. A licensed master plumber shall be in responsible charge of the work and for code compliance.

B. Before starting sewer work, verify grade levels and inverts. Check points of intersection with other utilities and walk the site to verify the routing shown on the drawings to be free from visible obstacles.

C. Wherever possible, run lines straight, direct and parallel to building walls. Keep accurate records of deviations and note concealed obstacles.

3.2 HANGERS AND SUPPORTS: Provide hangers and supports as required to properly install piping per CPC and Manufactures Standardization Society SP 58 and SP 69.

3.3 Provide unions where required to allow maintenance of equipment.

3.4 Do not run piping over electrical panels.

3.5 Provide for thermal expansion by means of piping off sets or change in direction.

3.6 Provide dielectric type connections where dissimilar materials are joined.

3.7 Provide chrome plated escutcheons where exposed piping passes through interior floors or walls and cast iron at exterior locations.

3.8 Provide pipe sleeves where pipe penetrates floors or walls.

3.9 SLOPE: Unless otherwise shown, slope interior sewer lines 1/4" per lineal foot and exterior sewer lines as shown on plan to meet existing lines of flow.

3.10 Install all materials in strict accordance with manufactures recommendations.

3.11 FLUSHING AND STERILIZATION: Potable water systems shall be thoroughly flushed and disinfected before being put into service per methods in AWWA C601 publication, "A Procedure for Disinfecting Water Mains", or as required by governing code.

3.12 Provide and adjust DHWR circuit setters to establish described flow in each DHWR branch.

3.13 Provide automatic air vent in DHWR lines at the highest points with drain to plumbing receptor.

END OF SECTION

SECTION 23 0050

GENERAL MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Requirements of the Contract Documents, including Division 1 specifications, apply to work of this Section.

1.2 SCOPE OF WORK:

A. Provide labor, material, equipment, and services required to furnish and install work in sections listed below.
   Section 21 0300 - Fire Protection
   Section 22 0400 - Plumbing System
   Section 23 0050 - General Mechanical Requirements
   Section 23 0060 - General Electrical Requirements for Mechanical Systems
   Section 23 0600 - HVAC System

B. Intent of Specifications: In the Specifications, plans, schedules, and details, information conveyed by means of brief mention or notation which regardless of brevity, shall be binding exactly as if presented in complete sentences employing mandatory language. Work not explicitly detailed in the Specification; or Drawings, but clearly standard practice of the trade as necessary to complete the systems shall be included as though fully specified and drawn.

C. Examination of the Site: Examine the site and premises prior to bidding to determine conditions under which the work is to be performed. No allowance will be made for extra expense incurred due to failure to examine the premises. Existing site conditions, locations of services and all requirements of the existing utilities shall be coordinated with the drawings and specifications.

1.3 STANDARD REFERENCES AND DEFINITIONS:

A. Standard is described by reference to various associations.

Abbreviation	Association
AABC	Associated Air Balance Council
AFI	Air Filter Institute
AGA	American Gas Association
AMCA	Air Moving and Conditioning Association
ANSI	American Standards Association
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
AWS	American Welding Society
AWWA	American Water Works Association
CMC	California Mechanical Code
CPC	California Plumbing Code
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Assoc.

OSHA	Occupational Safety and Health Act
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UL	Underwriters' Laboratories, Inc.

B. Reference is identified by appropriate prefix and number only, with latest revision being applicable.

1.4 DRAWINGS AND SPECIFICATIONS

A. With the exception of systems and equipment furnished by Owner, it is intended that work covered by specifications and drawings includes everything requisite and necessary to make various systems complete and operative, irrespective of whether or not every item is specifically provided. Any omission of direct reference herein to any essential item shall not excuse contractor from complying with above intent.

B. Figured dimensions supersede scaled ones. Contractor shall take no advantage of, and shall promptly call Architects attention to any error, omission or inconsistency in specifications and drawings.

C. Special attention is directed to requirement that equipment and materials stated in specifications and/or indicated on drawings shall be furnished, completely installed, adjusted, and left in safe and satisfactory operating condition.

D. Materials, apparatus, or equipment specified or otherwise provided for on drawings, addenda, or change order issued subsequent to award or contract, shall be same brand, type, quality and character originally specified unless otherwise provided for in addenda or change order.

E. Layout of equipment, accessories, specialties and suspended, concealed, or exposed piping systems are diagrammatic, unless dimensioned. In preparing shop drawings, Contractor shall check project conditions before installing work. If there are any interference’s or conflicts, they shall be called to attention of Architect immediately for clarifications.

1.5 PERMITS, FEES AND INSPECTIONS:

A. Contractor shall make all arrangements for permits and inspections with utility companies, utility districts, and Fire Marshall.

B. Contractor shall not allow or cause any of his work to be covered up or enclosed until it has been reviewed and/or witnessed tests by Owner or Owner's representative and by government authorities having jurisdiction over this work.

1.6 SUBMITTALS

A. Shop Drawings
1. Submit product data for review in accordance with contract documents.
2. Prior to submitting product data, Contractor shall check for dimensional correctness, interference’s, (fit available space), and conformance to specifications and plans. Contractor shall stamp drawings to indicate that stipulated check has been made. Identify submittal data by project name, specification section, and equipment identification number.

3. Cuts or catalogs, including descriptive literature and characteristics of equipment shall show major dimensions, capacities, curves, pressure drops, control diagram, finish, code compliance, and motor and drive data; special instructions for shop drawings may be included with the itemized specification below. Submit proof of Title 24 compliance.
4. Custom-made equipment and systems such as built-up air handling units and temperature controls and lists such as for grilles, diffusers and registers, fire dampers, etc., shall be submitted for review. Include shop drawings for each component in an assembly and wiring diagrams for all items incorporating electrical equipment.
5. Shop drawings are required for all equipment, specialties and materials used in this project including but not limited to the items in the shop drawing and vendor guide listed below.
6. Contractor agrees the Shop Drawing Submittals processed by the Architect are not change orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate his understanding by indicating which equipment and material he intends to furnish and install by detailing the fabrication and installation methods he intends to use.
7. Contractor further agrees that if deviations, discrepancies or conflicts between shop drawings, submittals and the Contract Documents in the form of Design Drawings and Specifications are discovered either prior to or after shop drawings submittals are processed by the Architect, the Design Drawings and Specifications shall control and shall be followed.

B. Shop Drawing List – Plumbing
1. Lists shall include all items listed and any other significant items not specifically listed.
2. Sanitary Fixtures: Fixtures and trim, supports
3. Sanitary Drainage Specialties: Cleanouts, trap primers
4. Domestic Water System Specialties: Wall hydrants, water hammer arrestors

C. Shop Drawing List - Fire Protection
1. Lists shall include all items listed and any other significant items not specifically listed.
2. Sprinkler system layout and specialties, sprinkler heads, valves, pressure gauges, hangers and supports, miscellaneous items (escutcheons, head guards, ball drips, etc.).
3. Water Supply Systems: Piping

D. Shop Drawing List – HVAC
1. Lists shall include all items listed and any other significant items not specifically listed.
2. Registers, grilles and diffusers

E. Record Drawings
1. Contractor shall keep on the job one complete set of the contractor working drawings on which he shall record any deviations or changes from such drawings made during construction. Record shall show changes in:
   Size, type, capacity, etc. of any material, device or piece of equipment.
   Location of any device or piece of equipment.
   Location of any outlet or source in building service systems.
   Routing of any piping, conduit, ducts, sewers, or other building services.
2. Drawings shall also record location of concealed water and electric service, water piping, sewers, wastes, vents, ducts, conduit and other piping, by indication of measured dimensions to each such line from readily identifiable and accessible walls or corners of the building. Drawings also shall show invert elevation of sewers and top of water lines.
3. Drawings shall be kept clean and undamaged, and shall not be used for any purpose other than recording deviations from working drawings and exact locations of concealed work.
4. Each will be able to install his work satisfactorily with least possible interference or delay.

5. Upon completion of work, Contractor shall obtain transparencies from Architect, at cost, and incorporate changes as noted on record set, including dimensions, and location and depth of bury of underground lines. Contractor shall sign and deliver transparencies with one set of prints to Architect. Corrections on transparencies shall be made by a professional draftsperson. Items superseded during construction shall be removed and only as-built conditions shall remain on transparencies.

1.7 CONFORMANCE WITH REGULATIONS

A. Give notices and comply with laws, ordinance, rules, regulations and orders of any public authority bearing on work. If Contractor observes that contract documents are at variance with such in any respect, promptly notify Architect, in writing. Necessary changes will be adjusted by change order.

1.8 WARRANTY

A. Warranty, in writing, to Owner that work herein shall be free from defects in workmanship and materials, that apparatus will develop capacities and characteristics required in drawings, and that, if any during period of one year after date of certificate of completion and acceptance of project, and such defects appear, he shall remedy them without any cost to Owner.

B. Warranty, as stated, shall include costs of any work required to be done by other Contractor for removal, access, etc. and replacement thereof.

1.9 SUBSTITUTIONS

A. Contractor is cautioned to bid materials listed in the specifications. Contractor may substitute listed material provided:
   1. Burden of proof of equivalency is on contractor and acceptance is by the Owner.
   2. Contractor is liable for project schedule.
   3. Contractor complies with contract documents.

B. Should substitution be allowed, contractor remains liable for operation and performance of originally specified material.

1.10 INTER-TRADE COORDINATION

A. Mechanical Contractor shall schedule and hold a coordination meeting at the beginning of the project. Meeting may be at the job site, Contractor’s office or Architect’s office.

B. As a minimum, Mechanical, Electrical, Plumbing and Fire Protection sub contractors shall be present. Architect and Mechanical Engineer shall be notified of the meeting schedule.

C. Minutes of the meeting shall be recorded by the Mechanical Contractor and forwarded to the Architect for review.

D. Meeting shall review:
   1. Voltage and phasing available at this project.
   2. Power requirements for each piece of equipment furnished.

3. Control and starter requirements for each piece of equipment including a review of who is providing said piece of equipment.
4. Location of each piece of equipment, including fans, pumps, smoke fire dampers and detectors, fire risers, fire alarm control panel.

PART 2 – PRODUCTS

2.1 Not Applicable

PART 3 – EXECUTION

3.1 Temporary Facilities shall be provided as stated in Division 1.

3.2 INSPECTIONS: Arrange with Architect and enforcing Governmental authorities for required permits and inspections. Furnish Architect with completed certificates of inspection and approval at completion. Call for inspections when they become due. Do not cover any work until accepted.

3.3 DAMAGE TO OTHER WORK: Contractor shall be held responsible for damage caused by his work or through neglect of his workmen. Contractor shall do repairing of damaged work as directed by Architect; Contractor shall pay cost of repairs.

3.4 SUPPORTS

A. Supports for ductwork, pipe, conduit, ceiling grid system, etc., shall not interfere with access to valves, etc.

B. Install equipment, ductwork and piping so that noise and vibration will not be transmitted throughout building.

C. Seismic support of all mechanical equipment, ductwork, grilles and registers, etc. shall comply with 2019 edition, California Building Code, earthquake regulations, SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems". The Architect and structural engineer prior to installation shall review all seismic restraints selected.

3.5 RUBBISH: Rubbish resulting from the work herein specified shall be removed from the premises by the trade at the end of each day. On completion of work, remove from the site all tools, equipment, surplus materials, and rubbish. Pay costs for such removal and disposition and cooperate with General Contractor in final cleaning.

3.6 HOISTS, RIGGING, TRANSPORTATION AND SCAFFOLDING

A. Provide scaffolding, staging, cribbing, tackle, hoists and rigging necessary for placing materials and equipment. Temporary work shall be removed from premises when its use in no longer required on job.

B. Pay costs for transportation of materials and equipment to job site and include such costs in proposal.

C. Scaffolding and hoisting equipment shall comply with requirements of Federal, State and Local laws and codes.

3.7 EQUIPMENT INGRESS: Contractor is solely responsible for purchasing equipment and materials in such knock-down condition that they will pass through building openings or such openings as may occur incidentally during building construction. Coordinate this effort with General Contractor.

3.8 ACCESSIBILITY

A. Install work so as to be readily accessible for operation, maintenance and repair; minor deviations from drawings may be made to accomplish this. Changes shall not be made without approval of the Architect.

B. Coordinate with other contractors for location of piping, ductwork and equipment.

3.9 PROTECTION OF BUILDING, OPENINGS AND MATERIALS

A. In addition to the provisions and stipulations in the General Conditions, provide various types of protection as follows:
1. Protect finished floors from chips and cutting oil by the use of metal chip receiving pan and a floor cover.
2. Protect equipment and finished surfaces from welding and cutting splatters with baffles and splatter blankets.
3. Protect equipment and finished surfaces from paint droppings, insulation adhesive and sizing droppings, etc., by use of drop cloths.

B. Duct, pipe and construction openings and excavations required for mechanical work shall be covered when work is not in progress, as follows:
1. Cover duct openings with canvas or plastic.
2. Cap pipe openings with fittings or plugs.
3. Cover wall and ceiling openings with plywood, or canvas covered framing.
4. Cover floor openings and excavations with structural material of adequate strength to support traffic.
5. Provide guards and rails at pits and openings as required by governing authority.

C. Equipment and material shall be covered and protected and kept clean during storage and shall not be exposed to the weather. Equipment such as chillers, boilers, fans, etc., shall be warehoused or stored indoors.

3.10 CLEANING-LUBRICATING: Clean systems internally before placing in operation. Clean externally and restore damaged surfaces. Lubricate equipment per manufacturer’s instructions. Where lubricating points are not easily accessible, provide extensions.

3.11 MAINTENANCE PRIOR TO FINAL ACCEPTANCE

A. Contractor shall be responsible for maintenance of equipment and systems installed until final acceptance by Owner, and shall take such measures as necessary to ensure adequate protection of equipment and materials during delivery, storage, installation, start-up, temporary operation, and shut-down.

B. Air handling systems used prior to final acceptance shall have specified filters installed.

C. A clean set of filters shall be installed at time of job acceptance.

3.12 EXCAVATION AND BACKFILLING

A. Unless otherwise specified, provide for excavation and backfilling. Determine lines and levels and provide necessary shoring, excavation, drainage, excavation protection. Bell holes shall be dug to ensure pipe resting for its entire length on bottom of trench.

B. Where pipe is being installed in filled areas, "structural fill" must be firmly compacted, and backfilled with crushed stone to pipe laying level.

C. Backfilling for pipe with bell and spigot joints shall be as follows: Pipe shall be added in compacted granular material placed on flat trench bottom. Sand bedding shall have minimum thickness of one-fourth outside pipe diameter, and extend halfway up pipe barrel at sides. Remainder of side fills, and to depth of 12 inches over top of pipe, shall be filled with same material carefully compacted.

D. Fill shall be as approved by the Architect. Sand fill shall be provided from off site borrows. Excess excavated material shall be disposed of off-site.

E. Where excavation is necessary in municipal property pavements, Contractor for whose work the excavation is required shall pay fees and costs for opening pavement and costs of filling and repaving in accordance with requirements of the municipality or utility company.

3.13 FLUSHING AND STERILIZATION: Potable water systems shall be thoroughly flushed and disinfected before being put into service per methods in AWWA C601 publications, "A Procedure for Disinfecting Water Mains", as required by Governing code. Provide laboratory certificate at close-out.

3.14 PAINTING: Painting of mechanical items unless otherwise specified, shall be done under Division 9. Mechanical Contractor shall cooperate with and coordinate this work.

3.15 EQUIPMENT BASES AND SUPPORTS

A. Equipment shall have driver and driven unit mounted on common bases.

B. Provide anchor bolts, structural supports, platforms, braces, tie rods, etc. required to support or hang piping and equipment.

C. Provide structural channel and/or angle iron framing around building openings required which are not shown on architectural and structural drawings and, therefore, are not "framed in" by General Contractor.

3.16 MACHINERY GUARDS

A. Provide barriers as required by code, and as specified, for moving parts of machinery exposed to personnel.

B. Guard exposed moving parts, such as belts and couplings, with expanded metal or solid 16 GA. sheet metal guards with edges rounded, and 1-1/4 x 1-1/4 x 1/8 inch angle iron frames, properly supported. Bolt guards in place and fabricate to permit easy removal.

C. Provide 2 inch openings, for insertion of tachometer at ends of motor and equipment shafts.

3.17 MANUFACTURER'S NAMEPLATES

A. Each unit of equipment shall be identified by permanently attached nameplate of corrosion resistant metal. Plates shall bear following information:
1. Manufacturers name
2. Serial and model numbers
3. Rated capacity
4. Temperature, pressure or other limitations.

B. Equipment and Systems Identification

C. Identify each unit as to function and system number as directed by the Architect and as listed.

D.

Item	Type Identification
Switches, pilot lights (Remote)	Label plastic laminate
Pipe lines	Stencil, labels

E. Service Abbreviations

Chilled Water Supply/Return	CHWS/R
Domestic Cold Water	DCW
Domestic Hot Water	DHW
Domestic Hot Water Return	DHWR
Fire Line	FL
Non Potable Water	NPW
Variable Refrigerant Flow	VRF

3.18 TESTING

A. Test all piping, new and existing. Report failures of existing piping to the Owner. Test piping and equipment as specified under CPC, CMC or other sections. Furnish labor, materials, instruments, power, etc. required for testing, unless otherwise specified.

B. Perform tests as required by parties having legal jurisdiction. Notify these parties a minimum of three days before testing.

C. In general, pressure tests shall be applied to piping only, before connection of equipment and appliances. In no case shall piping or appliances be subject to pressure exceeding their rating. Defective work shall be promptly repaired or replaced, and test shall be repeated until the particular system and component parts thereof receive approval of Architect.

D. Damages resulting from tests shall be repaired, or damaged materials replaced, to satisfaction of the Architect and at no cost to Owner.

E. If Contractor does not promptly repair damages and defects, Owner reserves the right to remedy such damages and defects at Contractor's expense.

3.19 REQUIREMENT FOR FINAL INSPECTION

A. Following items must be completed prior to final inspections. No final payment will be made and the mechanical work will not be accepted until all items are completed.
   1. Thoroughly clean parts of the apparatus and equipment. Exposed parts, which are to be painted, shall be thoroughly cleaned of cement, plaster and other materials and all oil and grease shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out.
   2. Exposed metal work shall be carefully brushed down with steel brush to remove rust and other spots and left smooth and clean.
   3. Provide clean set of specified filters in all air circulating equipment.
   4. Test and balance work shall be complete and reports received and reviewed by Architect.

3.20 OPERATING INSTRUCTION AND SERVICE MANUAL

A. Following items together with any other pertinent data shall be included. List is not necessarily complete and shall be considered minimum.
   1. Manufacturer's name, nearest representative and model and serial numbers of component of system.
   2. Operating instruction, start-up and shut down procedure.
   3. Maintenance and lubrication instructions.
   4. Parts list.
   5. Manufacturer's literature describing each piece of equipment.
   6. One stamped copy of each shop drawing submitted under item list.
   7. Part numbers of all replaceable items.
   8. List of belt sizes, types and lengths.
   9. Control diagram and operation sequence together with labeling of control piping and instruments to match diagram.

B. After review of a copy of the manual by the Architect, two (2) copies of each manual shall be furnished to the Owner.

C. The operating instructions and service manual shall be considered a part of the final inspection and shall be submitted for review at least 30 days in advance of request for final inspection.

END OF SECTION

SECTION 23 0060

GENERAL ELECTRICAL FOR MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of the Contract Documents, including Division 1 Specifications, apply to work of this section.

1.2 GENERAL

A. Provide design, materials and installation for electric motors, control panels, certain control and safety devices for proper operation of electrical systems associated with mechanical equipment specified in Divisions 22 and 23.

B. Notify Architect in writing within 14 days before bids are due, if it is necessary to increase horsepower of any motors or change any electrical requirements listed or shown. After this period, the responsible Contractor shall assume costs incurred because of changes.

1.3 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. Mechanical equipment with factory assembled and/or attached with electric equipment shall be U.L. listed and shall meet the latest edition of the National Electrical Code.

B. Electrical Motors
1. For each piece of equipment requiring electric drive, provide a motor having starting and running characteristics consistent with torque and speed requirements of the driven machine.
2. Manufacturers furnishing motors shall verify motor horsepower with the characteristic power curves of driven equipment on shop drawings.
3. Each motor shall be rated in accordance with NEMA standards to carry its full nameplate load continuously. In no case shall power requirements of driven machine exceed normal nameplate rating of the motor furnished.
4. Motor horsepower specified shall be considered minimums.
5. Unless otherwise specified, motors shall be of general-purpose type with open type enclosures, rated for temperature rise of 40^{o} C and operation at 1800 RPM.
6. Contractor shall verify electrical characteristics of each motor with electrical drawings.
7. Motors shall be as manufactured by Reliance, Gould, U.S. Motor or approved equal.

1.4 COORDINATION OF WORK

A. Verify Electrical Contractor is furnishing and installing the following for all mechanical/plumbing equipment: Power line voltage conduit and wiring, manual line voltage controls (disconnect switches, manual motor starters, etc.).

B. The Mechanical Contractor shall furnish Automatic line voltage controls and magnetic starters unless otherwise specifically noted on the plans.

C. All control wiring for mechanical/plumbing equipment shall be installed in conduit.

D. Furnishing of, installation of, and connection of all control wiring and conduit for controls shall be by the mechanical/plumbing contractor.

E. It shall be the responsibility of each subcontractor furnishing motors and devices to advise the Electrical Contractor of exact function of systems to assure proper type of starter with correct number of auxiliary contacts and coil voltage for proper operation of the systems.

F. Line voltage motor control equipment which is furnished loose under Division 15 will be delivered to the Electrical Contractor at the site for custody, erection in place, and wiring as specified elsewhere herein.

G. In general, power service wiring will be furnished and installed and connected to mechanical equipment by the Electrical Contractor under Division 16.

H. Summary of motors, electrical equipment, and controls is listed on drawings. It is not intended to be all-inclusive in defining Contractor's work.

PART 2 – PRODUCTS

2.1 Not Applicable.

PART 3 – EXECUTION

3.1 Not Applicable.

END OF SECTION

SECTION 23 0600

HVAC SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of the Contract Documents, including Division 1 specifications and Section 23 0050 General Mechanical Requirements, apply to work of the Section.

1.2 SCOPE OF WORK

A. Provide labor, material, equipment accessories, services, and tests necessary to completely execute all heating equipment work, which shall include, but not necessarily be limited to, the following:
1. Ductwork
2. Duct Insulation
3. Sheetmetal Accessories
4. VRF Indoor and Outdoor Unit
5. ERV
6. Exhaust Fan

PART 2 - PRODUCTS

2.1 DUCTWORK

A. Ductwork and sheetmetal accessories shall comply with NFPA, SMACNA and ASHRAE standards.

B. Galvanized steel-galvanized steel shall meet ASTM A525-71 standards-plain hot dipped with 1.25 oz. of zinc per square foot commercial class. Gauges of metal and reinforcement shall be in accordance with SMACNA for 2" W.C. positive or negative pressure.

C. Ductwork Sealants
1. Hardcast CCWI-181 U.L. listed. Apply per manufacturer's recommendations.
2. Watertight construction where noted with edges bent ½ in. for watertight seal. Longitudinal seam sealant shall be 3M Brand No. 800; Alcoa, Aluminastic Type C, or solder; Stiffeners shall be plug or spot welded. Transverse joints shall be bolted companion angles with ¼ in. cadmium-plated bolts with 6 in. minimum on centers and gasket.

2.2 DUCT INSULATION: Metal supply and return air duct systems in unconditioned space shall be insulated with 1" thick faced fiberglass insulation. Acceptable Manufactures: Owens/Corning All Service Faced Duct Wrap. Commercial Grade A-3 or equivalent from Johns-Manville, Armstrong, Knauf.

2.3 VOLUME DAMPER: Dampers shall be placed where shown on drawings and in branch take-off from main ducts to permit control of air flow into branches. Damper blades shall be of stamped design, made from 16-gauge galvanized steel. Positioning device for dampers shall be locking lever and quadrant. Lever shall be parallel to blade, locked to quadrant with thumbscrew or wing nut.

2.4 GRILLES & DIFFUSERS: Acceptable Manufacturers: Krueger, Titus, Carnes, or Nailor. Diffusers, grilles and accessories shall be constructed of steel unless otherwise noted. Finish shall be per Contracting Officer. Diffusers, grilles, are to be with volume damper unless marked otherwise on drawings. Provide margins, leveling clips, plaster ground, etc. as required for the particular ceiling system in which the diffuser or grille is installed.

2.5 VRF INDOOR AND OUTDOOR UNITS: See schedule on plans.

2.6 ERV: See schedule on plans.

2.7 Exhaust Fan: See schedule on plans. Units shall comply with all requirements indicated on the drawings. Surfaces in contact with the airstream shall comply with ASHRAE 62.1. Fans shall be forward curved, centrifugal. Motor shall be permanently lubricated and comply with requirements in Section 230060.

PART 3 - EXECUTION

3.1 Equipment shall be installed in accordance with manufacturer’s recommendations.

3.2 TEST AND BALANCE: Due to the nature of this project, the Test and Balance activity is unique. After the demolition and the new ductwork is installed, the Contractor shall make necessary field tests and calculations to estimate/establish the correct fan RPM and motor horse power. Re-sheaving is expected at each fan. Motor sizes are not expected to increase. If any are found to be required, notify the Owner.

A. Testing shall be done by an independent contractor who specializes in testing and balancing air handling and hydronic systems, in accordance with AABC or NEBB standards.

B. Upon completion of tests, Contractor shall compile the test information, and submit (4) copies of such to Mechanical Contractor to forward to Engineer for evaluation. Final report shall carry the Engineer's seal under whose direct supervision the work is done.

C. The report shall include a summary sheet which shall record devices, equipment and systems that cannot be adjusted to design requirements. The record shall include the extent of the variations from design conditions and the balance engineer’s opinion as to cause of the variation.

D. A record of deviations in excess of the tolerances for the following shall be included.

Motor Loads (Amps)	+5% of name plate
Motor Voltages at	+/- 10% (Volt)
Phase Voltage Diff.	+/- 3% (Volt)

E. Contractor shall include in his report a list of test equipment used stating make, model, and latest calibration date.

F. Air Systems and Air Distribution Balance Test Procedure.
1. Test and adjust system to design CFM supply, return, outside air, and exhaust air.
2. Inspect the condition of heating and cooling coils prior to balancing to establish that finned surfaces are clean and not damaged.
3. Adjust zones to proper design CFM supply and return.
4. Test and adjust each diffuser, grille, and register to within 10% of design requirements. Adjust these devices to minimize drafts in all areas and to provide required air pattern.

G. Test Report Data
1. Air Distribution
   a. Design conditions-CFM, static pressure, motor HP, fan speed, mixed air, discharge and return air temperature.
   b. Installed equipment-mfg., model, motor HP, electrical data, heater ratings.
   c. Field Test-fan speed, running amperes, voltage, brake horsepower; total CFM, total and external static pressure; mixed air, discharge air and return air, W.B. and D.B. temperature; check electrical interlocks required; read and record static pressure in the mixed air plenum for 100% return air and 25%, 50%, 75% and 100% outside air. Variation shall not exceed 10%.
   d. Grilles, Diffusers, Registers: test and record the following for each terminal device-identify as to room locations; mfg., type, and model no.; outlet size, core area or neck area; design outlet discharge velocity and test velocity; design CFM and test CFM.
2. Domestic Hot Water Recirculation: Adjust DHWR circuit setters to establish described flow in each branch. Coordinate with Section 22 0400.

H. Work shall be done under direct supervision of qualified air conditioning and heating engineer.

END OF SECTION

SECTION 26 0010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Table of Contents, Division 26 - Electrical:

SECTION NO.	SECTION TITLE
26 0010	BASIC ELECTRICAL REQUIREMENTS
26 0060	POWER SYSTEM STUDY
26 0090	ELECTRICAL DEMOLITION
26 0519	BUILDING WIRE AND CABLE
26 0526	GROUNDING AND BONDING
26 0529	ELECTRICAL HANGERS AND SUPPORTS
26 0531	CONDUIT
26 0533	BOXES
26 0553	ELECTRICAL IDENTIFICATION
26 0926	RELAY PANEL LIGHTING CONTROL
26 0942	DIGITAL LIGHTING CONTROL
26 0943	NETWORK ADDRESSABLE LIGHTING CONTROL
26 2213	DRY TYPE TRANSFORMERS
26 2416	PANELBOARDS
26 2716	CABINETS AND ENCLOSURES
26 2719	SURFACE RACEWAYS
26 2726	WIRING DEVICES
26 2736	ENERGY INFORMATION SYSTEMS
26 2816	OVERCURRENT PROTECTIVE DEVICES
26 2819	DISCONNECT SWITCHES
26 2900	MOTOR CONTROLS
26 5000	LIGHTING
26 6113	FIRE ALARM SYSTEM

B. Work included: This Section includes general administrative and procedural requirements for Division 26. The following administrative and procedural requirements are included in this Section to supplement the requirements specified in Division 01.
1. Quality assurance.
2. Definition of terms.
3. Submittals.
4. Coordination.
5. Record documents.
6. Operation and maintenance manuals.
7. Rough-in.
8. Electrical installation.
9. Cutting, patching, painting, and sealing.
10. Field quality control.
11. Cleaning.
12. Project closeout.

C. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete and operable installation.
   1. General and supplementary conditions: Drawings and general provisions of Contract and Division 01 of the Specifications, apply to all Division 26 Sections.
   2. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, lighting pole foundations, etc. Refer to Division 31, Earthwork.
   3. Selective demolition: Nondestructive removal of materials and equipment for reuse or salvage as indicated. Also dismantling electrical materials and equipment made obsolete by these installations. Refer to Division 02, Selective Demolition.
   4. Concrete work: Include forming, steel bar reinforcing, cast-in- place concrete, finishing and grouting as required for underground conduit encasement, light pole foundations, pull box slabs, vaults, housekeeping pads, etc. Also includes setting of floor boxes in existing concrete slabs, saw-cutting of existing slabs and grouting of conduits in saw-cut. Refer to Division 03, Concrete.
   5. Miscellaneous metal work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, luminaires, panelboards, distribution boards, switchboards, motor control centers, etc. Refer to Division 05, Miscellaneous Metals.
   6. Miscellaneous lumber and framing work: Include wood grounds, nailers, blocking, fasteners and anchorage for support of electrical materials and equipment. Refer to Division 06, Rough Carpentry.
   7. Moisture protection and smoke barrier penetrations: Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight. Refer to Division 07, Thermal and Moisture Protection.
   8. Access panels and doors: Required in walls, ceilings, and floors to provide access to electrical devices and equipment. Refer to Division 08, Access Doors also, Division 05, Metals.
   9. Painting: Include surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division. Refer to Division 09, Painting.
   10. Luminaire supports: Provide slack support wire for luminaires installed in acoustical tile or lay-in suspended ceilings. Refer to Division 09, Acoustical Treatment.

D. Work furnished and installed under another Division requiring connections under this Division includes but is not limited to:
   1. Electric motors.
   2. Package mechanical equipment: fans, fan coil units, pumps, boilers, compressors, etc.
   3. Flow switches and valve monitors for sprinkler system.
   4. Elevator controllers.
   5. Temperature control panel(s). (Line voltage only)
   6. Irrigation controller(s). (Line voltage only)
   7. Kitchen equipment and appliances.
   8. Electric door locks.
   9. Variable frequency drive units.
   10. Chiller starters.
   11. Motorized roll down/sliding doors and grills.

E. Items furnished under another Division, but installed and connected under this Division includes but is not limited to:
   1. Wall mounted control stations for motorized roll down and sliding doors.
   2. Electric fire sprinkler water flow bells.
   3. Speed control switches for ceiling exhaust fans.

1.2 QUALITY ASSURANCE

A. Reference to Codes, Standards, Specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. When codes, standards, regulations, etc. allow Work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements, or extent of the Contract Documents. The Contract Documents address the minimum requirements for construction.

C. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
   1. California Electric Code (CEC).
   2. California Building Code (CBC).
   3. California Fire Code (CFC).
   4. California Mechanical Code (CMC).

D. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:

ACI	American Concrete Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
CBM	Certified Ballast Manufacturers
ETL	Electrical Testing Laboratories
FS	Federal Specification
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IPCEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturer's Association
UL	Underwriters' Laboratories

E. Independent Testing Agency qualifications:
   1. Testing Agency shall be an independent testing organization that will function as an unbiased authority, professionally independent of Manufacturer, Supplier and Contractor, furnishing and installing equipment or system evaluated by Testing Agency.
   2. Testing Agency shall be regularly engaged in the testing of electrical equipment, devices, installations, and systems.
   3. Testing Agency shall meet Federal Occupational Safety and Health Administration (OSHA) requirements for accreditation of independent testing laboratories, Title 9, Part 1907.
   4. On-site technical personnel shall be currently certified by the International Electrical Testing Association in electrical power distribution system testing.
   5. Testing Agency shall use technicians who are regularly employed by the firm for testing services.

6. Contractor shall submit proof of above Testing Agency qualifications with bid documentation upon request.

F. All base material shall be ASTM and/or ANSI standards.

G. All electrical apparatus furnished under this Section shall conform to NEMA standards and the CEC and bear the UL label where such label is applicable.

H. Certify that each welder performing Work has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.3 DEFINITION OF TERMS

A. The following list of terms as used in the Division 26 documents shall be defined as follows:
1. "Provide": Shall mean furnish, install, and connect unless otherwise indicated.
2. "Furnish": Shall mean purchase and deliver to Project site.
3. "Install": Shall mean to physically install the items in-place.
4. "Connect": Shall mean make final electrical connections for a complete operating piece of equipment.
5. "As directed": Shall be as directed by the Owner or their authorized Representative.
6. "Utility Companies": Shall mean the company providing electrical, telephone or cable television services to the Project.

1.4 SUBMITTALS

A. Format: Furnish submittal data in electronic format for each Specification Section with a table of contents listing materials by Section and paragraph number.

B. Submittals shall consist of detailed Shop Drawings, Specifications, block wiring diagrams, "catalog cuts" and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication and material finish. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories which are included and those which are excluded. Furnish quantities of each submittal as noted in Division 01.

C. Each submittal shall be labeled with the Specification Section Number and shall be accompanied by a cover letter or shall bear a stamp stating that the submittal has been thoroughly reviewed by the Contractor and is in full compliance with the requirements of the Contract Documents or provide a Specification Section line-by-line compliance response statement with detailed exception/ deviation response statements for all applicable provisions for the applicable Specification Section. Any Specification Section lines without a detailed exception/ deviation response statement shall be treated as the Contractor or Vendor is submitting in full compliance with the applicable Specification Section requirements. Cover letters shall list in full the items and data submitted. Failure to comply with this requirement shall constitute grounds for rejection of data.

D. The Contractor shall submit detailed Drawings of all electrical equipment rooms and closets if the proposed installation layout differs from the construction documents. Physical size of electrical equipment indicated on the Drawings shall match those of the electrical equipment that is being submitted for review, i.e.: switchboards, panelboards, transformers, control panels, etc. Minimum scale: 1/4" = 1'- 0". Revised electrical equipment layouts must be approved prior to release of order for equipment and prior to installation.

E. As part of the equipment and fixture submittals, the Contractor shall provide anchorage calculations for floor and wall mounted electrical equipment and fixtures, distribution conduits and raceways, in conformance with the 2019 California Building Code (CBC) and ASCE 7-16. Use the Occupancy Category, Ground Accelerations, Site Class, Seismic Design Category, and Seismic Importance Factor as noted in the structural drawings. For components required for Life Safety or containing hazardous materials use Ip=1.5. Structural Calculations shall be prepared, stamped, and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.

F. The Manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the Contractor with the assembly dimensions, weights, and approximate centers of gravity.

G. Review of submittals is for general conformance to design concept and general compliance with the Specification Sections. Submittal Review Comments do not imply waiver of Specifications Section requirements unless specifically noted.

H. All resubmittals shall include a cover letter that lists the action taken and revisions made to each Drawing and equipment data sheet in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

I. Shop Drawings for the following systems must be prepared via a computer aided drafting (CAD) system for submission by the Contractor. The Engineer can provide CAD files of the electrical Contract Documents to the Contractor.
   1. Fire alarm system, Section 26 6113.
   2. Security system, Section 26 6513.
   3. Telecommunication cabling system, Section 26 7113.

J. Independent Testing Agency report:
   1. Testing Agency shall provide 3 copies of the complete testing report.
   2. Test report shall include the following:
      a. Summary of Project.
      b. Description of equipment.
      c. Equipment used to conduct the test.
         1) Type.
         2) Manufacturer.
         3) Model number.
         4) Serial number.
         5) Date of last calibration.
         6) Documentation of calibration leading to NIST standards.
      d. Description of test.
      e. Test results, as compared to Manufacturers or industry accepted standards and tolerances.
      f. Conclusion and recommendation.
      g. Signature of responsible test organization authority.
   3. Furnish completed test report to Engineer no later than 30-days after completion of testing, unless otherwise directed.

K. Substitutions:
   1. All requests for substitutions shall conform to the general requirements and procedure outlined in Division 01.

2. Where items are noted as "or equal," a product of equal design, construction and performance will be considered. Contractor must submit to the Engineer all pertinent test data, catalog cuts and product information required substantiating that the product is in fact equal to that specified. Only one substitution will be considered for each product specified.
3. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility, and appearance. Materials, processes, or equipment, which in the opinion of the Engineer is equal in quality, utility, and appearance, will be approved as substitutions to that specified.
4. Whenever any material, process or equipment is specified in accordance with a Federal specification, an ASTM standard, an ANSI specification, UL rating or other association standard, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, support test data to substantiate compliance shall be submitted by the Contractor at no additional cost.
5. Substitutions shall be equal, in the opinion of the Architect/Engineer, to the specified product. The burden of proof of such shall rest with the Contractor. When the Architect/Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted article or material to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the Work or from any provisions of the Specifications.
6. The Contractor shall be responsible for all expenses in connection with the substitution materials, processes, and equipment, including the effect of the substitution on the Contractor, Subcontractor’s, or other Contractor's Work. No substitution of material, processes or equipment shall be permitted without written authorization of the Architect/Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

1.5 COORDINATION

A. Discrepancies:
   1. In the event of discrepancies within the Contract Documents, the Engineer shall be so notified, within sufficient time, as delineated in Division 01, prior to the Bid Opening to allow the issuance of an Addendum.
   2. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply: The Drawings govern in matters of quantity and the Specifications govern in matters of quality. In the event of conflict within the Drawings involving quantities or within the Specifications involving quantities or within the Specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Contractor's Bid. No additional allowances will be made because of errors, ambiguities or omissions that reasonably should have been discovered during the preparation of the Bid.

B. Project conditions:
   1. Examination of Project site: The Contractor shall visit the Project site and thoroughly review the locale, working conditions, conflicting utilities, and the conditions in which the Electrical Work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that may be incurred because of any error or omission due to failure to examine the Project site and to notify the Engineer of any discrepancies between Contract Documents and actual Project site conditions.
   2. Protection: Keep conduits, junction boxes, outlet boxes and other openings closed to prevent entry of foreign matter. Cover fixtures, equipment, devices, and apparatus and protect them against dirt, paint, water, chemical or mechanical damage, before and during construction period. Prior to final acceptance, restore to original condition any fixture, apparatus or equipment damaged including restoration of damaged factory applied painted finishes. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.
   3. Supervision: Contractor shall personally or through an authorized and competent representative constantly supervise the Work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.

C. Preparation:
   1. Drawings:
      a. Layout: General layout indicated on the Drawings shall be followed except where other Work may conflict with the Drawings.
      b. Accuracy: Drawings for the Work under this Section are essentially diagrammatic within the constraints of the symbology applied.

1.6 RECORD DOCUMENTS

A. Provide Project Record Drawings as described herein:
   1. Drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit, and wire sizing as well as routing, revised luminaire schedule listing Manufacturers and products installed and revised panel schedules. Contractor shall record all changes in the Work during the course of construction on blue or black line prints. These prints shall be made subject of monthly review by the Owner's Representative to ascertain that they are current. If not current, monthly payments may be withheld.
   2. Record Drawings shall be the transfer of information on these prints to the construction documents via computer aided drafting (CAD) process. A set of CAD files of the electrical construction documents will be provided to the Contractor by the Engineer.
   3. Record drawing submissions shall be provided to the Engineer to review upon the completion of the following phases of Work:
      a. All underground installation.
      b. Building electrical rough-in.
      c. Final electrical installation.
   4. Include in the record drawing submission the following shop drawing submission with all updated installation information:
      a. Fire alarm system.
      b. Security system.
      c. Telecommunication cabling system
      d. Intercom system.
      e. Television distribution system.
      f. Public address system.

5. A single set of half size prints of the Record Drawings shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made, and the Contractor shall provide the following:
   a. Two sets of full-size prints.
   b. Four sets of half-size prints.
   c. One set of full size reproducibles.
   d. Electronic files of Drawings in PDF and CAD.

B. Panel schedules:
1. Typewritten panel schedules shall be provided for panelboards indicating the loads served and the correct branch circuit number. Schedules shall be prepared on forms provided by the Manufacturer and inserted in the pocket of the inner door of each panelboard. See Section 26 2416: Panelboards for requirements.
2. A single set of the record panel schedules shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made, and the Contractor shall provide the following:
   a. Fold and insert one copy of the appropriate schedule in the pocket of the inner door of each panelboard.
   b. Three binders, each containing a full set of the panel schedules. Provide index listing all schedules and dividers for separation of schedules as follows:
      1) 120/208V normal.
      2) 120/208V emergency.
      3) 120/208V equipment.

C. Field labels, markings, and warning signs: Provide in accordance and as required by:
1. General: CEC Article 110.21.
2. Arc-Flash Warning: CEC Article 110.16.
3. Identification of Disconnecting Means: CEC Article 110.22 (A).
4. Available Fault Current: CEC Article 110.24.
5. Depth of Working Space in Existing Buildings: CEC Article 110.26 (A)(1)(c).
6. Guarding of Live Parts: CEC Article 110.27 (C).
7. Locked Rooms or Enclosures: CEC Article 110.34 (C).

1.7 OPERATION AND MAINTENANCE MANUALS

A. Prior to Project closeout furnish to the Owner, six (6) hard back 3-ring binders containing all bulletins, operation and maintenance instructions, part lists, service telephone numbers and other pertinent information as noted in each Section all equipment furnished under Division 26. Binders shall be indexed into Division Sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXCAVATION

A. General: Cutting and digging shall be under the direct supervision of the General Contractor and included as necessary for the Work of this Section.

B. Excavation for underground vaults and electrical structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10-foot; plus, a sufficient distance to permit placing and removal of concrete formwork, installation or services, other construction and for inspection.
   1. Excavate, by hand, areas within dripline of large trees. Protect the root system for damage and dry-out. Maintain moist conditions for root system and over exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
   2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

C. Trenching: Excavate trenches for electrical installation as follows:
   1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearances on both side of raceways and equipment.
   2. Excavate trenches to depth indicated or required.
   3. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
   4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.

D. Backfilling: Place soil materials in layers to required subgrade elevations for each area classification, using materials and methods specified in Division 31, Earthwork.
   1. Under building slabs, use drainage fill materials.

3.2 ROUGH-IN

A. Contractor shall verify lines, levels and dimensions indicated on the Drawings and shall be responsible for the accuracy of the setting out of Work and for its strict conformance with existing conditions at the Project site.

B. Verify final locations for rough ins with field measurements and with the requirements for the actual equipment to be connected.

C. Refer to equipment specification in Divisions 22 through 33 for rough-in requirements.

3.3 ELECTRICAL INSTALLATION

A. Preparation, sequencing, handling, and installation shall be in accordance with Manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Comply with the following requirements:
   1. Shop Drawings prepared by Manufacturer.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting height is not detailed or dimensioned, contact the Architect for direction prior to proceeding with rough-in.
7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are indicated only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Coordinate electrical systems, equipment, and materials installations with other building components.
12. Provide access panel or doors where devices or equipment are concealed behind finished surfaces. Furnish and install access doors per the requirements of Division 08.
13. Install systems, materials and equipment giving right-of-way priority to other systems that are required to maintain a specified slope.
14. Conform to the National Electrical Contractors Association "Standard of Installation" for general installation practice.

3.4 CUTTING, PATCHING, PAINTING AND SEALING

A. Structural members shall in no case be drilled, bored, or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the Architect and Structural Engineer.

B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

C. Cut, remove, and legally dispose of selected electrical equipment, components and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new work.

D. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Patch existing surfaces and building components using experienced installers and new materials matching existing materials and the original installation. For installers' qualifications refer to the materials and methods required for the surface and building components being patched.

G. Application of joint sealers:
1. General: Comply with joint sealer Manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
2. Installation of fire-stopping sealant: Install sealant, including forming, packing and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops and fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.5 FIELD QUALITY CONTROL

A. General testing requirements:
1. The purpose of testing is to ensure that all tested electrical equipment, both Contractor and Owner supplied, is operational and within industry and Manufacturer’s tolerances and is installed in accordance with design Specifications.
2. Tests and inspections shall determine suitability for energization.
3. Perform tests in presence of the Owner's Representative and furnish test equipment, facilities and technical personnel required to perform tests.
4. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.

B. Tests: In addition to specific system test described elsewhere, tests shall include:
1. Equipment operations: Test motors for correct operation and rotation.
2. Lighting control circuits: Test lighting circuits for correct operation through their control devices.
3. Alarm and interlock systems: Produce malfunction symptoms in operating systems to test alarm and interlock systems. In addition, all specific tests described in the fire alarm system shall be performed.
4. Circuit numbering verification: Select on a random basis, various circuit breakers within the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.
5. Voltage check:
a. At completion of job, check voltage at several points of utilization on the system that has been installed under this Contract. During test, energize all installed loads.
b. If proper voltage cannot be obtained, inform the Owner and the serving Utility Company.

C. Contractor shall provide test power required when testing equipment before service energization and coordinate availability of test power with General Contractor after service energization. The Contractor shall provide any specialized test power as needed or specified herein.

D. Testing safety and precautions:
1. Safety practices shall include the following requirements:
a. Applicable State and Local safety operating procedures.
b. OSHA.
c. NSC.
d. NFPA 70E.
2. All tests shall be performed with apparatus de-energized and grounded except where otherwise specifically required ungrounded by test procedure.

E. Calibration of test equipment:
   1. Testing Agency shall have calibration program that assures test instruments are maintained within rated accuracy.
   2. Instruments shall be calibrated in accordance with the following frequency schedule:
      a. Field instruments: Analog, 6-months maximum; Digital, 12-months maximum.
      b. Laboratory instruments: 12-months.
      c. Leased specialty equipment: 12-months where accuracy is guaranteed by lessor.
   3. Dated calibration labels shall be visible on test equipment.
   4. Records, which show date and results of instruments calibrated or tested, must be kept up to date.
   5. Up-to-date instrument calibration instructions and procedures shall be maintained for test instrument.
   6. Calibration standards shall be of higher accuracy than instrument tested.
   7. Equipment used for field testing shall be more accurate than instrument being tested.

F. Coordinate with General Contractor regarding testing schedule and availability of equipment ready for testing.

G. Notify Owner and Engineer one week in advance of any testing.

H. Any products which fail during the tests or are ruled unsatisfactory by the Owner's Representative shall be replaced, repaired, or corrected as prescribed by the Owner's Representative at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.

I. Testing Agency shall maintain written record of tests and shall assemble and certify final test report.

J. Include all test results in the maintenance manuals.

3.6 CLEANING

A. Prior to energizing of electrical equipment, the Contractor shall thoroughly clean the interior of enclosures from construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project, prior to final acceptance, the Contractor shall thoroughly clean both the interior and exterior of all electrical equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.7 PROJECT CLOSEOUT

A. Training: At the time of completion, a period of not less than 24-hours shall be allotted by the Contractor for instruction of building operating and maintenance personnel in the use of all systems. This 24-hour training is in addition to any instruction time called out in the Specifications for specific systems, i.e., Fire Alarm, etc. All personnel shall be instructed at one time, the Contractor making all necessary arrangements with Manufacturer’s Representative. The equipment Manufacturer shall be requested to provide product literature and application guides for the users' reference. Costs, if any, for the above services shall be paid by the Contractor.

B. Special tools: Provide one of each tool type required for proper operation and maintenance of the equipment provided under this Section. All tools shall be delivered to the Owner at the Project completion.

C. Keying: Provide two keys for each lock furnished under this Section and turn over to Owner.

END OF SECTION

SECTION 26 0060

POWER SYSTEM STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Services necessary to complete the system analysis studies required for the item specified under this Division, including but not limited to:
   1. Short circuit study.
   2. Protective device evaluation study.
   3. Protective device coordination study.
   4. Arc flash and shock risk assessment.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with equipment specified elsewhere to perform a complete analysis study.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. American National Standards Institute, Inc. (ANSI):
      ANSI Z535.4; Product Safety Signs and Labels
   2. Institute of Electrical and Electronic Engineers (IEEE):
      IEEE 1584; Guide for Performing Arc-Flash Hazard Calculations
   3. National Fire Protection Association (NFPA):
      NFPA 70E; Standard for Electrical Safety in the Workplace

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. The results of the Power System Study shall be summarized in a final report. Three (3) bound copies of the final report shall be submitted.
   2. The report shall include the following Sections:
      a. Description, purpose, basis and scope of the study and a single line diagram of that portion of the power system, which is included within the scope of the study.
      b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties and commentary regarding it.
      c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection and commentary regarding it.
      d. Fault current calculations including a definition of terms and guide for interpretation of computer printout.
      e. Recommended size for power fuses and recommended settings for ground fault relays and for all adjustable trip relays.
      f. Confirmation in writing of compliance with Arc Energy Reduction per CEC Articles 240.67 and 240.87.

g. Confirmation in writing of compliance with all CEC mandated selective coordination requirements (e.g. CEC Articles 517, 620, 645, 695, 700, 701, and 708) associated with this project. Include manufacturer selective coordination tables, etc. for documentation to be submitted to the Authority Having Jurisdiction (AHJ).
h. Tabulations of arc flash and shock risk assessment results and commentary regarding results.
i. Sample arc flash and shock hazard warning label.

3. Contractor shall also provide an electronic copy of the report as part of the Record Document process. Electronic copy of the report shall be in PDF format and its native file format (e.g. XXX.PRJ).

B. The study shall be submitted prior to final review of the distribution equipment Shop Drawings, prior to release of equipment for manufacture. If formal completion of the study may cause delay in equipment manufacture, approval from the Architect may be obtained for a preliminary submittal of sufficient data to ensure that the selection of device ratings and characteristics will be satisfactory. Then the formal study will be provided to verify the preliminary findings.

1.4 QUALITY ASSURANCE

A. The system analysis studies shall be performed by the Switchboard/Switchgear Manufacturer or by an approved Independent Testing Company. The analysis shall be stamped by a professional engineer licensed in the State of California.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 GENERAL

A. The studies shall include all portions of the electrical distribution system from the main normal power services down to and including the 208volt AC distribution system. Normal system connections and those that result in maximum fault conditions shall be adequately covered in the study.

3.2 SHORT CIRCUIT STUDY AND PROTECTIVE DEVICE EVALUATION STUDY

A. The short circuit study shall be performed with the aid of a computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.

B. The study input data shall include the maximum available short circuit contribution, resistance and reactance components of the branch impedance, the X/R ratios, base quantities selected and other source impedance.

C. Short circuit close and latch duty values and interrupting duty values shall be calculated on the basis of maximum available current at each substation bus, switchgear bus, medium voltage controller, switchboard, low voltage motor control center, distribution panelboard, pertinent branch circuit panel and other significant locations through the system. The short circuit tabulations shall include asymmetrical fault currents, symmetrical fault currents and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contribution from each connected branch, shall be listed with its respective X/R ratio.

D. A protective device evaluation study shall be performed to determine the adequacy of circuit breakers, switches, transfer switches and fuses by tabulating and comparing the short circuit ratings of these devices with the calculated fault currents. Appropriate multiplying factors based on system X/R ratios and protective device rating standards shall be applied. Any problem areas or inadequacies in the equipment due to short circuit currents shall be promptly brought to the Architect's attention.

3.3 PROTECTIVE DEVICE COORDINATION STUDY

A. A protective device coordination study shall be performed to provide the necessary calculations and logic decisions required to select or to check the selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, ground fault relays and low voltage breaker trip characteristics and settings. The studies shall be in accordance with the latest applicable IEEE and ANSI standards.

B. The coordination study shall include all medium and low-voltage classes of equipment from the building or plant service protective devices down to and including low voltage motor control centers and panelboards. The phase and ground overcurrent protection shall be included as well as settings of all other adjustable protective devices

C. The time-current characteristics of the specified protective devices shall be drawn on log-log paper. The plots shall include complete titles, representative one-line diagram and legends, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves and fuses, phase cable damage curves, ground cable damage curves, medium-voltage cable shield damage curves, ground resistor damage curves, etc. as appropriate for the project. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits and significant symmetrical and asymmetrical fault currents. All restrictions of the National Electrical Code shall be adhered to and proper coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a system basis. A sufficient number of separate curves shall be used to clearly indicate the coordination achieved.

D. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, Manufacturer and type, range of adjustment and recommended settings. A tabulation of the recommended power fuse selection shall be provided for the medium voltage fuses where applied in the system. Any discrepancies, problem areas or inadequacies shall be promptly brought to the Architect's attention.

E. In addition to the protective device coordination study settings, temporary maintenance settings shall also be tabulated, which shall reduce the incident energy level to less than 8 cal/cm^2. Refer to specifications and submittals with equipment configured to accept an external maintenance mode setting. Consider all operating scenarios.

F. The company performing the protective device coordination study shall provide completed and filled out circuit breaker settings labels. Label type (size, colors, text size, etc.) shall be approved by the Owner. Labels shall be similar to the following example with industrial grade self-adhesive backing, weatherproof, and UV proof. Labels shall be provided to the commissioning agent for the commissioning agent to install during commissioning.

CIRCUIT BREAKER SETTINGS

CIRCUIT BREAKER SETTINGS			
T/U Mfr:		T/U Model:	
LTPU:		LTD:	
STPU:		STD:	
GFPU:		GFTD:	
INST:		Zone Intlk: (Y/N)	
Name:		Date:	
Verified By:		Date:	
Study Version:			

3.4 ARC FLASH AND SHOCK RISK ASSESSMENT

A. An arc flash and shock risk assessment shall be performed in accordance with NFPA 70E (utilizing IEEE 1584 calculation method for incident energy analysis method) at each switchboard, distribution board, panelboard, etc. in accordance with the referenced standards. NFPA 70E hazard/ risk tables for arc flash PPE category method are not acceptable for compliance with this section.

B. The arc flash and shock risk assessment shall include all voltage classes of equipment from the service entrance down to and including the panelboards, etc. in addition to all possible scenario configurations from alternate power sources (e.g. generators, etc.).

C. The company performing the arc flash and shock risk assessment shall provide arc flash and shock hazard warning labels for all equipment evaluated in accordance with NFPA 70E and ANSI Z535.4. Labeling shall be as follows:
   1. Label type:
      a. White vinyl or polyester with the following warning symbol color and black text:
         1) Incident energy below 40 cal/cm² = Orange.
         2) Incident energy for 40 cal/cm² and above = Red with DANGER symbol in lieu of WARNING.
      b. Industrial grade self-adhesive backing.
      c. Suitable for indoor or outdoor environments for a minimum of 3-years without fading or degrading.
   2. Label information (minimum):
      a. Nominal system voltage.
      b. Arc flash boundary (inches).
      c. Available incident energy and the corresponding working distance (inches).
      d. Limited approach boundary (inches).
      e. Restricted approach boundary (inches).
      f. Equipment identification.
      g. Date.
   3. Labels shall be affixed to all equipment covered under the risk assessment by the company performing the arc flash and shock risk assessment.
   4. Prior to printing and affixing labels, coordinate with the Owner and Architect, which scenario will be used for the labels.

3.5 PROTECTIVE DEVICE TESTING, CALIBRATION AND ADJUSTMENT

A. The equipment Manufacturer shall provide the services of a qualified field Engineer and necessary tools and equipment to test and calibrate the protective relays, ground fault relays and circuit breaker trip devices as recommended in the Power System Study.

END OF SECTION

SECTION 26 0090

ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor and equipment necessary to complete the demolition required for the item specified under this Division, including but not limited to:
   1. Selective Electrical demolition

1.2 SYSTEM DESCRIPTION

A. Disconnection, removal and relocation of all wiring, luminaires, outlets, conduit, and all other types of electrical equipment as described on Drawings.

B. Purpose is to remove, relocate and extend existing installations to accommodate new construction.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment necessary for patching and extending Work, as specified in other Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly review conditions in the area of demolition prior to commencing Work to ensure complete understanding of existing installation in relationship to demolition Work.

3.2 GENERAL REQUIREMENTS

A. Remove all wiring, luminaires, outlets, conduit, and all other types of electrical equipment indicated to be removed. Devices that are to be removed may require reworking conduit and wiring in order to maintain service to other devices. If removed devices are on walls or ceilings that are to remain, blank coverplates are to be installed on outlet boxes.

B. Where remodeling interferes with circuits in areas that are otherwise undisturbed, circuits shall be reworked as required.

C. Existing devices and circuiting that are indicated are indicated only for informational purposes. Contractor shall visit the Project site and shall verify conditions as they exist and shall remove, relocate, and/or rework any electrical equipment or circuits affected (whether indicated or not) due to removal of existing walls, ceilings, etc. Coordinate all Work with that of other trades.

D. All equipment, luminaires, devices, etc., which are removed shall be delivered to the Owner for disposition. All items which are removed and not wanted by the Owner and which are not reused shall become the property of the Contractor and shall be legally removed from the Project site.

E. Cutting and patching necessary for the removal of Electrical Work shall be included.

F. Remove and replace luminaires, rework, relocate or replace conduit and wiring and do other Work required by the installation of new ductwork, piping, etc., above the ceiling. Coordinate with other trades and verify the extent of the Work.

3.3 LUMINAIRES

A. Disconnect and remove abandoned luminaires. Remove conduits, wiring, boxes, brackets, stems, hangers, and other accessories.

3.4 OUTLETS

A. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

3.5 CONDUIT

A. Remove abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.

3.6 WIRING

A. Removed abandoned wiring to source of supply.

3.7 EXISTING SYSTEMS

A. Electrical distribution system: Disable system only to make switchovers and connections. Obtain permission from Owner's designated representative at least 24-hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to Work area.

B. Fire alarm system: Maintain the existing system in service. Disable system only to make temporary connections to maintain service in areas adjacent to Work area(s). Notify Owner and Fire Supervisory Service at least 24-hours before partially or completely disabling the system.

C. Telephone system: Maintain the existing system in service throughout construction. Disable system only to make temporary connections where necessary to maintain service in areas adjacent to Work area(s). Notify Owner and Telephone Utility at least 24-work week hours before partially or completely disabling the system.

3.8 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that shall remain.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaries: Remove lenses and lamps and clean all exposed surfaces. Also clean the lenses or replace if discolored. Provide all new lamping when re-assembling.

END OF SECTION

SECTION 26 0519

BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Building wire.
   2. Cable.
   3. Wiring connections and terminations.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Federal Specifications (FS):
      - FS J-C-30A; Cable and Wire, Electrical (Power, Fixed Installation).
      - FS W-S-610C; Splice Conductor.
      - FS HH-I-595C; Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic.
   2. Underwriters Laboratories, Inc. (UL):
      - UL 4; Armored Cable.
      - UL 44; Thermoset-Insulated Wires and Cables.
      - UL 62; Flexible Cord and Fixture Wire.
      - UL 83; Thermoplastic-Insulated Wires and Cables.
      - UL 183; Manufactured Wiring Systems.
      - UL 310; Electrical Quick-Connect Terminals.
      - UL 486A & B; Wire Connectors.
      - UL 486C; Splicing Wire Connectors.
      - UL 486D; Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
      - UL 493; Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables.
      - UL 510; Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
      - UL 854; Service-Entrance Cables.
      - UL 1569; Metal-Clad Cables.
      - UL 1581; Reference Standard for Electrical Wires, Cables and Flexible Cords.
      - UL 2196; Standard for Tests of Fire Resistive Cables.
   3. National Electrical Manufacturer Association (NEMA):
      - NEMA WC-70; Power Cables Rated 2,000 V or Less for the Distribution of Electrical Energy.
   4. Institute of Electrical and Electronic Engineers (IEEE):
      - IEEE 82; Test Procedure for Impulse Voltage Tests on Insulated Conductors.

IEEE 576; Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.
4. Final test results.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

C. Independent Testing Agency qualifications: Refer to Section 26 0010: Basic Electrical Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Building wire:
a. Cerrowire
b. General Cable
c. Southwire Company
d. Stabiloy (aluminum only)
e. United Wire and Cable
2. Metal-clad cable and Armored cable:
a. AFC Cable Systems
b. AFC Cable Systems – MC Luminary Cable (0-10V)
c. Southwire Company
3. Flexible cords and cables:
a. Carol Cable Company
b. Cerrowire
c. PWC Corp
4. Wiring connectors and terminations:
a. 3M Company.
b. Ideal.
c. Blackburn-Holub.
d. Burndy.
e. Thomas & Betts Corp.

f. Beau Barrier.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 BUILDING WIRE

A. Conductor material:
1. Provide annealed copper for all wire, conductor, and cable, unless otherwise indicated.
2. Copper wire AWG #8 and larger shall be stranded, unless otherwise indicated.
3. Copper wire AWG #10 and smaller may be solid or stranded as best suited for the installation.

B. Insulation material:
1. All insulated wire, conductor and cable shall be 600volt rated, unless otherwise noted on the Drawings.
2. Thermoplastic-insulated building wire.
3. Rubber-insulated building wire.
4. Copper feeders and branch circuits larger than #6 AWG: Type THW, XHHW or dual rated THHN/THWN.
5. Copper feeders and branch circuits #6 AWG and smaller: Type TW, THW, XHHW or dual rated THHN/THWN.
6. Conductors for variable frequency drives (VFD): Type XHHW-2.
7. Control Circuits: Type THW or dual rated THHN/THWN.
8. Identify system conductors as to voltage and phase connections by means of color-impregnated insulation.

2.3 METAL-CLAD CABLE (MC)

A. MC cable shall be an armored assembly of two or more dual rated THHN/THWN annealed copper conductors with a full sized green insulated ground wire.

B. MC cable shall be an armored assembly of two or more dual rated THHN/THWN annealed copper conductors rated below 100amps with a full sized green insulated ground wire.

C. MC cable shall be an armored assembly of two or more XHHW-2, 90-degree C rated compact stranded aluminum conductors rated 100amps and above with a full sized green insulated ground wire.

D. MC cable sheath shall be fabricated in continuous lengths from galvanized steel strips, spirally wound and formed to provide an interlocking design.

E. Conductors shall be color-coded for the correct phase and voltage as specified herein.

F. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Fittings shall be UL listed for use with MC cable type specified.

G. MC cable used for 0-10volt signal wiring shall have the 0-10volt wires twisted at a different twist ratio than that of the current carrying conductors.

2.4 ARMORED CABLE (AC)

A. AC cable shall be an armored assembly of two or more dual rated THHN/THWN conductors. A full sized green insulated ground wire and a bare wire metal sheath bond conductor.

B. AC cable shall be an armored assembly of two or more dual rated THHN/THWN annealed copper conductors rated below 100amps with a full sized green insulated ground wire.

C. AC cable shall be an armored assembly of two or more XHHW-2, 90-degree C rated compact stranded aluminum conductors rated 100amps and above with a full sized green insulated ground wire.

D. MC cable sheath shall be fabricated in continuous lengths from galvanized steel strips, spirally wound and formed to provide an interlocking design.

E. Conductors shall be color-coded for the correct phase and voltage as specified herein.

F. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Fittings shall be UL listed for use with MC cable type specified.

2.5 FLEXIBLE CORDS AND CABLES (TYPE'S')

A. Provide flexible cords and cables of size, type and arrangement as indicated on the Drawings.

B. Type 'S' flexible cords and cables shall be manufactured in accordance with CEC Article 400 and composed of two or more conductors and a full size green insulated ground wire with an outer jacket of rubber or neoprene as noted.

C. Flexible cords and cables shall be fitted with wire mesh strain relief grips either as an integral component of the connector or as an independently supported unit.

D. Suspended flexible cords and cables shall incorporate safety spring(s) unless otherwise noted.

2.6 WIRING CONNECTIONS AND TERMINATIONS

A. Bolted pressure connectors: Provide wide range-taking connectors with cast bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.

B. Electrical spring wire connectors:
1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-section steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.
2. Self-striping pigtail and tap U-contact connectors shall not be used.

C. Push-in wire connectors:
1. Multi-port push-in wire connectors for a maximum of 8-wires, as required for specific application. Connectors are manufactured to accommodate a wide range of sizes with either solid or stranded conductors, up to a maximum wire size of #10 AWG. Low insertion force required for ease of installation.
2. Housing shall be 105-degrees C and transparent for visual connection verification.
3. 600volt maximum rating with copper contacts.

4. UL Listed to 486C and UL 467 Listed for grounding and bonding applications.

D. Compression type terminating lugs:
   1. Provide tin-plated copper high-compression type lugs for installation with hand or hydraulically operated circumference-crimping tools and dies as stipulated by the lug Manufacturer or as indicated on Drawings. Notch or single point type crimping is NOT acceptable.
   2. Two-hole, long barrel lugs shall be provided for size #4/0 and larger wire where terminated to bus bars. Use minimum of three crimps per lug, on sizes where possible.

E. Splicing and insulating tape: Provide black, ultraviolet proof, self-extinguishing, 7-mil thick vinyl general purpose electrical tape with a dielectric strength of 10,000volts suitable for temperatures from minus 18-degrees C to 105-degrees C. Federal Spec. HH-I-595, Scotch 33+ or equal minimum.

F. Insulating putty:
   1. Provide pads or rolls of non-corrosive, self-fusing, one-eighth inch thick rubber putty with PVC backing sheet. Scotch vinyl mastic pads and roll or equal.
   2. Use putty suitable for temperatures from minus 17.8-degrees C to 37.8-degrees C with a dielectric strength of 570volts/mil minimum.

G. Insulating resin:
   1. Provide two-part liquid epoxy resin with resin and catalyst in pre-measured, sealed mixing pouch. Scotchcast 4 or equal for wet or underground vaults, boxes, etc. splices or terminations.
   2. Use resin with a set up time of approximately 30-minutes at 21.1-degrees C and with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.

H. Terminal strips:
   1. Provide box type terminal strips in the required quantity plus 25% spare. Install in continuous rows in terminal cabinets.
   2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.
   3. Identify all terminals with numbering sequence being used for a system.

I. Crimp type connectors:
   1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support
   2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector Manufacturer.
   3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support.
   4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support.

J. Cable ties: Provide harnessing and point-to-point wire bundling with nylon cable ties. All cable ties shall be installed using tool supplied by Manufacturer of ties.

K. Wire lubricating compound:
   1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.
   2. Shall not be used on wire for isolated type electrical power systems.

L. Bolt termination hardware:
1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE grade 5; or silicon bronze alloy ASTM B-9954 Type B.
2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.
3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, confirming to ANSI B27.2. SAE or narrow series shall not be used.
4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.
5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:
   a. 1/4" bolt: 125amps
   b. 5/16" bolt: 175amps
   c. 3/8" bolt: 225amps
   d. 1/2" bolt: 300amps
   e. 5/8" bolt: 375amps
   f. 3/4" bolt: 450amps

M. The above connections and terminations were specifically design for copper wire to copper bussing. For aluminum connections and terminations, the following ANSI standards with sufficient plating, to prevent oxidation or bi-metallic corrosion, shall be applied.

CONNECTION	CONNECTOR BODY	BOLT & LOCKWASHER MATERIAL
Aluminum to tinned aluminum	Aluminum	Aluminum
Copper to tinned aluminum	Bronze	Bronze or Steel
Copper to tinned copper	Copper of bronze	Bronze

N. Coat aluminum feeder contact surfaces with a “nongrit” joint compound such as No-Ox-ID-A special.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wire and cable installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 APPLICATION

A. All wire, conductor and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient condition.

B. Feeders and branch circuits in wet locations shall be rated 75-degree C.

C. Feeders and branch circuits in dry locations shall be rated 90-degree C.

D. Feeders and branch circuits for direct-current (DC) systems, such as PV installations, in wet locations shall be type XHHW-2 copper conductors.

E. Feeders for VFD's shall be type XHHW-2 copper conductors High Flex Belden VFD copper cable.

F. For wiring of the following, refer to the indicated Code Articles:
1. Fire pump systems shall comply with CEC Article 695.
2. Emergency systems shall comply with CEC Article 700.
3. Critical operations power systems (COPS) shall comply with CEC Article 708.
4. Fire alarm systems shall comply with CEC Article 760.

G. Minimum conductor size:
1. Provide minimum AWG #12 for all power and lighting branch circuits.
2. Provide minimum AWG #14 for all line voltage signal and control wiring unless otherwise indicated.

H. Color coding:
1. For 120/208volt, 3-phase, 4-wire systems:
a. Phase A - Black
b. Phase B - Red
c. Phase C - Blue
d. Neutral - White
e. Ground - Green
2. Switch leg individually installed shall be the same color as the branch circuit to which they are connected, unless otherwise noted.
3. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral.

3.3 WIRING METHODS

A. Install wires and cables in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Install all single conductors in raceway system, unless otherwise noted.

C. Parallel circuit conductors and terminations shall be equal in length and identical in all ways.

D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

E. 20amp power and lighting branch circuit containing no more than four (4) current carrying conductors (phases and neutrals). Use #10 AWG conductor for 120/208volt circuits located outside a 75-foot radius of panel source and unless otherwise noted.

F. 20amp power and lighting branch circuits containing no more than eight (8) current carrying conductors (phases and neutrals). Use #10 AWG conductors for 120/208volt circuits located outside a 65-foot radius of panel source

G. Provide #10 AWG pig tails on all 20amp and 30amp wiring devices served by #8 AWG conductors and larger.

H. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes or handholes. Group and bundle with tie wrap each neutral with its associated phase conductor where more than one neutral is present in a conduit.

I. Install cable supports for all vertical feeders in accordance with the CEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.

J. Neatly form, train, and tie the cables in individual circuits. For panelboards, cabinets, wireways, switches, and equipment assemblies.

K. Seal cable or wire, entering a building from underground, between the wire or cable and conduit, where it exits the conduit, with a non-hardening approved compound, i.e. duct seal or equal.

L. Provide UL-listed factory-fabricated, solderless metal connectors of size, ampacity rating, material, type, and class for applications and for services indicated. Use connectors with temperature ratings equal to or greater than the wires that are being terminated.

M. Stranded wire shall be terminated using fitting, lugs or devices listed for the application. However, in no case shall stranded wire be terminated solely by wrapping it around a screw or bolt.

N. Flexible cords and cables supplied, as part of a pre-manufacturer fixture or unit assembly shall be installed according to Manufacturers published installation instructions.

3.4 WIRING INSTALLATION IN RACEWAYS

A. Install wire in raceway in accordance with IEEE 576, Manufacturer's written instructions, as indicated on the Drawings and as specified herein after interior of building has been physically protected from the weather and all mechanical Work likely to injure conductors has been completed. Pull all conductors into a raceway at the same time. Exercise care in pulling conductors so that insulation is not damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.

B. Completely mandrel all underground or concrete encased conduits prior to installing conductors.

C. Completely and thoroughly swab raceway system before installing conductors.

D. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors of size smaller than #1 AWG.

E. Wire pulling:
1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
2. Use rope made of nonmetallic material for pulling feeders.
3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. Pull in together multiple conductors or cables in a single conduit.
5. Pulling tensions and sidewall pressures shall not exceed 60% of the manufacturer's recommended maximum values. Pulling tension shall be continuously monitored during the pull by a calibrated dynamometer. If pulling tension is exceeded during the pull, immediately notify the engineer to determine if the cables will be considered damaged and require contractor replacement.

F. Install and test all cables in accordance with Manufacturer's instructions and warranty.

3.5 MC CABLE INSTALLATION

A. The Drawings indicate above suspended ceiling power distribution junction boxes for conversion from hardwire to MC cable wiring system. Install these boxes such that they are accessible from below. MC cable shall be run to each device as described in documents. MC cable runs have not been indicated.

B. Use of MC Cable is restricted as follows:
1. Do not install MC Cable above inaccessible ceiling space.
2. Do not install MC Cable horizontally in wall cavities.

C. Install MC cable in accordance with Manufacturer's instructions and in strict accordance with CEC Article 330. Secure and support MC cable with straps, independent hanger wire per CEC 300.11 (B), or cable ties listed for the purpose. Follow Manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly secured to the cable, but not over-tightened. Connector shall be firmly attached to the metal boxes.

D. Support cables every 6-feet and within 12-inches of boxes, per CEC Article 330, using separate spring metal clip or metal cable ties (not steel tie wire) for each cable. Cables shall not be bundled together.

E. Hanger wire used to support suspended ceilings may not be used to directly support MC cables.

F. Do not rest cables on ceiling tiles or allow contact with mechanical piping systems.

G. Bend the cable per CEC Article 330.

H. Provide separate sleeves and/or fire barriers where cable penetrated firewalls, unless cable is UL listed for the application.

3.6 AC CABLE – INSTALLATION

A. The Drawings indicate above suspended ceiling power distribution junction boxes for conversion from hardwire to AC cable wiring system. Install these boxes such that they are accessible from below. AC cable shall be run to each device as described in documents. AC cable runs have not been indicated.

B. Use of AC Cable is restricted as follows:
1. Do not install AC Cable above inaccessible ceiling space.
2. Do not install AC Cable horizontally in wall cavities.

C. Install AC cable in accordance with Manufacturer instructions and in strict accordance with CEC Article 320. Secure and support MC cable with straps, independent hanger wire per CEC 300.11 (B), or cable ties listed for the purpose. Follow Manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly secured to the cable, but not over tightened. Connector shall be firmly attached to the metal boxes.

D. Support cables every 4 ½-feet and within 12-inches of boxes, per CEC Article 320, using separate spring metal clip or metal cable ties (not steel tie wire) for each cable. Cables shall not be bundled together.

E. Hanger wire used to support suspended ceilings may not be used to directly support AC cables.

F. Do not rest cables on ceiling tiles or allow contact with mechanical piping systems.

G. Bend the cable per CEC Article 320.

H. Provide separate sleeves and/or fire barriers where cable penetrated firewalls, unless cable is UL listed for the application.

3.7 WIRE SPLICES, JOINTS AND TERMINATION

A. Join and terminate wire, conductors, and cables in accordance with UL 486A, C, CEC and Manufacturer's instructions.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

D. Splices and terminations shall be made mechanically and electrically secure.

E. Where it's determined that unsatisfactory splice or terminations have been installed, remove the devices and install approved devices at no addition cost.

F. Terminate wires in Terminal Cabinets, relay, and contactor panels, etc. using terminal strip connectors.

G. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere in the panel or cabinet.

H. Install cable ties and maintain harnessing.

I. Encapsulate splices in exterior outlets, pull boxes and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment and equipment in pump rooms.

J. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as the feed conductor. Form conductor prior to cutting and provide at least 6-inches of tail and neatly packed in box after splice is made up.

K. Branch circuits (#10 AWG and smaller):
   1. Connectors: Solderless, screw-on, reusable spring pressure cable type, 600volt, 105-degree C. with integral insulation, approved for copper conductors.
   2. The integral insulator shall have a skirt to completely cover the stripped wires.
   3. The number, size and combination of conductors as listed on the Manufacturers packaging shall be strictly complied with.

L. Feeder circuits: (#6 to 750 kCMIL)
   1. Join or tap conductors from #6 AWG to 750 kCMIL using bolted pressure connectors or insulate mechanical compression (hi-press) taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of the joint.

2. Terminate conductors from size #6 AWG to 750 kCMIL copper using bolted pressure or mechanical compression lugs in accordance with Manufacturer recommendation or as specified elsewhere.
3. Field installed compression connectors for cable sizes 250 kCMIL and larger shall have not less than two clamping elements or compression indents per wire.
4. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.

M. Termination hardware assemblies:
1. AL/CU lugs connected to aluminum plated or copper buss, shall be secured using a steel bolt, flat washer (two per bolt), Belleville washer and nut.
2. Copper lugs connected to copper bus, shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.
3. The crown of Belleville washers shall be under the nut.
4. Bolt assemblies shall be torque to Manufacturer recommendation. Where manufacture recommendations are not obtainable, the following values shall be used:
   a. 1/4" - 20 bolt at 80-inch pounds torque.
   b. 5/16" - 18 bolt at 180-inch pounds torque.
   c. 3/8" - 16 bolt at 20-foot pounds torque.
   d. 1/2" - 13 bolt at 40-foot pounds torque.
   e. 5/8" - 11 bolt at 55-foot pounds torque.
   f. 3/4" - 10 bolt at 158-foot pounds torque.

3.8 IDENTIFICATION

A. Refer to Section 26 0553: Electrical Identification for additional requirements.

B. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.

C. Color code conductors' size #8 and larger using specified phase color markers and identification tags.

D. Provide all terminal strips with each individual terminal identified using specified vinyl markers.

E. In manholes, pull boxes and handholes, provide tags of the embossed brass type and show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.9 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein. Independent Testing Agency shall meet the requirements as outlined in Section 26 0010: Basic Electrical Requirements.

B. Prefunctional testing:
1. Visual and mechanical inspection:
   a. Compare cable data with Contract Documents.
   b. Inspect exposed sections of wires and cables for physical damage and proper connections.

c. Verify tightness of accessible bolted connections with calibrated torque wrench in accordance with Manufacturer's published data.
d. Inspect compression applied connectors for correct cable match and indention.
e. Verify visible cable bend meet or exceed ICEA and Manufacturer's minimum allowable bending radius.
f. If cables are terminated through window type current transformers, inspect to verify neutral and ground conductors are correctly placed for operation of protective devices.
g. Ensure wire and cable identification has been installed as specified herein.

2. Electrical testing:
   a. Contractor shall perform feeder and branch circuit insulation test after installation and prior to connection to utilization devices such as fixtures, motors, or appliances. Testing shall be as follows:
      1) 100% of all feeders 100amp rated and above.
      2) 50% of all feeders smaller than 100amps.
      3) 10% of all branch circuits at each individual panelboard.
   b. Perform insulation-resistance test using megohm meter with applied potential of 1000volt DC for a continuous duration of 60-seconds. Test conductors' phase-to-phase and phase-to-ground. Conductors shall test free from short-circuit and ground faults.
   c. Perform continuity test of all feeder and branch circuits to ensure correct cable connections. Test all neutrals for improper grounds.
   d. Contractor shall furnish instruments, materials, and labor for these tests.
3. Test values: Investigate resistance values less than 50-megohms.
4. Furnish test results in typewritten report form for review and inclusion in the operation and maintenance manuals.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Power system grounding.
   2. Site lighting grounding.
   3. Telecommunication system grounding.
   4. Electrical equipment and raceway grounding and bonding.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 05: Building Steel.
   2. Division 22: Cold Water Piping.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Underwriters Laboratories, Inc. (UL):
      UL 467; Grounding and Bonding Equipment.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      IEEE No. 142; Recommended Practice for Grounding of industrial and Commercial Power Systems.
      IEEE No. 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.3 SYSTEM DESCRIPTION

A. Ground the electrical service system neutral at service entrance equipment as described herein and indicated on Drawings.

B. Ground each separately derived system neutral as described herein and indicated on Drawings.

C. Provide telecommunications system grounding conductor as described herein and indicate on Drawings.

D. xcept as otherwise indicated, the complete electrical installation including the neutral conductor, metallic conduits and raceways, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically indicated or specified.

E. Resistance:
   1. Resistance from the main switchboard ground bus through the ground electrode to earth shall not exceed 5-OHMS unless otherwise noted.

2. Resistance from the farthest panelboard, switchboard, etc. ground bus through the ground electrode to earth shall not exceed 20-OHMS

1.4 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Ground Rods:
a. Weaver.
b. Erico "Cadweld" Products, Inc.
2. Ground Wells:
a. Christy Concrete Products, Inc.
b. Forni Corp.
3. Ground Bushings, Connectors, Jumpers and Bus:
a. O-Z/Gedney.
b. Thomas & Betts Corp.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 GROUND CONDUCTORS

A. Refer to Specification Section 26 0519: Building Wire and Cable for conductor specifications.

B. General purpose insulated:
1. UL approved and code sized copper conductor, with dual rated THHN/THWN insulation, color identified green.
2. Where continuous color-coded conductors are not commercially available, provide a minimum 4" long color band with green, non-aging, plastic tape in accordance with CEC.

C. Bare conductors in direct contact with earth or encased in concrete: #4/0 AWG copper minimum, U.O.N.

D. Bonding pigtails: Insulated copper conductor, identified green, sized per code, and provide with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.

2.3 DRIVEN (GROUND) RODS

A. Copper clad steel, minimum 3/4-inch diameter by 8 feet long, unless otherwise noted.

2.4 GROUND WELL BOXES FOR GROUND RODS

A. Precast concrete box nominal 9" throat diameter x 14" deep with light duty concrete cover for non-traffic areas or steel plate for traffic areas. Cover shall be embossed or engraved with "GROUND ROD".

2.5 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron or steel body with 150-degree Centigrade molded plastic insulating throat and lay-in grounding lug.

2.6 CONNECTIONS TO PIPE

A. For cable to pipe: UL and CEC approved bolted connection.

2.7 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPLICES

A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high-pressure compression type connectors.
   1. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Cadweld or equal. Each particular type of weld shall use a kit unique to that type of weld.
   2. High-pressure compression type connectors shall be used for cable-to-cable and cable-to-ground rod connections.

2.8 EXTRA FLEXIBLE, FLAT BONDING JUMPERS

A. Where required by Code, indicated on the Drawing, and specified herein.

2.9 BUILDING GROUND BUS REQUIREMENTS

A. Main building power system ground bus:
   1. Provide one 24" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in main electrical room utilizing insulating stand-offs at 18" above finished floor.
   2. Furnish complete with cast copper alloy body lugs for connecting grounding system conductors. Attach lugs to bus with appropriate size cadmium bronze bolt, flat washer, and Belleville washer. Torque all lug connections.
   3. All holes shall be drilled and tapped for single-hole lugs. Provide 6 spare lugs and lug spaces.

B. Building power system reference ground bus:
   1. The reference ground bus is furnished as part of the main electrical switchboard for the building, along with neutral disconnect and bus, and is in addition to the main building power system ground bus outlined above. The building grounding electrode shall make a direct connection to the building referenced ground bus in the main switchboard.
   2. Provide a #4/0 AWG copper ground conductor connection between the building reference ground bus in switchboard and the main building ground bus wall mounted in main electrical room.

C. Telecommunication system ground bus requirements:
   1. Main telecommunication system ground bus: Provide one 18" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in MDF room utilizing insulating stand-offs at 18" above finished floor.
   2. Telecommunication system ground bus: Provide one 12" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in each IDF room and in the MPOE room utilizing insulating stand-offs at 18" above finished floor.
   3. Furnish complete with cast copper alloy body lugs for connecting grounding system conductors. Attach lugs to bus with appropriate size cadmium bronze bolt, flat washer, and Belleville washer. Torque all lug connections.
   4. All holes shall be drilled and tapped for single-hole lugs. Provide 3 spare lugs and lug spaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of grounding system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Grounding electrodes:
   1. Metal underground water pipe: Cold water metal piping system: Where the underground cold water service line is metal, indirect contact with the earth for 10-feet or more, the Contractor shall install a grounding electrode conductor from the main incoming cold water line ahead of the meter and extend to the main building reference ground bus in the main electrical room. The electrode shall be sized per CEC Article 250. Electrode connection should be accessible.
   2. Concrete encased grounding electrode (UFER ground): Provide a #4/0 AWG minimum bare copper conductor encased along the bottom of concrete foundation or footings which are in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. The electrode shall extend through a horizontal length of 30 feet minimum and shall be encased in not less than 2 or more than 5 inches of concrete separating it from surrounding soils. The electrode shall emerge from the concrete slab through a protective non-metallic sleeve and shall be extended to the main building reference ground bus.

3. Concrete encased grounding electrode (UFER ground) with ground rods: When there is a waterproof membrane between earth the concrete slab, foundation, or footing, there shall be no penetration of the membrane with the bare copper grounding electrode conductor. Instead the 30 feet of #2/0 AWG bare copper conductor shall be routed in the foundation floor slab, above the waterproof membrane, with four 10-foot long ground rods, spaced at 10-feet intervals and exothermically welded to ground electrode conductor in slab. Only the ground rods shall penetrate the membrane, so that a minimum of 8-feet of rod is exposed to earth at each of the four locations.
4. Supplementary grounding electrode (ground ring, grid and driven rods): Provide, as indicated on the Drawings, driven ground rod(s) installed in listed ground well box(s) and filled with gravel after connection is made. Interconnect ground rod with structural steel and adjacent rods with minimum #2 AWG bare copper conductor. Ground rod shall not be less than 10 foot from any other electrode of another electrical system or from adjacent ground rod(s).

B. Grounding electrode conductor: Provide grounding electrode conductor as indicated on the Drawings or sized per CEC Article 250, whichever is greater.

C. Power system grounding:
1. Provide, unless otherwise indicated, a main building power system ground bus mounted on the wall in the main electrical room. Connect the following items using CEC sized copper grounding conductors to lugs on the main building ground bus:
   a. Grounding conductor from building reference ground bus in main service switchboard.
   b. Bonding conductor to metallic cold-water piping system.
   c. Bonding conductor to building structural steel.
   d. Separately derived system grounding conductors in same room.
2. At the building power system reference ground bus in the main service switchboard, connect the grounding electrode conductor from concrete encased UFER ground or other grounding electrode systems as indicated on the Drawing or herein.

D. Separately derived electrical system grounding:
1. Ground each separately derived system per requirements in CEC Article 250 as a minimum, unless greater requirements are required elsewhere in the Contract Documents.
2. Transformers: Provide copper terminal bar for grounding and bonding the transformer in accordance with CEC Articles 250.30 and 450.10. Bond the terminal bar to the enclosure and connect the following to the terminal bar:
   a. Primary feeder equipment ground conductor(s).
   b. Secondary feeder supply-side bonding jumper(s).
   c. Grounding electrode conductor.
   d. Main bonding jumper to neutral (when present).
   e. Isolated ground conductor(s).
   f. Supplemental grounding electrodes.
3. Where construction of the building does not allow for easy connections to building steel, i.e. concrete constructed building structural system, a separate ground riser system shall be installed within the building. System shall consist of the following:
   a. From main building power system ground bus provide a #2/0 THHN ground conductor in a 1-1/4” conduit to each electrical riser closet and extend up through building to top floor electrical rooms.
   b. At each floor within each electrical room, provide a wall mounted pull box at 7’6” above finished floor to terminate and extend the ground riser conduit and conductor.

c. Pull box shall be a minimum of 14” x 14” x 6” deep and shall house a 12” wide x 4” high x ¼” thick bus bar on stand-off, mounted to back of pull box. Furnish complete with cast copper alloy body lugs for connecting grounding system conductors. Attach lugs to bus with appropriate size cadmium bronze bolt, flat washer and Belleville washer. Torque all lug connections.

E. Equipment bonding/grounding:
1. Provide a CEC sized insulated copper ground conductor in all 120volt AC through 600volt AC feeder and branch circuit distribution conduits and cables.
2. Provide a separate grounding bus at panelboards, switchboards, motor control centers. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35volts above ground.
3. Conduit terminating in concentric, eccentric, or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.
4. Provide bonding jumpers across expansion and deflection couplings in conduit runs, pipe connections to water meters, dielectric couplings in metallic cold-water piping system.
5. Provide internal ground wire in flexible conduit connected at each end via grounding bushing.

F. Site lighting grounding: Bond all metallic light poles and bollards. Provide ground rods where indicated on the Drawings.

G. Telecommunication system grounding:
1. In addition to grounding noted on the Drawings for the power systems, provide a telecommunication system ground riser for interconnecting the MDF, MPOE and all the IDF rooms in the building.
2. Riser shall consist of the following:
a. Provide a main telecommunication system ground bus wall mounted in the MDF room at the ground floor of building.
b. Provide telecommunication system ground bus wall mounted in each IDF room and at MPOE room.
c. From the main telecommunication system ground bus provide one #1/0 THHN in 1-1/4" conduit to the main electrical room and terminate conductor at the main building power system ground bus.
d. Additionally, from the main telecommunication system ground bus provide one #1/0 THHN in 1-1/4" conduit to the MPOE room and terminate conductor at the telecommunication system ground bus.
e. If IDF rooms exist on the ground floor of building, provide one #1/0 THHN in 1-1/4” conduit from the telecommunication system ground bus in each room to the main telecommunication system ground bus in the MDF room. If there are no IDF rooms at ground floor, provide one #1/0 THHN in 1-1/4” conduit from the telecommunication system ground bus in each IDF room at second floor and route to the main telecommunication system ground bus in the MDF room at ground floor.
f. From each of the telecommunication system ground buses at the IDF rooms on ground or second floor, route one #1/0 THHN in 1-1/4” conduit as a riser up the building to intertie all the telecommunication system ground buses in each IDF room.

3.3 FIELD QUALITY CONTROL

A. Independent Testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein.

B. Prefunctional testing:
   1. Provide Testing Agency with Contract Documents for their review prior to the commencement of ground testing.
   2. Visual and mechanical inspection:
      a. The Testing Agency shall inspect the grounding electrode and connections prior to concrete encasement, burial, or concealment.
      b. Check tightness and welds of all ground conductor terminations.
      c. Verify installation complies with the intent of the Contract Documents
   3. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required complying with resistance limits specified under this Section of the Specification.
   4. A typewritten record of measured resistance values shall be submitted for review and included with the operation and maintenance manual furnished to the Owner at the time of Project closeout and before certificate of final payment is issued.

END OF SECTION

SECTION 26 0529

ELECTRICAL HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Conduit supports.
   2. Equipment supports.
   3. Fastening hardware.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 03: Cast-in-place concrete. Concrete equipment pads.
   2. Division 05: Miscellaneous metals. Hangers for electrical equipment.
   3. Division 09: Ceiling suspension systems. Slack support wires.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Underwriters Laboratories, Inc. (UL):
      UL 2239; Hardware for the Supports of Conduit, Tubing and Cable.

1.3 SYSTEM DESCRIPTION

A. Provide devices specified in this Section and related Sections for support of electrical equipment furnished and installed under Division 26.

B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.4 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Submit Manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Concrete fasteners:
      a. Phillips "Red-Head".
      b. Remington.
      c. Ramset.
   2. Concrete inserts and construction channel:
      a. Unistrut Corp.
      b. GS Metals "Globe Strut."
      c. Thomas & Betts "Kindorf" Corp.
   3. Conduit straps:
      a. O-Z/Gedney.
      b. Erico "Caddy" Fastening Products.
      c. Thomas & Betts "Kindorf" Corp.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 CONCRETE FASTENERS

A. Provide expansion-shield type concrete anchors.

B. Provide powder driven concrete fasteners with washers. Obtain approval by Architect and Structural Engineer prior to use.

2.3 CONCRETE INSERTS

A. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.

2.4 THREADED ROD

A. Provide steel threaded rod, sized for the load unless otherwise noted on the Drawings or in the Specifications.

2.5 CONSTRUCTION CHANNEL

A. Provide 1.5-inch by 1.5-inch, 12-gauge galvanized steel channel with 17/32-inch diameter bolt holes and 1-1/2 inch on center in the base of the channel.

2.6 CONDUIT STRAPS

A. One-hole strap, steel, or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.
   1. Use malleable strap with spacers for exterior and wet locations.
   2. Use steel strap without spacers for interior locations.

B. Steel channel conduit strap for support from construction channel.

C. Steel conduit hanger for pendant support with threaded rod

D. Steel wire conduit support strap for support from independent #12-gauge hanger wires.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of supporting device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Coordinate size, shape, and location of concrete pads with Division 03, Cast-in-place concrete.

B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.

C. Where indicated on the Contract Documents, install freestanding electrical equipment on concrete pads.

3.3 INSTALLATION

A. Furnish and install supporting devices as noted throughout Division 26.

B. Electrical device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.

C. Fasten hanger rods, conduit clamps, outlet, and junction boxes to building structure using precast inserts, expansion anchors, preset inserts, or beam clamps.

D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster or gypsum board partitions and walls.

E. Use expansion anchors or preset inserts in solid masonry walls.

F. Use self-drilling anchors, expansion anchor or preset inserts on concrete surfaces.

G. Use sheet metal screws in sheet metal studs and wood screws in wood construction.

H. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or acoustical ceiling suspension wires.

I. Do not drill structural steel members unless first approved in writing by the Architect or Structural Engineer.

J. Fabricate supports from structural steel or steel channel, rigidly welded, or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

K. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.

L. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.4 ERECTION OF METAL SUPPORTS

A. Cut, fit and place miscellaneous metal fabrications accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.5 WOOD SUPPORTS

A. Cut, fit, and place wood grounds, nailers, blocking and anchorage accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

3.6 ANCHORAGE

A. All floor mounted, free standing electrical equipment such as transformers, switchboards, distribution boards, motor control centers, etc. shall be securely fastened to the floor structure.

B. Anchorage of electrical equipment shall comply with the seismic requirements as outlined in Section 26 0010: Basic Electrical Requirements.

END OF SECTION

SECTION 26 0531

CONDUIT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Rigid steel conduit and fittings.
   2. PVC insulated rigid steel conduit and fittings.
   3. Intermediate metal conduit and fittings.
   4. Electrical metallic tubing and fittings.
   5. Rigid non-metallic conduit and fittings.
   6. Flexible metallic conduit and fittings.
   7. Liquidtight flexible metallic conduit and fittings.
   8. Miscellaneous conduit fittings and products.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 01: Cutting and patching.
   2. Division 31: Earthwork. Excavation and backfill for conduit and utilities on Project site.
   3. Division 03: Cast-in-place concrete. Protective envelope for underground conduit installations.
   4. Division 07: Sheet metal flashing and trim.
   5. Division 09: Painting. Exposed conduit and other devices.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Federal Specifications (FS):
      FS WW-C-563; Electrical Metallic Tubing.
      FS WW-C-566; Specification for Flexible Metal Conduit.
      FS WW-C-581; Specification for Galvanized Rigid Conduit.
      FS W-C-1094A; Conduit and Conduit Fittings Plastic, Rigid.
   2. American National Standards Institute, Inc. (ANSI):
      ANSI C80.1; Rigid Steel Conduit, Zinc-Coated.
      ANSI C80.3; Electrical Metallic Tubing, Zinc Coated.
      ANSI/ TIA-569-D Telecommunications Pathways and Spaces.
   3. Underwriters Laboratories, Inc. (UL):
      UL 1; Flexible Metal Conduit.
      UL 6; Rigid Metal Conduit.
      UL 360; Liquid-Tight Flexible Steel Conduit.
      UL 514B; Conduit, Tubing and Cable Fittings.
      UL 635; Insulating Bushings.
      UL 651; Schedule 40 and 80 Rigid PVC Conduit.
      UL 651A; Type EB and A Rigid PVC Conduit and HDPE Conduit.
      UL 797; Electrical Metallic Tubing - Steel.

UL 1242; Intermediate Metal Conduit - Steel.

4. National Electrical Manufacturer Association (NEMA):
   NEMA RN1; PVC Externally coated Galvanized Rigid Steel Conduit.
   NEMA TC 2; Electrical Plastic Tubing and Conduit.
   NEMA TC 3; PVC Fittings for use with Rigid PVC Conduit.
   NEMA TC 6; PVC Plastic Utilities Duct (EB and DB Type)
   NEMA TC 9; Fittings for PVC Plastic Utilities Duct (EB and DB Type)

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Submit Manufacturer's installation instruction. Provide written instructions for raceway products requiring glues, special tools, or specific installation techniques.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Metal conduit:
      a. Allied Tube and Conduit Co.
      b. Triangle PWC, Inc.
      c. Western Tube and Conduit Corp.
      d. Spring City Electrical Manufacturing Co.
      e. Occidental Coating Co. (OCAL).
      f. Alflex Corp.
      g. American Flexible Metal Conduit Co.
      h. Anaconda.
   2. Nonmetallic conduit:
      a. Prime Conduit.
      b. JM Eagle.
      c. Cantex.
   3. Fittings:
      a. Appleton Electric Co.
      b. OZ/Gedney.
      c. Thomas & Betts Corp.
      d. Spring City Electrical Manufacturing Co.
      e. Occidental Coating Co. (OCAL).

f. Carlon.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 GALVANIZED RIGID STEEL CONDUIT (GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.

B. Standard threaded couplings, locknuts, bushings, and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.

C. Three-piece couplings: Hot dip galvanized, cast malleable iron.

D. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150-degree C minimum.

E. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.

F. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150-degrees C.

G. All fittings and connectors shall be threaded.

2.3 PVC INSULATED GALVANIZED RIGID STEEL CONDUIT (PVC GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.

B. Fittings: Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.

2.4 INTERMEDIATE METAL CONDUIT (IMC)

A. Conduit: Hot dip galvanized steel meeting the requirements of CEC Article 345 and conforming to ANSI C80.6 and UL 1242.

B. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 Specifications and shall meet UL requirements.

B. Set screw type couplings: Hot dip galvanized, steel or cast malleable iron, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of case-hardened steel with hex-head and cup point to firmly seat in wall of conduit for positive grounding.

C. Set screw type connectors: Hot dip galvanized, steel or cast malleable iron UL listed concrete tight with male hub and insulated plastic throat, 150-degree C temperature rated. Setscrew shall be same as for couplings.

D. Raintight couplings: Hot dip galvanized, steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.

E. Raintight connectors: Hot dip galvanized, steel or cast malleable iron, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.

2.6 RIGID NON-METALLIC CONDUIT (PVC)

A. Conduit:
1. Rigid polyvinyl chloride, Schedule 40 or 80 conforming to NEMA TC1 and UL 651, latest edition. UL listed for exposed and direct-burial applications and for 90 degrees C conductor insulation. Conduit shall include an integral bell fitting at one end.
2. Rigid polyvinyl chloride, Type EB or DB conforming to NEMA TC 6 and UL 651, latest edition. UL listed for concrete encased burial and direct burial applications and for 90 degrees C conductor insulation. Conduit shall include an integral bell fitting at one end.

B. Fittings: Couplings, adaptors, transition fittings, etc., shall be molded PVC, slip on, solvent weld type conforming to NEMA TC3 for Schedule 40 or 80 and NEMA TC 9 for type EB or DB.

2.7 FLEXIBLE METALLIC CONDUIT (FMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design and conforming to UL 1.

B. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for luminaire connection in suspended ceilings and cut-in outlet boxes within existing furred walls.

2.8 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.

B. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.9 RIGID NON-METALLIC CONDUIT (FRE)

A. Conduit: Rigid fiberglass reinforced epoxy composed of glass filaments encapsulated in an epoxy matrix. Each conduit length shall have an integral wound in expanded couplings. Size 2" through 6" shall incorporate an integral urethane gasket for sealing. No threads or adhesive shall be required to assemble the joints for in ground installations. All conduit and fittings will be pigmented with carbon black dispersed homogeneously throughout the epoxy glass matrix for U.V. protection.

B. Conduit and fittings shall be filament wound.

C. Conduit shall be suitable for continuous operation from -40°C to +110°C without significant change of mechanical properties. Conduit combustion by-products shall not contain chlorine gas in excess of trace levels and always less than OSHA limits.

D. FRE conduit shall be designated so conductors shall not adhere to conduit or fittings in fault conditions.

E. Dimensions: Conduit and fittings in 2" through 6" sizes inclusive shall have inside diameter equal to the trade size.

2.10 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

A. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.

B. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.

C. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.

D. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate 0.75-inch deflection, expansion or contraction in any direction and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless-steel jacket clamps. Unit shall comply with UL467 and UL514. Manufacturer shall be OZ/Gedney Type DX, Steel City Type EDF or equal.

E. Fire rated penetration seals:
1. UL building materials directory classified.
2. Conduit penetrations in fire rated separation shall be sealed with a UL classified fill, void or cavity material.
3. The fire rated sealant material shall be the product best suited for each type of penetration and may be a caulk, putty, composite sheet, or wrap/strip.

F. Standard products not herein specified:
1. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e. locknuts, bushings, etc.

2. Listing shall include Manufacturers name, part numbers and a written description of the item indicating type of material and construction.
3. Miscellaneous components shall be equal in quality, material and construction to similar items herein specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of conduit system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 APPLICATION

A. Galvanized rigid steel conduit (GRS) can be used in the following applications:
1. For feeders and branch circuits located indoors, concealed or exposed above suspended ceilings, in damp/wet locations, in crawl spaces, in attics, chases, furred spaces, equipment rooms, loading docks or in hazardous locations in accordance with CEC and local Codes.
2. For feeders and branch circuits concealed in concrete floors and walls when not in contact with earth.

B. PVC insulated galvanized rigid steel conduit can be used in the following applications:
1. Use 40-mil coating for feeders and branch circuits in damp or wet locations.
2. Use 20- or 40-mil for feeders and branch circuits concealed in concrete walls or slabs in contact with earth.
3. Use 20- or 40-mil for runs beneath floor slabs on grade.
4. Use 40-mil for all below grade penetrations through floor slabs on grade or exterior walls.

C. Intermediate metal conduit (IMC): Can be used for the same application as galvanized rigid steel conduit as specified herein, except for hazardous locations prohibited by CEC or Local Codes.

D. Electrical metallic tubing (EMT): Can be used exposed or concealed for interior electrical feeders 4" and smaller, interior power and lighting branch circuits and low tension distribution system where run above suspended ceilings, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces. EMT shall not be installed exposed below 6 feet above the finish floor except within electrical, communication or signal rooms or closets.

E. Rigid non-metallic conduit (PVC): Can be used in the following applications:
1. Schedule 40 or 80 for feeders and branch circuits run beneath ground floor slab except that bends and penetrations through the floor must be PVC coated galvanized rigid steel.
2. Schedule 40 or 80 for exterior branch circuits directly buried in earth, 18" minimum below grade. PVC may be used below exterior slabs not subject to vehicular traffic.
3. PVC may be used below exterior slab subjects to vehicular traffic when encased in a minimum of 2 inches of concrete.
4. Only schedule 80 PVC may be used for above ground conduit extensions on utility poles.

5. PVC elbows shall be radius sweep type schedule 40 for bends 45°or less and large radius sweep type schedule 80 for bends 46°or greater.
6. In general, PVC may not be run exposed in concrete walls or in floor slabs unless expressly indicated on the Drawings.
7. EB or DB type may be installed in lieu of the above only if encased in a minimum of 2 inches of concrete.
8. Serving utility electrical and telephone and cable television service entrance conduits may be EB or DB type conduit only if acceptable by serving utility. Coordinate in field prior to installation.

F. Flexible metallic conduit (FMC): Can be used only in dry locations for connections from an adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices and to luminaires installed in suspended ceilings, minimum sizes shall be 3/8" for luminaires and control wiring and 1/2" for motor and transformer connections. U.O.N.

G. Liquidtight flexible metallic conduit (LFMC): Can be used in wet or damp locations for connections from adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices. These areas are typically food preparation and dishwashing areas, sump wells, loading docks, pump rooms, exterior areas, etc. Minimum sizes shall be 1/2" and 1” for communications.

H. Rigid non-metallic conduit (FRE): Can be used for direct burial, concrete encasement and for bridge applications whether suspended or encased; except in hazardous location, where indicated on Contract Drawings or by these Specification.

3.3 PREPARATION

A. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.

C. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed, concealed above suspended ceiling or in concrete slabs.

D. Conduits shall not be placed closer than 12-inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

E. Communications conduits shall not be placed closer than 12 inches to power, a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

F. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.

G. The largest trade size conduits in concrete floor and wall slabs shall not exceed 1/3 the floor or wall thickness and conduits shall be spaced a minimum of three conduit diameters apart unless otherwise noted on the Drawings. All conduits shall be installed in the center of concrete slabs or wall and shall not be placed between reinforcing steel and the bottom of floor slabs.

H. In long runs of conduit, provide sufficient pull boxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150-feet. Support pull boxes from structure independent of conduit supports. These pull boxes are not indicated on the Drawings.

I. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, indicated, or specified in the Contract Documents or not.

J. Connect recessed luminaires to conduit runs with maximum six feet of flexible metal conduit or MC cable extending from a junction box to the luminaire or manufactured wiring system.

3.4 INSTALLATION

A. Install conduit in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Minimum Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1/2" for interior applications and 3/4" for exterior and underground applications.

C. Minimum Communication and Signal Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1" for interior applications and 2" for exterior and underground applications.

D. All conduit sizes indicated on the Drawings are sized for copper conductors with THHN/THWN insulation. If conductor type or size is changed the Contractor shall be responsible for resizing conduits upward to meet Code.

E. All communication and signal conduit sizes indicated on the Drawings are sized for 40% fill or less for category 6 or 6A cable. If cable type or size is changed the Contractor shall be responsible for resizing conduits upward to meet a maximum 40% fill.

F. In general, all conduit work shall be concealed where possible. Exceptions shall be electrical, communication and mechanical rooms, exposed ceiling areas, and parking garages.

G. Conduit connections to motors and surface cabinets shall be concealed, except for electrical, communication and mechanical rooms, or unless exposed Work is clearly called for on the Drawings.

H. Install conduits in complete runs before pulling in cables or wires.

I. Install conduit free from dented, bruises or deformations. Remove and replace any damaged conduits with new undamaged material.

J. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.

K. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading. Coat all field-threaded joints with UL approved conductive type compound to ensure low resistance ground continuity through conduit and to prevent seizing and corrosion.

L. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field-threaded joints to prevent corrosion.

M. In all empty conduits or ducts, install a “True Tape” conduit measuring tape line to provide overall conduit length for determining length of cables/conductors for future use.

N. Conduit systems shall be mechanically and electrically continuous throughout. Install code size, insulated, copper, green-grounding conductors in all conduit runs for branch circuits and feeders. This conductor is not indicated on the Drawings. Refer to Section 260526: Grounding and Bonding.

O. Metallic conduit shall not be in contact with other dissimilar metal pipes (i.e. plumbing).

P. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.

Q. A run of conduit between terminations at wire pulling points shall not contain more than the equivalent of four quarter bends (360-degrees, total).

R. A run of communications and signal conduit between terminations at wire pulling points shall not contain more than the equivalent of two quarter bends (180-degrees, total).

S. Emergency power raceway system: Install entirely independent of other raceway systems, except where specifically allowed by CEC Article 517.

T. Conduit for conductors above 600volts use rigid steel.

3.5 PENETRATIONS

A. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:
   1. Where indicated on the Structural Drawings.
   2. As approved by the Structural Engineer prior to construction and after submittal of Drawing showing location, size, and position of each penetration.

B. Cutting or holes:
   1. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space. Obtain the approval of the Structural Engineer prior to drilling through structural sections.
   2. Provide sleeves or “can outs” for cast-in-place concrete floors and walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack grouting compounds; or fire rated penetration-sealing materials.
   3. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions, or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.
   4. Provide single piece escutcheon plates around all exposed conduit penetrations in public places.

C. Sealing:
   1. Non-rated penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.
   2. Fire stop: Where conduits, wireways and other electrical raceways pass through fire rated partitions, walls, smoke partitions or floor; install a UL classified fire stop material to provide an effective barrier against the spread of fire, smoke, and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.

D. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Division 07: Sealants and Caulking.
   1. Install specified watertight conduit entrance seals at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be PVC coated rigid galvanized steel.
   2. For roof penetrations furnish and install roof flashing, counter flashing and pitch-pockets as specified under Roofing and Sheet Metal Sections of the Specifications.
   3. Provide membrane clamps and cable sealing fittings for any conduit that horizontally penetrates the waterproof membrane.
   4. Conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration on the exterior side a minimum of two times the conduit diameters.

3.6 CONCEALED IN CONCRETE

A. Install conduits approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the conduits.

B. Installation of conduit in structural concrete that is less than three inches thick is prohibited. Topping slabs, maintenance pads and curbs are exempted.

C. Tie conduits to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.

D. Where nonmetallic conduit or tubing is used, raceways must be converted to PVC coated rigid steel conduit before rising above floor.

E. Make couplings and connections watertight.

F. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

G. Provide schedule 40 non-metallic sleeve through concrete or masonry walls where aluminum conduit penetrations are required.

3.7 UNDERGROUND INSTALLATION

A. Perform trenching, backfilling and compaction operations as specified in Division 31: Trenching.

B. Install service utility company underground conduits in strict conformance to each utility company's requirements. Obtain a copy of each utility company's installation guidelines prior to commencing Work.

C. Tops of conduits shall be as follows unless otherwise noted:

D. Not less than 18-inches below finished grade.

E. Not less than 24-inches below roadways, paved parking lots, driveways or any surface subject to vehicular traffic.

F. Not less than 4 inches below building floor slab for branch circuits. Major feeders and large signal conduits (2" and greater) at not less than 18-inches.

G. Depth of service utility conduits shall conform to utility company requirements.

H. Furnish and install specified underground conduit marker 12" above conduits in trenches with all buried conduits.

3.8 TERMINATIONS AND JOINTS

A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.

B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.

C. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.

D. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.

E. Stub-up connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver operated threaded flush plugs with floor.

F. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets, or gutters inside the building. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction, or outlet boxes.

G. Raceway seal: Inject into wire filled raceways, a pre-formulated rigid 2 lbs. density polyurethane foam which expands a minimum 35 times its original bulk. Foam shall have the physical properties of water vapor transmission of 1.2 to 3.0 perms: water absorption less than 2% by volume, fungus and bacterial resistant. Foam shall permanent seal against water, moisture, insects, and rodents. Install raceway sealing foam at the following points:
   1. Where conduits pass from warm locations to cold locations to prevent passage of water vapor (such as refrigerated spaces, constant temperature rooms, air-conditioned spaces, etc.).
   2. Where conduits enter buildings from below grade.
   3. Where conduits enter or leave animal rooms or research labs.

H. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows:
   1. Conduits three inches and larger, shall be rigidly secured to the building structure on opposite sides of a building expansion joint and provided with expansion or deflection couplings. Install the couplings in accordance with the Manufacturer's recommendations.
   2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a green copper ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits.

I. Use short length (maximum of 6ft) of the appropriate FMC or LFMC conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquidtight flexible metal conduit for installation in exterior locations, moisture or humidity-laden atmosphere, corrosive atmosphere, water hose or spray wash-down operations and locations subject to seepage or dripping of oil, grease, or water. Provide a green ground wire with FMC or LFMC conduit.

3.9 SUPPORTS

A. Provide supports for raceways as specified in Section 26 0529: Electrical Hangers and Supports.

B. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the CEC.

C. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.

D. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard one-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.

E. Individual 1/2" and 3/4" conduits installed above suspended ceilings may be attached to the ceiling's hanger wire using spring steel support clips provided that not more than two conduits are attached to any single support wire.

F. Support exposed vertical conduit runs at each floor level, independent of cabinets or switches to which they run, by means of acceptable supports.

G. Fasteners and supports in solid masonry and concrete:
   1. Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
   2. After concrete installation:
      a. Steel expansion anchors not less than ¼ inch bolt size and not less than 1-1/8" embedment.
      b. Power set fasteners not less than ¼ inch diameter with depth of penetration not less than three inches.
      c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

H. Hollow masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.

I. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

END OF SECTION

SECTION 26 0533

BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Wall and ceiling outlet boxes.
   2. Pull and junction boxes.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 08: Access doors. Wall and ceiling access doors.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
   1. American National Standards Institute/National Electrical Manufacturer Association:
      ANSI/NEMA OS-1; Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
      ANSI/NEMA OS-2; Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
      NEMA 250; Enclosures for Electrical Equipment (1000 volts maximum).
   2. Underwriters Laboratories (UL):
      UL 50; Enclosures for Electrical Equipment.
      UL 514A; Metallic Outlet Boxes.
      UL 1773; Termination Boxes.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Submit Manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Outlet and junction boxes:
      a. Spring City Electrical Manufacturing Co.
      b. Thomas & Betts Corp.
      c. Raco, Inc.
   2. Cast boxes:
      a. Appleton Electric Co.
      b. Crouse-Hinds.
   3. Floor boxes:
      a. Hubbell Inc.
      b. Walker.
      c. Raceway Components, Inc.
   4. Pullboxes:
      a. Circle AW Products.
      b. Hoffman Engineering Co.
   5. Precast concrete boxes:
      a. Oldcastle Enclosure Solutions.
      b. Jensen Precast.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 OUTLET BOXES

A. Standard outlet box:
   1. Provide galvanized, one-piece die formed or drawn steel or welded, knockout type box of size and configuration best suited to the application indicated on the Drawings.
   2. 4-inch square by 1.5-inch deep shall be minimum box size.
   3. ANSI/NEMA OS 1.

B. Concrete box:
   1. Provide galvanized steel, 4-inch octagon rings with mounting lugs, backplate and adapter ring as required.
   2. Select height as necessary to position knockouts above concrete reinforcing steel.
   3. ANSI/NEMA OS 1.

C. Tile box:
   1. Provide outlet boxes for installation in tile or concrete block walls.
   2. Standard outlet boxes with raised, square corners and device covers are acceptable.
   3. ANSI/NEMA OS 1.

D. Cast metal outlet body:
   1. Provide 4-inch round, galvanized cast iron alloy with threaded hubs and mounting lugs as required.
   2. Provide boxes with cast cover plates of the same material as the box and neoprene cover gaskets.

E. Conduit outlet body: Provide Cadmium plated cast iron alloy, oblong conduit outlet bodies with threaded conduit hubs and neoprene gasket, cast iron covers.

2.3 PULL AND JUNCTION BOXES

A. Sheet metal pull and junction box:
1. Provide standard outlet or concrete ring boxes wherever possible; otherwise use minimum 16-gauge galvanized sheet metal, NEMA 1 boxes, sized to Code requirements with covers secured by cadmium plated machine screws located 6 inches on centers.
2. ANSI/NEMA OS 1.

B. Cast metal pull and junction box: Provide standard cast malleable iron outlet or device boxes wherever possible; otherwise use cadmium plated, cast malleable iron boxes with bolt-on, interchangeable conduit hub plates with neoprene gaskets.

C. Flush mounted pullboxes and junction boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

D. Precast concrete boxes: Provide high density reinforced concrete pull and junction box with end and side knockouts and non-settling shoulders. Use cast iron lid with hold down bolts or use traffic rated covers in areas subject to vehicular traffic.

2.4 FLOOR BOXES

A. Refer to Section 26 2726: Wiring Devices for floor mounted service boxes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of box installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Install all outlet boxes flush with building walls, ceilings, and floors except where boxes are installed in mechanical and electrical rooms, in cabinetry, above accessible ceilings or where exposed Work is called for on the Drawings.

B. Locate pullboxes and junction boxes in concealed locations above removable ceilings or exposed in electrical rooms, utility rooms or storage areas.

C. Install outlet boxes at the locations and elevations indicated on the Drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.

D. Locate switch outlet boxes on the latch side of doorways unless otherwise indicated.

E. Locate outlet boxes above hung ceilings having concealed suspension systems, adjacent to openings for removable recessed luminaires.

F. Do not install outlet boxes back-to-back, separate boxes by at least 6". In fire-rated walls separate boxes by at least 24" and wall stud.

G. Adjust position of outlet boxes in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for boxes.

3.3 INSTALLATION

A. Install boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Locate electrical boxes as indicated on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.

C. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not indicated on the Drawings.

D. Install raised covers (plaster rings) on all outlet boxes in stud walls or in furred, suspended, or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.

E. Leave no unused openings in any box. Install close-up plugs as required to seal openings.

F. Provide cast metal boxes with gasketed cast metal cover plates where boxes are exposed in damp or wet locations.

G. Welded outlet boxes shall only be used in concealed interior installations.

H. Provide precast concrete boxes in exterior planting areas, walkways, roads etc.

I. Provide an access panel in permanent ceiling or wall where boxes are installed and will be inaccessible.

J. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.

K. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.

L. Use conduit outlet bodies to facilitate pulling of conductors or to make changes in conduit direction only. Do not make splices in conduit outlet bodies.

M. Add additional sheet rock as necessary to maintain original fire rating of walls where boxes are installed.

N. Install galvanized steel coverplates on boxes in unfinished areas, above accessible ceilings and on surface mounted outlets.

3.4 SUPPORTS

A. Provide boxes installed in metal stud walls with brackets designed for attaching directly to the studs or mount boxes on specified box supports.

B. Mount boxes, installed in suspended ceilings of gypsum board or lath and plaster construction, to 16-gauge metal channel bars attached to main ceiling runners.

C. Support boxes independently of conduit system.

D. Support boxes, installed in suspended ceilings supporting acoustical tiles or panels, directly from the structure above wherever pendant mounted luminaires are to be installed from the box.

E. Support boxes mounted above suspended acoustical tile ceilings, directly from the structure above.

END OF SECTION

SECTION 26 0553

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Electrical equipment nameplates.
   2. Panelboard directories.
   3. Wire and cable identification.
   4. Buried electrical line warnings.
   5. Junction box identification.
   6. Warning and caution signs.
   7. Inscribed device coverplates.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 09: Painting.

1.2 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein.
   2. Schedules for nameplates to be furnished.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Conduit and wire markers:
      a. Thomas & Betts Corp.
      b. Brady.
      c. Griffolyn.
   2. Inscription Tape:
      a. Kroy.
      b. Merlin.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.2 NAMEPLATES

A. Type NP: Engraved, plastic laminated labels, signs, and instruction plates. Engrave stock melamine plastic laminate 1/16-inch minimum thickness for signs up to 20-square inches or 8-inches in length; 1/8-inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.

B. Color and letter height as specified in Part 3: Execution.

2.3 LEGEND PLATES

A. Type LP: Die-stamped metal legend plate with mounting hole and positioning key for panel mounted operator devices, i.e. motor control pilot devices, hand-off-auto switches, reset buttons, etc.

B. Stamped characters to be paint filled.

2.4 BRASS TAGS

A. Type BT: Metal tags with die-stamped legend, punched for fastener.

B. Dimensions: 2" diameter 19 gauge.

2.5 PANELBOARD DIRECTORIES (400 AMP OR LESS)

A. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panel door.

B. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126) for all 42-pole panelboards. For 84-pole panelboards the numbering is Section 1 (circuit numbers 1-84), Section 2 (circuit numbers (85-168), etc.

2.6 WIRE AND TERMINAL MARKERS

A. Provide self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips.

B. Blank markers shall be inscribed using the printer or pen recommended by Manufacturer for this purpose.

2.7 CONDUCTOR PHASE MARKERS

A. Colored vinyl plastic electrical tape, 3/4" wide, for identification of phase conductors. Scotch 35 Brand Tape or equal.

2.8 UNDERGROUND CONDUIT MARKER

A. 6-inch wide, yellow polyethylene tape, with continuous black imprinting reading "Caution - Buried Electric Line Below".

2.9 INSCRIBED DEVICE COVERPLATES

A. Coverplate material shall be as specified in Section 26 2726: Wiring Devices.

B. Methods of inscription: (Unless otherwise noted)
1. Type-on-tape:
a. Imprinted or thermal transfer characters onto tape lettering system.
b. Tape trimmer.
c. Matte finish spray-on clear coating.
2. Engraving:
a. 1/8" high letters.
b. Paint filled letters finished in black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of identification device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 NAMEPLATES

A. Installation:
1. Degrease and clean surfaces to receive nameplates.
2. Install nameplates parallel to equipment lines.
3. Secure nameplates to equipment fronts using machine screws.

B. Provide type 'NP' color coded nameplates that present, as applicable, the following information:
1. Equipment or device designation:
a. Equipment designations shall conform to the following:
1) Power source:
a) Normal - __
b) Emergency – E
c) UPS – U
2) Equipment description:
a) Main switchboard – MS
b) 120/208volt distribution board – LD
c) 120/208volt panelboard – L
d) Transformer – TX
3) Floor number where equipment is located – 03
4) Equipment designation – B
b. Example: EHL03A
1) Emergency source.
2) 120/208volt distribution board.
3) Floor level 03.
4) Board designation A
2. Amperage, KVA or horsepower rating, where applicable.
3. Voltage or signal system name.
4. Source of power or control.
5. Examples:
a. Boards: EHD03A; 1200A, 277/480volt, 3-phase, 4-wire; Served from EATS03A

b. Transformers: ETX03A; 150KVA, 480volt primary, 120/208volt, 3-phase, 4-wire secondary; Served from EHD03A; Load Served: EL03A
c. Disconnects or Individual Motor Starters: EF-1; 20HP; 480volt, 3-phase,3-wire; Served from EHD03A

C. Nameplates for power system distribution equipment and devices are to be black.

D. Nameplates for signal systems equipment and devices are to be black except as follows:
1. Fire alarm and life safety - Red.
2. Security/card access/CCTV systems - Green.
3. Clock, intercom, sound, MATV, CATV - Blue.

E. Minimum letter height shall be as follows:
1. For panelboards, switchboards, battery panels, etc.: ½ inch letters to identify equipment designation. Use ¼ inch letters to identify voltage, phase, wires, etc.
2. For individual circuit breakers, switches and motor starters in panelboards, distribution boards, and switchboards use 3/8-inch letters to identify equipment designation. Use 1/8-inch letters to identify all other.
3. For individual mounted circuit breakers, disconnect switches, enclosed switches and motor starters use 3/8-inch letters to identify equipment designation. Use 1/8" letters to identify all other.
4. For transformers use ½-inch letters to identify equipment designation. Use ¼-inch letters to identify primary and secondary voltages, etc.
5. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8-inch letters to identify equipment designation.

3.3 LEGEND PLATES

A. Provide panel-mounted operators devices such as pilot lights, reset buttons, “HAND-OFF-AUTO” switches, etc.

3.4 BRASS TAGS

A. Provide type BT tags for individual ground conductors to exposed ground bus indicating connection i.e. "UFER", "Cold water bond", etc.

B. Provide tags for all feeder cables in underground vaults and pull boxes.

C. Provide tags for empty conduits in underground vault, pull boxes and stubs.

3.5 PANELBOARD DIRECTORIES (400AMP OR LESS)

A. Provide typewritten directories arranged in numerical order denoting loads served by room number or area for each circuit.

B. Verify room numbers or area designation with Project Manager.

C. Mount panelboard directories in a minimum 6" x 8" metal frame under clear plastic cover inside every panelboard.

3.6 WIRE AND CABLE IDENTIFICATION

A. Provide wire markers on each conductor in panelboards, pull boxes, outlet, and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment Manufacturer's Shop Drawings for control wiring.

B. Provide colored phase markers for conductors as noted in Section 26 0519: Building Wire and Cable. Apply colored, pressure sensitive plastic tape in half-lapped turns for a distance of 3-inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markings by taping.

3.7 UNDERGROUND CONDUIT MARKERS

A. During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

3.8 JUNCTION BOX IDENTIFICATION

A. The cover of junction, pull and connection boxes for both power and signal systems, located above suspended ceilings and below ceilings in non-public areas, shall be clearly marked with a permanent ink felt pen. Identify the circuit(s) (panel designation and circuit numbers) contained in each box, unless otherwise noted or specified.

3.9 WARNING, CAUTION, AND INSTRUCTION SIGNS

A. Provide warning, caution or instruction signs where required by CEC, where indicated or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

B. Emergency Operating Signs: Install engraved laminate signs with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding or other emergency operations.

C. Elevator Machine Rooms(s): Provide warning sign for each elevator controller disconnect to read "Warning - Part of the Control Panel is not De-energized by this Switch."

D. Elevator car light and fan switch: Provide signage indicating elevator number serving and function of each switch.

3.10 INSCRIBED DEVICE COVERPLATE

A. General:
1. Lettering type: Helvetica, 12 point or 1/8" high.
2. Color of characters shall be black.
3. Locate the top of the inscription ½” below the top edge of the coverplate.
4. Inscription shall be centered and square with coverplate.

B. Application:
   1. Provide inscribed coverplates for devices as outlined below:
      a. Receptacles.
      b. Outlets in surface raceways.
      c. Multi-ganged (four or more) switch arrangement.
      d. Special purpose switches, i.e. projection screens, shades, exhaust fans, etc.
      e. Telecommunication outlets.
   2. Type-on-tape inscriptions shall be provided for the following devices:
      a. Receptacles.
      b. Outlets in surface raceways.
      c. Telecommunication outlets.
   3. Engraved inscriptions shall be provided for the following devices:
      a. Multi-ganged switches.
      b. Special purpose switches.
   4. Type-on-tape installation:
      a. Tape shall be trimmed to the height of the letters.
      b. Trim tape length to ¼-inch back from each edge of coverplate.
      c. Contractor hands shall be clean or covered with surgical type glove prior to application of tape. Tape installations with visible fingerprints or smudges will not be acceptable.

END OF SECTION

SECTION 26 0942

DIGITAL LIGHTING CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Lighting control modules.
2. Plug load control modules.
3. Control stations.
4. Occupancy sensors.
5. Daylight sensors.
6. Relay panels.
7. Emergency bypass relays or transfer device.
8. Network communication cabling.
9. Startup and field quality control.
10. Commissioning.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. National Electrical Manufacturer Association (NEMA):
NEMA 250; Enclosures for Electrical Equipment.
NEMA ICS 1; Industrial Control and Systems.
NEMA ICS 4; Terminal Blocks and Industrial use.
NEMA ICS 6; Enclosures for Industrial Controls and Systems.
2. Underwriters Laboratories, Inc. (UL):
UL 50; Cabinets and Boxes.
UL 773A; Nonindustrial Photoelectric Switches for Lighting Control.
UL 916; Energy Management.
UL 924 Standard for emergency lighting and power equipment.
UL1008 Transfer switch equipment.

1.3 SYSTEM DESCRIPTION

A. A standalone digital lighting control system that interconnects and lighting components such as occupancy and daylight sensors, control stations, etc. to control luminaires connected to the system. All components are locally connected and function independently of any central control software.

B. Control of luminaries will come from distributed control modules capable of “ON/OFF” control and 0-10volt dimming. The system shall be capable of dimming other loads such as electronic low voltage (ELV) and magnetic low voltage (MLV).

C. The lighting control components shall be capable of adjusting their specific parameters such as dimming presets, time delays, etc. per the device type. Handheld or computer-based commissioning tools shall be available during startup to reduce the time required at startup and commissioning. These tools shall be available to the Owner after startup and commissioning.

D. The control system is connected independent of electrical lighting circuits.

E. The system shall utilize either hardwired or wireless components.

1.4 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Describe system operation, equipment and dimensions and indicate features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Furnish structural calculations for equipment anchorage as described in Section 26 0010: Basic Electrical Requirements.
5. Submit Manufacturer's installation instructions.
6. Complete bill of materials listing all components.
7. Warranty.

1.5 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 26 0010: Basic Electrical Requirements to include the following:
1. Operation and maintenance manuals shall include the following:
a. A detailed explanation of the operation of the system.
b. Instructions for routine maintenance.
c. Pictorial parts list and part numbers.
2. Telephone numbers for the authorized parts and service distributors.
3. Final testing report.

1.6 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Digital lighting control components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 WARRANTY

A. Units and components offered under this Section shall be covered by a minimum *2*-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Network addressable lighting control system:
a. Wattstopper “DLM”.
b. Acuity “nLight”.
c. Douglas “Dialog”.
d. ETC “Echo”.
e. Eaton “Greengate Room Controller”.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 GENERAL

A. The lighting control system shall be standalone with no central control software. Lighting components shall tie together and communicate directly with each other as required for the device type.

B. Control stations, occupancy sensors, and daylight sensors shall tie into dimming and relay modules to control luminaires.

C. The control parameters shall be set within each device, either as dip switches or dials on the device itself or with handheld or computer-based commissioning tools. The parameters remain set until they are manually changed.

D. Daylight sensors shall rationalize changes to light levels when daylight is available and shall maintain a steady light level when subjected to fluctuating ambient conditions.

E. Where required in a sequence of operation an astronomical time clock function shall be integrated into the control modules or relay panels.

F. During an emergency condition (loss of normal power), the system shall not impede the emergency lighting to function properly, i.e. the control system shall control emergency lighting to turn on at full light output and lock out user controls.

G. The control system shall allow occupancy sensor, when relaying a vacant status to either turn lights off or dim lights to a preset level.

H. The control system components shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The California Energy Commission.

2.3 LIGHTING CONTROL MODULES

A. General:
1. Lighting control modules provide an interface between the control system and luminaires. Modules take inputs from the system and convert the commands through the power and control wiring to the fixture providing “ON/OFF/DIMMING” functions.
2. Lighting control modules contain a 16amp minimum rated relay(s) for “ON/OFF” control as well as a 0-10volt dimming signal. Modules shall also have the capability of two wire phase dimming (MLV or ELV).
3. In the event of a power failure, control modules connected to luminaires shall default to the “on” state at full light output.

B. The following lighting control modules shall be available with the system, at a minimum:
1. Single zone 0-10volt control module with a relay.
2. Multi-zone 0-10volt control module with one relay per 0-10volt zone (“Room Controller”).
3. Single zone two wire dimming module (Incandescent, MLV, or ELV) with a relay.
4. Multi-zone two wire dimming module (Incandescent, MLB, or ELV with one relay per zone (“Room controller”)

C. Mounting:
1. Single zone modules shall have a ½” nipple to mount directly to a ½” knockout on a junction box.
2. Multi-zone modules shall mount stand alone or onto a 4 square junction box.

2.4 PLUG LOAD CONTROL MODULES

A. General:
1. Plug load Control modules provide an interface between the control system and controlled outlets. Modules take inputs from the system and convert the commands through the power wiring to the receptacle(s) being controlled.
2. Control modules contain a 20amp rated relay(s) for “ON/OFF” control.

B. Mounting:
1. Modules shall have a ½” nipple to mount directly to a ½” knockout on a junction box.

2.5 CONTROL STATIONS

A. General:
1. The controllers are configurable wall mounted devices that provide local “ON/OFF/DIMMING” control to lighting zones.
2. Each device can be set-up and modified through the control systems software interface.

B. Dimmer switch controller:
1. Software configurable dimmer switch that provides “ON/OFF” switching and the capability to dim.

2. Dimming to be continuous over the full range of the driver or ballast it is controlling.

C. Dimming scene controller:
1. Multi-button controller allowing the end user to recall zones or scenes for "ON/OFF/DIMMING" control.
2. Scenes are made up of multiple zones, where each zone is dimmed to a specific light output.
3. Scene configuration can be changed via control systems software.
4. The scene controller shall also allow for a custom labeling feature that allows scene labels on the controller to be easily modified.

D. Specifics:
1. Mounting:
a. Controllers utilize a standard single-gang device strap configuration for ease in mounting. Where multiple controllers are ganged together, they shall allow for a single multi-gang cover plat to be used.
b. Mounts to standard switch box or cut-in ring.
2. Controllers shall tie to the system in one of the following ways:
a. Hardwired low voltage, wiring and connections per manufacturer's requirements.
b. Wireless with a 10-year minimum battery life. Mechanically triggered wireless switches shall not be allowed unless approved by The Owner.

2.6 OCCUPANCY SENSOR

A. General:
1. Occupancy sensors shall automatically detect movement within a space, reporting the state of occupancy to the control modules for "ON/OFF/DIMMING" control of lighting zones and "ON/OFF" control of the controlled receptacle circuits within that space.
2. All setpoints for the occupancy sensor shall be accessible on the device or through the commissioning tool.
3. Sensors shall capable of being linked together via hard wired connections to provide a larger coverage area.
4. Provide enough occupancy sensors as required for complete area coverage they are installed in, regardless of how many sensors are shown on the Drawings.

B. Specifics:
1. Sensor shall have a coverage of 1,000 square feet. Manufacturer to provide additional sensors if coverage is less than 1,000 square feet.
2. Sensors shall be infrared or dual technology or microphonic. Dual technology sensors shall be capable of disabling either infrared or ultrasonic sensing.

2.7 DAYLIGHT SENSOR

A. General:
1. Daylight sensors shall automatically measure the amount of ambient light within a space, reporting the state of occupancy to the control modules for "ON/OFF/DIMMING" control of lighting zones.
2. Setpoints for the sensors shall be adjusted directly on the device or through commissioning tool. The setpoints refer to the range at which electric lighting will dim in response to the amount of light the sensor detects.
3. Daylight sensors shall continuously monitor the ambient light level.
4. Interior daylight sensors shall operate on a "closed loop" protocol, measuring both daylight and electric light contributions.

5. Exterior daylight sensors shall operate on an “open loop” protocol, measuring only daylight contributions.

B. Specifics:
1. Sensor shall mount directly to any surface, no junction box required.
2. Integrated sensors on luminaires shall be installed at the lighting manufacturer’s factory.
3. Sensors shall tie to the system in one of the following ways:
a. Hardwired low voltage, wiring and connections per manufacturer’s requirements.
b. Wireless with a 10-year minimum battery life.
4. Exterior sensors shall be outdoor rated.

2.8 RELAY PANEL

A. Addressable relay panel that fully integrates with the addressable control system, consisting of individual relays, control module, power supplies, network connection interface, etc.

B. Cabinet: NEMA 1 enclosure sized to accept the quantity of relays as noted on the Drawings.

C. Control relays: Heavy-duty momentary pulsed mechanically latching contactors. Operating voltage is 24volt AC; contacts are rated at 20amp at 120 or 277volt AC. Power supply: 120/277volt AC input transformer with 24volt AC, 60Hz, 1.6amp (40 VA) Class II power supplies output.

D. Network connection: Per manufacturer.

E. Panel shall be UL924 rated. Systems which integrate a UL924 sensing module for the entire panel or system shall not require the panel to be UL924 rated.

F. Panel shall allow for barriers between voltage classes, 120volt, 277volt, normal, and emergency.

2.9 EMERGENCY BYPASS RELAYS

A. General:
1. System manufacturer shall provide emergency bypass relays as shown on the Drawings.
2. The bypass relay device shall take an uncontrolled normal sensing hot, uncontrolled emergency hot, and controlled normal circuit as inputs.
3. The device shall bypass the controlled normal hot and control signal at the loss of power from the normal sensing hot and allow the uncontrolled emergency hot to power the downstream luminaires.
4. The device shall be capable of accepting a 0-10volt control signal and breaking if the downstream fixtures are 0-10volt controlled.

B. Specifics:
1. Mounting: directly onto a junction box or integral to the luminaire.
2. UL924 rated for switched and dimmed loads.
3. Where more than six bypass relays are located in a central location provide an enclosure to mount all devices.

2.10 EMERGENCY TRANSFER DEVICE

A. General:
1. System manufacturer shall provide emergency transfer devices as shown on the Drawings.
2. The transfer devices shall take an uncontrolled normal sensing hot, uncontrolled emergency hot, and controlled normal circuit as inputs.
3. The device shall transfer be an open transition “make before break” type. The normal controlled circuit shall transfer to emergency circuit at the loss of power from the normal sensing hot and allow the uncontrolled emergency hot to power the downstream luminaires.
4. The device shall be capable of accepting a 0-10volt control signal and breaking if the downstream fixtures are 0-10volt controlled.

B. Specifics:
1. Mounting: directly onto a junction box.
2. UL1008 rated for switched and dimmed loads.
3. Where more than six transfer devices are located in a central location, provide either an enclosure or panel housing to mount all devices within.

2.11 DEVICE COMMUNICATION CABLING

A. General:
1. The device communication cabling integrates devices such as occupancy sensors, photocell sensors, control modules and control stations with each other to provide a complete standalone system.
2. The network communication cabling provides low-voltage power to all devices on the network, eliminating the need for external power supplies and power packs for devices such as occupancy sensors. Where a device requires 120volt power it shall be noted on the submittal.
3. Cabling shall be topology free.
4. Cabling shall be plenum rated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of low-voltage lighting control installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Install the addressable lighting control system in accordance with the Manufacturer's written instructions, as indicated on the drawings and as specified herein.

B. Locate relay panel(s) where indicated on the plans.

C. All interior luminaires shall be controlled via the control system unless otherwise noted on the plans. Refer to the drawing symbols list for the differentiation between networked luminaire devices and standalone devices.

3.3 OCCUPANCY SENSOR

A. Occupancy sensors shall be placed in a location that provides maximum coverage and minimizes false positives such as being triggered through an open door.

B. Refer to the architectural RCPs and locate sensors as shown or if not shown, locate in line with other ceiling devices while still maximizing area coverage.

C. Where the coverage of a sensor is inadequate for the space it is being installed in, the manufacturer shall provide additional sensors for the contractor to install. The cost of these sensors and installation shall be included at the time of bid.

3.4 DAYLIGHT SENSORS

A. Locate daylight sensors per the manufacturer’s requirements in order to provide accurate electric and daylight light levels.

B. Coordinate the final location of the sensor with other devices in the area.

3.5 CONTROL MODULES

A. Install all control modules per the shop drawings and manufacturer’s requirements. Ensure devices are in an accessible location. Avoid locations where the devices are visible to the public.

3.6 AUXILIARY DEVICES

A. Where devices, not covered under these Division 26 specifications, are required to provide a complete lighting control system, furnish and install such devices per the manufacturer’s instructions.

3.7 STARTUP AND FIELD QUALITY CONTROL

A. General:
   1. All work related to the startup of the addressable lighting control system shall be by a factory-authorized agent of the Manufacturer of the system along with the assistance of the electrical contractor.
   2. All programming, testing, trouble shooting, etc. shall be included in this contract.

B. Prefunctional resting:
   1. Visual and mechanical inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
      c. Compare nameplate information and connections to Contract Documents.
      d. Check tightness of all control and power connections.
      e. Check that all covers, barriers, and doors are secure.
   2. Contractor shall provide all necessary programming assistance to set up and program the lighting control parameters.
   3. Electrical tests:
      a. The system shall be completely tested in accordance with operational parameters, tolerances, and Manufacturer's instructions. Any problem shall be documented and corrected.

b. Test all control circuits and verify proper operation of all lighting circuits throughout the control system.
c. Ensure the lighting zone controls match that of the Contract Documents.
d. Verify the proper integration with the mechanical control system for override control and monitoring of low-voltage lighting control system.
e. Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.

C. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

D. Contractor shall submit the testing final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.8 COMMISSIONING

A. General:
1. Once startup of the system is complete and no defects to the system are detected the commissioning process shall begin; furthermore, it is acceptable to program the system per the commissioning requirements during the startup phase.
2. All work related to the commissioning of the digital lighting controls shall be by the electrical contractor or by a factory-authorized agent of the Manufacturer of the system.
3. At least three weeks prior to any commissioning verification, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
4. Refer to the Lighting Control Sequence of Operation on the Drawings.

B. Occupancy sensors:
1. All occupancy sensors shall have a sensitivity appropriate for the space. Contractor shall be responsible for testing the sensitivity of the sensor in the space and adjusting as needed.
2. Where no direction is provided in a sequence of operation or by the owner set the occupancy sensor timeout to 15 minutes.

C. Daylight sensors:
1. Where no direction is provided in a sequence of operation or by the owner, the daylight sensor setpoint to dim the electric light should be at 150% of the maximum electric light output.

D. Scene controllers:
1. Where no scenes have been described in a sequence of operation or by the owner the contractor shall provide the following scenes as appropriate for the space:
a. Scene 1: All luminaires on at 100%
b. Scene 2: Luminaires near screen displays off, all other luminaires on at 75%.
c. Scene 3: All indirect luminaires off, all direct luminaires on at 100%.
d. Scene 4: All direct luminaires off, all indirect luminaires on at 100%.
e. Scene 5: All luminaires off.

E. Time schedules:
   1. All time schedules required shall be done through an astronomical time clock integral to the devices and equipment. The building location and date shall be programmed to ensure proper time schedule functions.
   2. If no sequence of operations is provided program time schedules as follows:
      a. Interior spaces: Per owner’s direction, do not assume hours of operation.
      b. Exterior spaces: on 30 minutes before sunset, and off 30 minutes after sunrise.

F. Third party commissioning:
   1. The purpose of third-party commissioning shall be to verify the system’s functionality and parameters as detailed on the Drawings and specifications. The contractor and factory agent are still responsible for performing the startup and commissioning of the system.

G. Contractor shall be responsible for all acceptance testing requirements related to the lighting control system as outlined in the California Energy Code Title 24 Part 6.

3.9 TRAINING

A. Factory authorized service representative shall conduct a 1-hour training session for Owner's Representatives upon completion and acceptance of system. Instruction shall include operation, programming, and maintenance of equipment.

B. Contractor shall schedule training with a minimum of 7 days advanced notice.

END OF SECTION

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Branch circuit panelboards.
   2. Distribution panelboards (400amps to 800amps).

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
   1. Federal Specifications (FS):
      - FS W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service.
      - FS W-F-870; Fuseholders (for plug and enclosed fuses).
      - FS W-P-115; Power Distribution Panel.
      - FS W-S-865; Enclosed Knife Switch.
   2. National Electrical Manufacturers Association (NEMA):
      - NEMA AB 1; Molded Case Circuit Breakers.
      - NEMA KS 1; Enclosed Switches.
      - NEMA PB 1; Panelboards.
      - NEMA PB 1.1; General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
      - NEMA PB 1.2; Application Guide for Ground-Fault Protective Devices for Equipment.
   3. Underwriters Laboratories, Inc. (UL):
      - UL 67; Panelboards.
      - UL 363; Knife Switches.
      - UL 486E; Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
      - UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
      - UL 512; Fuseholders.
      - UL 870; Wireways, Auxiliary Gutters and Associated Fittings.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards

2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Shop Drawings: Include elevations, cabinet dimensions, gutter sizes, layout of contactors, relays, time clocks, lug sizes, bussing diagrams; make, location and capacity of installed equipment; mounting style; finish and panelboard nameplate inscription.
4. Furnish structural calculations for equipment anchorage as described in Section 26 0010: Basic Electrical Requirements.
5. Submit Manufacturer's installation instructions.
6. Complete bill of material listing all components.
7. Warranty.

B. Dimensions and configurations of panelboards shall conform to the spaces allocated on the Drawings for their installation. The Contractor shall include with the submittal a layout of the electrical room if it differs from construction documents for review and approval by the Engineer prior to release of order.

1.4 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Pictorial parts list and parts number.
4. Telephone numbers for authorized parts and service distributors.
5. Final testing reports.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Panelboard components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with NEMA PB1.1 and Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.7 WARRANTY

A. Units and components offered under this Section shall be covered by a ***1***-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.8 EXTRA MATERIAL

A. Turn over two (2) sets of panelboard keys to the Owner at completion of Project. All panelboards shall be keyed alike.

B. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. ABB/ General Electric.
2. Eaton.
3. Siemens.
4. Square D.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 PANELBOARDS - GENERAL

A. Enclosure:
1. Cabinets shall be NEMA Type 1 enclosure, door, and trim of code gauge galvanized steel. Provide NEMA Type 3R enclosures for exterior mounted panelboard.
2. Panelboard covers shall be door-in-door construction such that inner door exposes the overcurrent protective devices and the outer door exposes the complete panelboard interior (i.e. branch circuit conductors, lugs, neutral and ground bus, overcurrent protective devices, etc.). Outer door shall have full-length piano hinge and inner door shall have two-point hinges.
3. Provide combination spring catch and lock on inside edge of the inner door trims with flush fitting joint between door and trim. Locks on all panelboards shall be keyed alike. Doors 36 inches and over in height shall be provided with three-point catch and lock. Provide quarter-turn captive bolts on the outer door.
4. Riser gutter shall be sized for feeder and requirements of CEC. Refer to feeder schedule on Drawings for conductor sizes and quantities.

B. Bus assembly and terminations:
1. Bus shall be bolted copper with taps arranged for distributed phase connections to branch circuit devices
2. Cross connectors shall be copper drilled and tapped for bolt-on device connections, arranged for double row placement of device and designed to permit removal or addition of overcurrent protection devices without disturbing adjacent devices or removing main bus connections.

3. Neutral bus shall be 100 percent rated of phase bus bars and shall have lugs for each outgoing branch circuit or feeder requiring a neutral connection unless otherwise noted.
4. Ground bus shall be full size with lugs for each outgoing branch circuit and feeder. In addition to ground bus provide an isolated ground bus when indicated on Drawings or in schedules.
5. Refer to panelboard schedules on Drawings for bus rating. Bus rating shall match or be greater than main device or main lug rating.
6. As a minimum, bus bars shall be rated 10,000 AIC for 120/208volt panelboards and. Unless otherwise noted.
7. Provide full sized bussing in all sections of multi-section panelboards.
8. No panelboard section shall have greater than 42 poles.
9. Termination Lugs: Rated for use with aluminum/copper conductors.
10. All "SPACES" shall be ready for installation of future overcurrent protective device.

C. Miscellaneous requirements:
1. Circuit numbering: Starting at the top, indicate odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1 to 42, Section 2 (circuit numbers 43 to 84), Section 3 (circuit numbers 85 to 126. Provide metal embossed circuit identification of panelboards.
2. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panelboard door to reflect conditions at completion of Work. Directory shall be typewritten denoting loads served by room number or area for each circuit.
3. Nameplates: Provide engraved nameplate for each panelboard. See Section 260533: Electrical Identification for requirements.

D. Refer to Panelboard Schedules for the following:
1. Mounting style; service voltage; terminal lug size, location, and quantity; bus ampacity; interrupting capacity of bus and breakers; quantity, poles and rating of overcurrent protective devices.
2. If indicated on the Panelboard Schedules and/or Electrical Drawings provide contactors, relays, time clocks, etc. mounted within panelboard enclosure. Enclosure shall be fabricated such that circuit breaker portion of panel and contactor section shall have separate, lockable, hinged doors.

E. Overcurrent protective devices:
1. Refer to Section 26 2816: Overcurrent Protection Devices.
2. Overcurrent protective devices shall be molded case circuit breakers where indicated on panelboard schedules or Electrical Drawings.
3. Main devices shall be hard bus connected to the panelboard bus bars.
4. In all cases, panelboards fed directly from a transformer shall have a main overcurrent protective device. If not indicated on the Drawings or Panelboard Schedules, provide this device sized to provide the full capacity of the transformer rating.
5. Main devices shall be vertically mounted and shall have their operating handle in the up position when energized. Main devices that are mounted in the same manner as the branch devices are NOT acceptable, i.e. main devices shall be individually mounted at the top or bottom of the phase bus bars.
6. Panelboards overcurrent protective devices layout shall conform to the layout indicated on the panelboard schedules.
7. Provide identified handle ties for single pole circuit breakers that share a neutral conductor.

F. Surge Protective Devices:
1. Refer to Section 26 4313: Surge Protective Devices.

G. Finish: Five step zinc phosphate pre-treatment, one coat of rust inhibiting dichromate primer and one coat of baked-on enamel finish, ANSI 61 (light gray).

2.3 DISTRIBUTION PANELBOARDS

A. Enclosures shall be sized as required and shall meet the space restriction allocated on Drawings. Panelboard shall comply with NEMA PB 1 and FS W-P-115.

B. Provide necessary hardware to permit locking every overcurrent protective device handle in the "OFF" position.

C. Where "SPACE" is indicated on panelboard schedules or Drawings, install cross connectors and mounting hardware to match the frame size ampere rated noted.

2.4 BRANCH CIRCUIT PANELBOARDS

A. Enclosure shall be 20" wide x 5-3/4" deep, surface or flush mounted and shall comply with NEMA PB 1 and FS W-P-115.

B. Flush panelboards mounted adjacent to each other shall be same physical size.

C. Where "SPACE" is indicated on panelboard schedules or Drawings, install minimum 100amp branch circuit cross connectors and mounting hardware. For future device spaces larger than 100amps, cross connectors shall match the frame size ampere rated noted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of panelboard installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

B. Where panelboards are shown to be flush mounted in walls, the contractor shall insure that 6” deep studs are employed in wall construction to accommodate the 5-3/4” deep panelboard enclosure.

3.2 INSTALLATION

A. Install panelboards in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Set panels plumb and symmetrical with building lines in conformance with PB1.1. Furnish and install all construction channel bolts, angles, etc., required to mount the equipment furnished under this Section.

C. Mounting height shall be 6 feet.

D. Panelboards shall be anchored and braced to withstand seismic forces as calculated per Section 260010: Basic Electrical Requirements.

E. Provide mounting hardware brackets, busbar drillings and filler pieces for all unused spaces.

F. "Train" interior wiring; bundle and clamp, using specified plastic wire wraps specified under Section 260519: Building Wire and Cable.

G. Replace panel pieces, doors or trim exhibiting dents, bends, warps, or poor fit that may impede ready access, security, or integrity.

H. Conduits terminating in concentric, eccentric, or oversized knockouts at panelboards shall have ground bushings and bonding jumpers installed interconnecting all such conduits and the panelboard.

I. Check and tighten all bolts and connections with a torque wrench using Manufacturer's recommended values.

J. Provide four 3/4" spare conduits stubbed-out of flush mounted panelboards to nearest accessible ceiling space.

K. Visually inspect panelboard for rust and corrosion. If signs of rust and corrosion are present, restore or replace panelboard to new condition.

L. In damp and wet locations, mount panelboards with a minimum one inch of air space between cabinet and the wall or other support material.

M. Provide close up plugs in all unused openings in the cabinet.

N. Field install handle ties on single pole circuit breakers that share a neutral conductor.

O. Circuit breakers feeding "Fire Alarm Control Panel(s)" shall be red in color.

3.3 FIELD QUALITY CONTROLS

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
   1. Assure panelboard installation conforms to specified requirements and operates within specified tolerances.
   2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
   3. Prepare final test report including results, observations, failures, adjustments, and remedies.
   4. Apply label on panelboards upon satisfactory completion of tests and results.
   5. Verify ratings and settings and make final adjustments.

B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.

D. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.

E. Prefunctional testing:
   1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
   2. Visual and mechanical inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
      c. Compare nameplate information and connections to Contract Documents.
      d. Check tightness of all power connections.
      e. Check that all covers, barriers, and doors are secure.
   3. Electrical tests:
      a. Insulation resistance: 1000volt DC tests for one minute on all 600volt and lower rated equipment, components, buses, feeder and branch circuits and control circuits. Test phase-to-phase and phase-to-ground circuits showing less than 10-megohms resistance to ground shall be repaired or replaced.
      b. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
      c. Ground resistance: Test resistance to ground of system and equipment ground connection.
      d. Test overcurrent protection devices per Section 26 2816: Overcurrent Protective Devices.

F. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation. The Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence, and the Engineer's hourly rate.

G. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

H. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.4 CLEANING

A. Prior to energizing of panelboards, the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of panelboards per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

END OF SECTION

SECTION 26 2716

CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Hinged cover enclosures.
   2. Cabinets.
   3. Terminal blocks and accessories.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. National Electrical Manufacturer's Association (NEMA):
      NEMA 250; Enclosures for Electrical Equipment.
      NEMA ICS 1; Industrial Control and Systems.
      NEMA ICS 4; Terminal Blocks and Industrial use.
      NEMA ICS 6; Enclosures for Industrial Controls and Systems.
   2. Underwriters Laboratories (UL):
      UL 50; Enclosures for Electrical Equipment.
      UL 65; Standards for Wired Cabinets.
      UL 1059; Terminal Blocks.
      UL 1773; Termination Boxes.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe Project construction, material, finish, and any specific features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Submit Manufacturer's installation instructions.
   5. Shop Drawings: Indicating wiring diagrams and equipment arrangement within cabinets.
   6. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Hoffman Engineering Co.
2. Circle AW Products.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 CABINETS AND ENCLOSURES

A. Construction: Shall be code gauge galvanized steel with standard concentric knockouts for conduit terminations. Size shall be as indicated on Drawings. Cabinet shall be NEMA 250 Type 1, 3R or 4.

B. Finish: Manufacturer's standard gray baked enamel finish.

C. Covers: Continuous hinged steel door, lockable and keyed to match panelboard locks.

D. Mounting:
1. Flush cabinets shall be furnished with concealed trim clamps and shall be not less than 4 inches deep.
2. Surface cabinets shall be furnished with screw cover trim, flush hinged door and shall not be less than 6 inches deep.

2.3 BACKBOARDS

A. Furnish cabinet with 3/4-inch fire retardant plywood mounting backboard on interior unless otherwise indicated on Drawings.

2.4 TERMINAL BLOCKS AND ACCESSORIES

A. Terminal blocks: NEMA ICS 4; UL listed.

B. Power terminals: Unit construction type, closed-back with tubular pressure screw connections, rated 600 volts.

C. Signal and control terminals: See terminal strips in Section 26 0519: Building Wire and Cable.

D. Identification: Identify terminal strips with permanent numbers.

E. Wiring diagram: Provide wiring diagram in protective pocket on inside front cover of cabinet. Diagram shall indicate control wiring, connections, and layout of components within enclosure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of cabinets and enclosures installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Set cabinets and enclosures plumb and symmetrical with building lines. Furnish and install all construction channel bolts, angles, etc. required to mount all equipment furnished under this Section of the Specifications.

B. Cabinets and enclosures shall be anchored and braced to withstand seismic forces calculated in accordance with that referenced in Section 26 0010: Basic Electrical Requirement.

C. "Train" interior wiring, bundle and clamp using specified plastic wire wraps.

D. Replace doors or trim exhibiting dents, bends, warps, or poor fit that may impede ready access, security, or integrity.

E. Terminate conduit in cabinet with lock nut and grounding bushing.

F. Terminate wiring on terminal blocks and identify each with heat shrink tags.

3.3 CLEANING

A. Touch-up paint any marks, blemishes, or other finish damage suffered during installation.

B. Vacuum clean cabinet on completion of installation.

END OF SECTION

SECTION 26 2719

SURFACE RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Surface metal raceways.
   2. Surface nonmetallic raceways.
   3. Multi-outlet assemblies.
   4. Wireways.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
   1. Federal Specifications (FS):
      FS W-C-582; Conduit, Raceway, Metal and Fitting; Surface.
   2. Underwriters Laboratories, Inc. (UL):
      UL 5; Standard for Surface Metal Raceways and Fittings.
      UL 5A Nonmetallic Surface Raceways and Fittings.
      UL 870; Wireways, Auxiliary Gutters and Associated Fittings.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and proposed application.
   3. Submit Manufacturer's installation: Provide written instructions for raceway products special installation techniques.
   4. Complete bill of material listing all components.
   5. Shop Drawings: Indicate layout, dimensions, support locations and mounting details.
   6. Furnish structural calculations for suspended wireway support as described in Section 26 0010: Basic Electrical Requirements.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Surface metal raceways and multi-outlet assemblies:
      a. The Wiremold Co.
      b. Isoduct (Aluminum).
   2. Surface nonmetallic raceways and multi-outlet assemblies:
      a. The Wiremold Co.
   3. Wireways:
      a. Hoffman Engineering Co.
      b. Circle AW Products.
      c. Square D Co.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 SURFACE METAL RACEWAYS

A. Assembly: Single or Double compartment raceway shall be complete to include bases, covers, end plates, compartment divider, fittings and connections as required. Raceways shall be UL labeled.

B. Construction: Raceway base, cover, compartment divider and end plates shall be constructed of cold rolled steel with 0.094" minimum wall thickness of extruded aluminum of No. 6063-T5 aluminum alloy extrusion. Corner extrusions shall be identical to linear extrusions.

C. Size: Raceway size and length shall be as indicated on Drawings.

D. Fittings: Boxes, extension rings, couplings, elbows, and connectors shall be designed for use with raceway system.

E. Finish: Gray enamel. Stainless steel, 215 R1 clear anodized.

2.3 SURFACE NONMETALLIC RACEWAYS

A. Assembly: Single, double, or triple compartment raceway shall be complete to include bases, covers, end plates, compartment divider, fittings and connections as required. Raceways shall be UL labeled. Double and triple compartment raceway shall have individual covers for each channel to allow access to one compartment at a time.

B. Construction: Raceway base, cover, compartment divider and end plates shall be of non-metallic construction.

C. Size: Raceway size and length shall be as indicated on Drawings.

D. Fittings: Boxes, extension rings, couplings, elbows and connectors shall be designed for use with raceway system.

E. Finish: White or Ivory.

2.4 MULTI-OUTLET ASSEMBLIES

A. Assembly: Single or Double compartment raceway shall be factory pre-assembled, pre-cut and complete, including bases, covers, end plates, compartment dividers, wiring, receptacles, fittings and connections as required. Raceway shall be U.L. labeled.

B. Construction: Raceway base, cover, compartment divider and end plates shall be constructed of cold rolled steel with 0.094" minimum wall thickness of extruded aluminum of No. 6063-T5 aluminum alloy extrusion. Corner extrusions shall be identical to linear extrusions of non-metallic materials.

C. Size: Raceway size and length shall be as indicated on Drawings.

D. Receptacles: Convenience receptacles mounted in cover shall be NEMA 5-20R in accordance with Specification Section 26 2726: Wiring Devices. Space receptacles on center as indicated on Drawings.

E. Coverplates: Device coverplates shall be of same material and finish as the raceway.

F. Wiring: Receptacle circuits shall be pre-wired, or field wired with minimum #12 AWG conductors throughout entire length of section. 12" pigtails shall be provided for field connections. Pigtails shall be properly tagged with circuit identification in the field. Tap splicing shall be accomplished with No. 562 "Scotch-Lok" tap connectors.

G. Wire retention clips: Shall be installed in sufficient numbers to securely hold all wire lengths in place.

H. Grounding: Ground continuity shall be maintained to receptacles throughout the entire length of raceway by means of a separate, insulated, code sized ground conductor.

I. Fittings: Boxes, extension rings, couplings, elbows and connectors shall be designed for use with raceway system.

J. Finish: Gray enamel. Stainless steel. 215 R1 clear anodized.

2.5 WIREWAYS

A. Assembly: Wireway shall be complete to include channel, cover, end plates, fittings and connectors as required. Wireway shall be U.L. labeled.

B. Construction: Wireway channel, cover and end plates shall be constructed of galvanized code gauge sheet steel for general-purpose use. Wireway shall have concentric knockouts, spaced a maximum of 12" on center, on both sides of hinged opening.

C. Size: Wireway size and length shall be as indicated on Drawings.

D. Cover: Hinged covers with screw retention.

E. Connector: Shall be slip-in construction with hinged cover.

F. Fittings: Lay-in types with removable covers and designed for use with wireway system.

G. Finish: Rust inhibiting primer coat with gray enamel finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of surface raceway installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 SURFACE METAL RACEWAY AND MULTI-OUTLET ASSEMBLY

A. Installation:
1. Install raceway in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
2. Contractor shall coordinate raceway lengths with building walls, counter, and actual field conditions.
3. Raceways mounted on walls above benches and counters shall align exactly with each end of bench or counter.
4. Use flat-head screws to fasten channel to surfaces, at heights indicated on Drawings, per Manufacturer's instructions. Mount plumb and level.
5. Installed complete with all necessary corner connectors, 'T' connectors, feed connectors, compartment dividers and any other hardware required to provide a complete system as described in the Drawings.
6. Provide fittings to feed the raceway from the back.

B. Branch circuiting: Provide connection to pre-wired or field wired assembly as indicated on Drawings. Install circuit identification tags on pigtails. Receptacles shall be identified with panel and circuit I.D. above each outlet with gray dymo label.

C. Grounding: Ground continuity shall be maintained throughout entire raceway length per CEC.

3.3 WIREWAYS

A. Preparation:
1. Locations of wireways shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.
2. Exposed wireways shall be run parallel or at right angles to the centerlines of columns and beams.
3. Wireways shall not be placed closer than 12-inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

B. Installation:
1. Install wireways in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
2. Installed complete with all necessary corner connectors, 'T' connectors feed connectors and any other hardware required to install raceway systems as indicated in Drawings.

3. Conduits shall be securely fastened to wireways using two locknuts and an insulating bushing or specified insulated connectors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric knockouts.

C. Supports:
1. All wireways shall be secured to building structures using specified fasteners, clamps and hangers spaced according to Code.
2. Suspended wireways shall be supported with universal hangers attached to structure above, spaced according to Manufacturer installation instructions.
3. Provide lateral bracing support along suspended wireway spaced at a maximum of 30'-0" on center. Bracing shall consist of 3/8" threaded rod installed at a 45-degree angle up to structural slab and anchored. Alternate bracing on both sides of cable tray.

D. Grounding: Ground continuity shall be maintained throughout the entire raceway length per CEC.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Wall switches.
   2. Wall dimmer controls.
   3. Occupancy/vacancy sensors, including wallbox and ceiling mounted.
   4. Time switches.
   5. Receptacles.
   6. Floor mounted service boxes.
   7. Coverplates.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 03: Cast-in-place concrete.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
   1. Federal Specification (FS):
      FS W-P-455A; Plate, Wall Electrical.
      FS W-C-596; Electrical Power Connector, Plug, Receptacle and Cable Outlet.
      FS W-S-896; Switch, Toggle.
   2. National Electrical Manufacturer's Association (NEMA):
      NEMA WD-1; General-Purpose Wiring Devices.
      NEMA WD-2; Semiconductor Dimmers for Incandescent Lamps.
      NEMA WD-5; Specific-Purpose Wiring Devices.
      NEMA SSL 7A; Phase-Cut Dimming for Solid State Lighting
   3. Underwriter's Laboratories (UL):
      UL 20 General-Use Snap Switches.
      UL 231; Power Outlets.
      UL 310; Electrical Quick-Connect Terminals.
      UL 498; Attachment Plugs and Receptacles.
      UL 514A; Metallic Outlet Boxes.
      UL 514D; Cover Plates for Flush-Mounted Wiring Devices.
      UL 943; Ground-Fault Circuit-Interrupters.
      UL 1681; Wiring Device Configurations.
      UL 1682; Plugs, Receptacles and Cable Connectors of the Pin and Sleeve Type.
      UL 1686; Pin and Sleeve Configurations.
      UL 1699A; Outlet Branch Circuit Arc-Fault Circuit-Interrupters.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Provide color finishes for Architect to select from.
   4. Submit Manufacturer's installation instructions.

B. Where inscribed device coverplates are noted on the Drawings or in the Specifications, conform to the requirements of Section 26 0553: Electrical Identification.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.5 WARRANTY

A. Occupancy sensors offered under this Section shall be covered by a ***1***-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Switches, receptacles and coverplates:
      a. Hubbell.
      b. Pass & Seymour.
      c. Leviton.
   2. Wallbox dimmer controls:
      a. Lutron: Lumea, Skylark Contour.
      b. Legrand P&S: radiant.
      c. Leviton; IllumaTech.
      d. Cooper Greengate: WBSD.
      e. Types as specifically shown on drawings.
   3. Occupancy/vacancy sensors switches, time switches:
      a. Cooper Controls “Greengate”
      b. Wattstopper
      c. Leviton
      d. SensorSwitch, Inc.
      e. Hubbell Building Automation, Inc.
   4. Floor mounted service boxes:
      a. Hubbell.

b. Walker.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 WALL SWITCHES

A. Standards: Provide general-purpose 120/277volt AC switches that conform to NEMA WD-1 Specifications.

B. Color: Device color shall be as selected by the Architect, unless otherwise noted.

C. Wall switches:
1. Provide twenty amperes, 120/277volt, Specification grade, designer decora style, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with totally enclosed case.
2. Single-pole, single-throw switches: Hubbell #2121 series, Pass & Seymour #26021 series or Leviton #5621-2 series.
3. Double-pole, single-throw switches Hubbell #2122 series, Pass & Seymour #26022 series or Leviton #5622-2 series.
4. Three-way switches: Hubbell #2123 series, Pass & Seymour #26023 series or Leviton #5623-2 series.

2.3 WALLBOX DIMMER CONTROLS

A. Standards: Provide dimmers that conform to NEMA WD-2 and UL 20.

B. Color: Device color shall be as selected by the Architect, unless otherwise noted.

C. Designed and listed for specific control types:
1. 0-10volt LED and Fluorescent
2. Incandescent/Halogen
3. Forward Phase
4. Reverse Phase
5. Universal load type dimmers are not acceptable.

D. Dimmers:
1. Linear slide type dimmer with smooth and continuous square law dimming curve.
2. Separate control of intensity and on/off.
3. Minimum load limit as required for wattage controlled, to avoid low-end flicker.
4. Maximum load limit as required for load type controlled; wattage or unit based.
5. Dimmers shall have power failure memory to bring lights back on at same level prior to power interruption.
6. Dimmers shall incorporate air-gap switch.
7. Provide dimmers with single and multi-gang coverplate of high impact ABS plastic.

2.4 OCCUPANCY/VACANCY SENSOR SWITCHES

A. Occupancy sensors: automatic on, automatic off.

B. Vacancy sensors: manual on, automatic off.

C. General:
1. Occupancy sensors shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The

California Energy Commission. All sensors shall be listed in the most current directory of Certified Occupancy Sensing Devices or be on file with the CEC.

2. Sensors shall be dual-technology type infrared/ultrasonic or infrared/microphonic or as specified herein.
3. Neutral connection required. Sensors that rely on ground leakage current for operation shall not be provided.
4. All sensors shall have an adjustable time delay off setting and a sensitivity adjustment.
5. Ceiling mounted sensors shall operate be line voltage or low voltage with separate control unit. Control unit shall contain power supply and relays for switching loads.
6. Units shall be furnished with area coverage to suit application. No allowance shall be given for providing sensors improperly sized for the square footage of the controlled area.

D. Color: Device color shall be as selected by Architect, unless otherwise noted.

E. Wallbox mounted single level control sensors:
1. Sensor shall provide minimum coverage of 900-square feet.
2. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 4-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
3. Load capacity of 0 to 1800watts at connected voltage.
4. For use in small utility closets and similar areas where dual level switching is not indicated.

F. Wallbox mounted dual level control sensors:
1. Sensor shall provide dual level switching capability and minimum coverage of 1000-square feet.
2. Operation shall be manual (in two levels) “ON” and manual (in two levels) or automatic (full) “OFF”.
3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 20-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
4. Load capacity of 50 to 1000watts at connected voltages.
5. Integral photocell. Provide with ambient light control adjustment.
6. For use in offices and similar areas where dual level switching is indicated.

G. Wallbox mounted combination sensor and dimmer:
1. Sensor shall provide 0-10volt dimming capability for LED loads.
2. Sensor shall provide minimum coverage of 20-feet for clear line-of-sight applications.
3. Infrared only or dual-technology sensor.
4. Time delay adjustment from 3-minutes to 20-minutes. Set initial time-out setting at 15-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
5. For use in private offices and similar areas where dimming is indicated.

H. Ceiling or wall mounted single-directional sensors:
1. Sensor shall provide minimum coverage of 900-square feet.
2. Operation shall be automatic “ON” and automatic “OFF”. Provide with a manual override switch.
3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 10-minutes. Set sensitivity adjustment at maximum.
4. Load capacity of 20amps per power or slave pack at connected voltage.
5. Power pack, if required, consisting of Class 2, 24volt output transformer and relay in single housing, capable of powering up 2 sensors and mounted inside standard 4-inch square box.
6. For use in small office, classroom, and similar areas.

I. Ceiling mounted omnidirectional sensors:
   1. Sensor shall provide minimum omnidirectional coverage of 1000-square feet.
   2. Operation shall be automatic “ON” and automatic “OFF”. Provide with a manual override switch.
   3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 10-minutes. Set sensitivity adjustment at maximum.
   4. Load capacity of 20amps per power or slave pack at connected voltage.
   5. Power pack, if required, consisting of Class 2, 24volt output transformer and relay in single housing, capable of powering up to 2 sensors and mounted inside standard 4-inch square box.
   6. For use in large storage rooms and similar areas.

2.5 TIME SWITCHES

A. Wallbox mounted, line voltage type.

B. Shall be compatible with all LED lighting loads, electronic ballasts, motor loads, and inductive loads. Triac and other harmonic generating devices shall not be allowed.

C. Shall have no minimum load requirement and shall be capable of controlling up to 800watts.

D. Shall allow manual override of the preset time-out period.

E. Time switch shall be capable of operating as an “ON/OFF” switch.

F. Digital time switch:
   1. Shall have the option for a beep warning that shall sound every 5-seconds once the time switch countdown reaches one minute.
   2. Shall have an electroluminescent backlit Liquid Crystal Display that shows the timer’s countdown.
   3. Maximum setting of 30-minutes for server aisles and 10-minutes for closets.

G. Analog time switch:
   1. Spring wound rotary style.
   2. Maximum setting of 30-minutes for server aisles and 10-minutes for closets.

H. Astronomical time switch:
   1. Includes integral programming function for precise Time Zone, Longitude, and Latitude input/
   2. Weekly schedule format.
   3. Minimum 5 programmable schedules.

2.6 RECEPTACLES

A. Standards:
   1. Provide general purpose 20amp, 125/250volt AC receptacles that conform to NEMA WD-1 Specifications. Specialty receptacles shall conform to NEMA WD-5 Specifications as applicable.
   2. Provide NEMA 5-20R, industrial (heavy-duty) specification grade as noted herein, 20amp, 125volt AC, 2-pole, 3-wire grounding type receptacles.
   3. Receptacles shall be the designer decora style device.

B. Color:
   1. Device color shall be as selected by the Architect, unless otherwise noted.

2. Devices connected to an emergency circuit shall be red.

C. General purpose single outlets:
1. Provide self-grounding back and side wired with binding head staked terminal screw.
2. Use Hubbell #2161 series, Pass & Seymour #26361 series or Leviton #16351 series.

D. General purpose duplex receptacles:
1. Provide self-grounding, back and side wired with binding head staked terminal screws and break-off strip for two-circuit wiring.
2. Use Hubbell #5362 series, Pass & Seymour #5362 series or Leviton #5362 series or Hubbell #2162 series, Pass & Seymour #26362 series or Leviton #16352 series.

E. Ground fault circuit interrupting (GFCI) receptacles:
1. Provide 20amp, 125volt AC, receptacles consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5-milli-amp line-to-ground fault current in approximately 1/40th of a second.
2. Provide visual device with trip indication, manual reset, and test mechanisms and with point of use and multi-outlet protection.
3. Provide self-test and monitor feature with visual indicators on device face representing power status, trip condition, ground fault condition and end of life status.
4. Provide weather resistant devices at all damp and wet locations.
5. Use Pass & Seymour #2097TR series, Hubbell GFTRST20 series, Leviton #S7899 series, for Specification grade GFCI receptacles.
6. Use Pass & Seymour #2097HGTR series, Hubbell GFR8300SG series, Leviton #S7899-HG series for hospital grade GFCI receptacle.
7. Use Pass & Seymour #2097TRWR series, Hubbell GFTWRST20 series, Leviton #WT899 series for weather resistant GFCI receptacles.

F. Controlled Receptacles:
1. Provide 20amp, 125volt AC, receptacles consisting of NEMA 5-20R duplex device permanently marked with universal symbol for controlled receptacle, and the word “CONTROLLED”.
2. Controlled duplex receptacles shall include split circuit hot tab for one controlled outlet, and one uncontrolled.
3. Controlled double duplex receptacle shall consist of one uncontrolled general-purpose duplex receptacle, and one controlled duplex receptacle.
4. For half controlled receptacle with split-circuit hot tab, use Pass & Seymour 26352CH, Hubbell DR20C1, Leviton 16352-1P.
5. For dual controlled receptacle, use Pass & Seymour 26352CD, Hubbell DR20C2, Leviton 16352-2P.

G. USB Charger Type Duplex Receptacles
1. Provide 20amp, 125volt AC, tamper-resistant specification grade receptacles consisting of NEMA 5-20R duplex device with two 5volt DC USB Type A charging ports; compatible with USB 2.0 and 3.0 devices, and capable of charging two devices simultaneously while still using receptacles.
2. Comply with USB battery charging spec USB BC1.2
3. Minimum 3.1 amps total charging capacity.
4. Use Pass & Seymour TR5362USB series, Hubbell USB20X2 series, Leviton #T5832 series, for USB charger type duplex receptacles.

H. Isolated ground (IG) receptacles:
1. Provide 20amp, 125volt AC, receptacles consisting of NEMA 5-20R duplex device with an isolated ground terminal.
2. Device color shall be orange, unless otherwise noted.
3. Use Pass & Seymour #IG5362 series, Hubbell IG-5362 series, Leviton #5362-IG series, for Specification grade IG receptacles.

I. Special purpose receptacles: Provide Specification grade devices with the NEMA configuration, voltage and current rating, number of poles and ground provisions as noted on the Drawings.

J. Surge Protective Device (SPD) receptacles:
1. Provide 20amp, 125volt AC, NEMA 5-20R, duplex receptacle with integral SPD protection.
2. Type 3: Point-of-utilization SPDs installed at a minimum conductor length of 10-meters (30-feet) from the electrical service panel to the point-of-utilization.
3. Provide devices that comply with FS-WP455A, ANSI/IEEE C 62.41-1980 and that are UL listed.
4. Use Hubbell #5352S or equal standard SPD protection devices.
5. Use Hubbell #IG5352S or equal isolated ground SPD protection devices.
6. Use Hubbell #IG8300HS or equal hospital grade SPD protection devices.

2.7 FLOOR MOUNTED SERVICE BOXES

A. Multi-service recessed floor box:
1. Combination power and communication cable service floor box with flush cover and recessed compartment for access to service device(s). Box shall be for installation concrete floors.
2. Box shall be constructed of formed steel with provisions for adjustments before and after pour. Access hatch shall be steel and provided with carpet trim and insert. Make allowances for floor finishes if other than carpet. Furnish with specified receptacle(s) and accessories called for on Drawings.
3. Use Hubbell #3SFB-SS series or Walker 'Resource RFB' series.

B. Cast flush floor box:
1. Single or multi-gang floor box for flush applications in concrete floor. Box shall be cast iron with brass coverplates and carpet flange. Furnish with provisions for adjustments before and after pour. Provide with all accessories such as receptacles, compartment dividers, coverplate options, rings, etc. as indicated for application on Drawings.
2. Furnish box in either shallow or deep sizes as determined by the concrete floor depth and in ganged configurations indicated on Drawings.
3. Use Hubbell #B-2400, B-4200 and B-4300 series or Walker #880C series.

C. Poke-through floor fitting:
1. Flush style fire rated poke-through device for installation in a 2" or 3" cured hole through a concrete floor. Provide with finish ring housing, receptacle, cable access, box, etc. or any other accessories to facilitate the installation indicated on Drawings.
2. Use raceway components #RC 700 series or Walker #1500 series for flush installations.
3. Use raceway components #FIT-200 series or Walker #1600 series for monument installation.

2.8 COVERPLATES

A. General:
1. Provide all coverplates with rounded edges and corners, smooth and free of grooves, embossing or other embellishment.
2. Provide mounting screws to match the plate finish.
3. Provide gang type coverplates where two or more devices are installed at one location. Individual gangable coverplates are not acceptable.
4. Provide plates of one design, designer decora style, throughout the Project unless otherwise specified.

B. Color: Coverplate color shall be as specified by the Architect, unless otherwise noted.

C. Plastic coverplates:
1. Provide smooth, high impact, self-extinguishing thermoplastic coverplates and 0.100 inches thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.

D. Metal coverplates:
1. Provide smooth, type 430 stainless steel coverplates, 0.035" thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.
3. Provide removable plastic film to protect coverplates during installation. Remove film at time of final acceptance.

E. Weatherproof coverplates:
1. Non-public areas:
a. Provide horizontal mounted, weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, spring loaded, vertically self-closing covers suitable for use in damp and wet locations as described in UL 514 and CEC 406. Covers shall allow the use of the device with the cover closed.
b. Furnish base plates, covers, hinge pins, spring, and screws of corrosion resistant type 302 stainless steel.
2. Public area receptacles:
a. Provide horizontal mounted weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, spring loaded, lockable, vertically self-closing covers suitable for use in damp and wet locations as described in UL 514 and CEC 406. Covers shall allow the use of the device with the cover closed.
b. Furnish base plates, covers, hinge pins, spring and screws of corrosion resistant type 302 stainless steel.
c. Provide two (2) keys for each locking type coverplate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wiring device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Coordinate device heights in vending, kitchen and utility areas with benches and counters.

B. Coordinate switch mounting location with Architectural details. Unless otherwise noted, locate switches on latch side of door.

3.3 INSTALLATION

A. Install wiring devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Install devices with the vertical centerline plumb and with all edges of the device flush against the adjacent wall surfaces.

C. Mount switches at 42 inches to center above finished floor unless otherwise noted.

D. Mount receptacles vertically with the centerline 18-inches above finished floor and with grounding slot at bottom.

E. Mount receptacles vertically or horizontally per Architect’s direction when mounting above counters, mount with grounding slot to the left.

F. Mount GFCI receptacles in the following locations, whether indicated as GFCI type or not on the drawings:
1. In bathrooms.
2. Where receptacles are installed within 6’0” from edge of sinks.
3. In kitchens above counters.
4. On rooftops.
5. Outdoors.
6. Where serving vending machines.
7. Where serving electric drinking fountains.

G. Derate ganged dimmer switches as instructed by Manufacturer. Do not use common neutrals in dimmer circuits.

H. Install red receptacles where connected to an emergency circuit.

I. Provide coverplates for all outlet boxes, switches, receptacles, etc.

J. Install blank coverplates on all outlet boxes in which no device is required or installed.

K. Provide coverplates that completely cover wall opening and seat against wall.

L. Provide stainless steel coverplates for all devices in kitchen/food service equipment areas.

3.4 OCCUPANCY/VACANCY WALLBOX SENSORS

A. All occupancy/vacancy sensors shall have a sensitivity appropriate for the space. Contractor shall be responsible for testing the sensitivity of the sensor in the space and adjusting as needed.

B. Where no direction is provided in a sequence of operation or by the owner set the occupancy sensor timeout to values as indicated in Part 2 above.

C. Install wall mounted devices with the vertical centerline plumb and alleges of device flush against adjacent wall surfaces. Mount devices at 42-inches to center above finished floor unless otherwise noted.

3.5 FLOOR MOUNTED SERVICE BOXES

A. Installation:
1. Install floor boxes to be level or within 1/16" below screed line.
2. Make conduit connections and anchor box to sub-flooring.
3. Core drill hole in floor (core sized based on Manufacturer's installation instructions) for insert of poke-through device.
4. Make conduit connection to poke-through box from floor below.

B. Coordination: Contractor shall mark the location of all floor boxes with paint prior to installation or core drilling for review and approval by Architect.

3.6 FIELD QUALITY CONTROL

A. Electrical testing:
1. Test proper polarity of all receptacles.
2. Test ground continuity of all wiring devices.
3. Test ground fault interrupting device operation.

B. Visual and mechanical inspection:
1. Check proper operation of all switches.
2. Check indicating lights on all SPD receptacles.
3. Visually inspect and replace damaged or defective devices.

3.7 CLEANING

A. Clean interior of all boxes from dirt and paint prior to installation of devices.

B. Clean wiring devices and coverplates from dirt and paint over spray.

END OF SECTION

SECTION 26 2816

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Fuses.
   2. Fused switches.
   3. Molded case circuit breakers.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. Federal Specification (FS):
      FS W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service.
      FS W-F-870; Fuseholders (for Plug and Enclosed Cartridge Fuses.
      FS W-S-865; Enclosed Knife Switch.
   2. Underwriters Laboratories, Inc. (UL):
      UL 98; Dead-Front Switches.
      UL 248(1-16); Low-Voltage Fuses.
      UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
      UL 512; Fuseholders.
      UL 1066; Low Voltage AC and DC Power Circuit Breakers Used in Enclosures.
   3. National Electrical Manufacturer Association (NEMA):
      NEMA AB 1; Molded Case Circuit Breakers.
      NEMA KS 1; Enclosed Switches.
      NEMA SG 3; Low-Voltage Power Circuit Breakers.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe product operation, equipment and dimensions and indicate features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Provide factory certification of trip characteristics for each type and rating of circuit breaker.

5. Provide current let-through and melting time information for each type and rating of fuses.
6. Confirmation in writing of compliance with Arc Energy Reduction per CEC Articles 240.67 and 240.87.
7. Confirmation in writing of compliance with all CEC mandated selective coordination requirements (e.g. CEC Articles 517, 620, 645, 695, 700, 701, 708) associated with this project. Include manufacturer selective coordination tables, etc. for documentation to be submitted to the Power System Study engineer and the Authority Having Jurisdiction (AHJ).
8. Submit Manufacturer's installation instructions.
9. Complete bill of material listing all components.
10. Warranty.

1.4 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Parts list and part numbers.
4. Telephone numbers for authorized parts and service distributors.
5. Final testing reports.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Overcurrent Protective Device components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.7 WARRANTY

A. Units and components offered under this Section shall be covered by a ***1***-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.8 EXTRA MATERIAL

A. Three spare fuses of each size and type or a minimum of 10% of the number installed, whichever is greater, shall be supplied to the Owner in the specified spare fuse cabinet(s).

B. Provide and locate a spare fuse cabinet(s) in the main electrical room. Cabinet shall have lockable piano hinged door, keyed to match panelboards, with fuse schedules mounted in a frame on interior. Size and quantity of cabinets shall be as required to accommodate spare fuses required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Fuses:
      a. Bussmann Division, Cooper Industries.
      b. Gould Shawmut Co.
   2. Fused switches hes:
      a. ABB/ General Electric.
      b. Eaton.
      c. Siemens.
      d. Square D.
   3. Circuit breakers:
      a. ABB/ General Electric.
      b. Eaton.
      c. Siemens.
      d. Square D.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 GENERAL

A. Overcurrent protective devices shall satisfy all CEC mandated selective coordination requirements (e.g. CEC Articles 517, 620, 645, 695, 700, 701, 708) in addition to any project specific selective coordination requirements above and beyond CEC requirements.

B. Fuses rated 1200 amps or higher shall satisfy CEC Article 240.67 requirements.

C. Circuit breakers rated (or can be adjusted) 1200amps or higher shall satisfy CEC Article 240.87 requirements.

2.3 FUSES

A. General: All power fuses shall be time-delay, high interrupting (300K AIC), current limiting type, unless otherwise noted on the Drawings. All fuses shall be the product of a single Manufacturer and shall be selectively coordinated when applied in 2:1 ratio. Types of fuses shall be as follows:
   1. 0 to 600amps: UL Class J, dual element, time delay type fuse with separate overload and short-circuit elements. The fuse shall hold 500% of rated current for a minimum of 10-seconds.

2. Motor branch circuit fuses (0 to 600amps): UL Class J dual element, time delay type fuse. Motor branch circuit fuses shall be sized for Type 2 coordination for the motor controller and back-up motor overload protection and shall be coordinated with motor starter overload relay heaters. See Section 26 2900: Motor Controls.

B. Control and instrument fuses shall be suitable for installing in blocks or fuseholders. Exact type and rating shall be as recommended by the Manufacturer of the equipment being protected.

C. Fuses for installation in current limiting circuit breakers or motor circuit protectors shall meet the specific requirements of the Manufacturers of that equipment to ensure compatibility.

2.4 FUSED SWITCHES

A. General: This Section covers fused switches for mounting in switchboards and distribution boards for sizes 30amp through 800amp.

B. Fusible switches shall be quick-make, quick-break of the sizes indicated on the Drawings. The units shall be listed and approved by Underwriters' Laboratories and, where applicable, shall be dual horsepower rated for both standards one-time or dual element uses.

C. Fusible switches shall be group mounted in switchboards. Each switch is to be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses. Incorporate safety cover interlocks to prevent opening the cover with the switch in the “ON” position or prevent placing the switch in the “ON” position with the cover open. This interlock shall be constructed so that it can be released with a standard electrician's tool for testing fuses without interrupting service.

D. Provide handles with provisions for padlocking and shall clearly indicate the “ON” and "OFF" positions. Provide front cover doors capable of being padlocked in the closed position.

E. Switches shall pass industry standard I2t withstand tests and fuse race tests.

F. Fusible switches shall be suitable for use on circuits having available fault currents as of 200,000 RMS symmetrical amperes.

G. Furnish fusible switches 30amps through 600amps frames with rejection type fuse clips. Furnish fusible switches 800amps through 1200amps with Class L fuse clips.

2.5 MOLDED CASE CIRCUIT BREAKERS

A. Branch and feeder circuit breakers shall be molded case, bolt on and trip indicating.

B. Where stationary molded case circuit breakers are indicated on the Drawings to be current limiting type, they shall be current limiting as defined by UL 489 and shall not employ any fusible elements.

C. Circuit breakers shall have interrupting capacity not less than that indicated on the Drawings or if not indicated, not less than 10,000 RMS symmetrical amps for 208volt systems.

D. Covers shall be sealed on non-interchangeable breakers and trip unit covers shall be sealed on interchangeable trip breakers to prevent tampering. Circuit breaker ratings shall be clearly visible after installation or engraved nameplates shall be provided stating the rating. All ferrous parts shall be plated to minimize corrosion.

E. Circuit breakers shall be toggle, quick-make and quick-break operating mechanisms with trip-free feature to prevent contacts being held closed against overcurrent conditions in the circuit. Trip position of the breakers shall be clearly indicated by operating handles moving to a center position.

F. Provide identified handle ties for single pole circuit breakers that share a neutral conductor.

G. Multipole breakers shall have a single handle to open and close all contacts simultaneously in both manual operation and under automatic tripping. Interpole barriers shall be provided inside the breaker to prevent any phase-to-phase flashover. Each pole of the breaker shall have means for Arc extinguishing.

H. All terminals shall be dual rated for aluminum or copper wire.

I. Circuit breakers with frame ratings 100amps and smaller shall be ambient temperature compensated, thermal magnetic type unless otherwise noted. Breakers shall be of full size, 1" per pole type. Panels with more than one branch breaker larger than 100amps shall be installed in distribution type panels.

J. Circuit breakers with frame ratings above 100amps through 225 amps shall have solid state electronic trips with true RMS reading through the 13th harmonic with 1% accuracy, interchangeable trip via front accessible current plug, adjustable instantaneous and short time be rated as indicated on Drawings at the voltage indicated.

K. Circuit breakers with frame ratings above 225 amps shall have microprocessor-based RMS sensing trip units with the following characteristics:
   1. Interchangeable current rating plug or an adjustable trip setting to match the trip rating as indicated on Drawings.
   2. Adjustable long-time pick-up setting. Minimum of five settings from 50% to 100%.
   3. Adjustable long-time delay setting. Minimum of three delay bands.
   4. Adjustable short time pick-up setting. Minimum of five settings from 200% to 800%.
   5. Adjustable short-time delay setting. Minimum of three delay bands with I2t IN and OUT curves.
   6. Adjustable instantaneous pick-up setting. Minimum of five settings from 200% to 1000%. Where the instantaneous feature is omitted on the Drawings, the trip unit shall have an instantaneous override feature.
   7. Zone selective interlocking (ZSI) for short-time delay and ground-fault delay trip functions, if indicated on the drawings.
   8. LED status indication to show “health” of trip unit.
   9. Three-phase ammeter, if indicated on the drawings.
   10. Trip indication targets on overload, ground fault and short circuit, if indicated on the drawings.

L. Accessories: Provide accessories as noted on the Drawings, i.e. shunt-trip, auxiliary contacts, undervoltage trip, alarm switch, etc.

M. Spaces in the boards shall be able to accept any combination of 1, 2 or 3-pole circuit breakers as indicated. Provide all necessary bus, device supports, and mounting hardware sized for frame, not trip rating.

N. Series rated breakers are not acceptable unless specifically noted on the Drawings.

O. Breaker shall be rated to operate in an ambient temperature of 40-degrees C and at 100% of their frame ampere rating on a continuous basis, if indicated on the drawings.

P. Refer to the Drawings for breakers requiring ground fault protection. See Section 26 2413: Switchboards for requirements of ground fault protection system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of overcurrent protective device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Install overcurrent protective devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. A fuse identification label shall be placed inside the door of each fused switch. Each label shall show fuse type, ampere rating and Manufacturer.

C. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A.

D. Install overcurrent protective devices and accessories in accordance with Manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. All devices shall be installed in accordance with applicable CEC and NEMA standards for installation.

E. Circuit breakers serving “Fire Alarm Control Panel(s)” shall be red in color.

3.3 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
   1. Assure overcurrent protective device installation conforms to specified requirements and operates within specified tolerances.
   2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
   3. Prepare final test report including results, observations, failures, adjustments, and remedies.
   4. Verify ratings and settings and make final adjustments.

B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.

D. Testing of overcurrent protective devices shall be done only after all devices are installed and prior to system being energized.

E. Prefunctional testing:
   1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
   2. Visual and mechanical inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
      c. Compare nameplate information and connections to Contract Documents.
      d. Check tightness of all control and power connections.
      e. Check that all covers, barriers, and doors are secure.
   3. Electrical tests:
      a. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
      b. Test all circuit breakers with frame size 225amps and larger in each panelboard, distribution board, switchboard, etc. unless otherwise noted via primary current injection testing. Testing shall verify the following:
         1) Determine that circuit breaker will trip under overcurrent conditions, with tripping time in conformance with NEMA AB 1 requirements.
         2) Circuit breaker pickup and delay measurements are within the manufacturers published tolerances for long time, short time, instantaneous, and ground fault.
         3) For circuit breakers rated or can be adjusted to 1200amps (or higher), confirm ZSI protection is acceptable or the maintenance mode switch is operational (enabled and disabled) with reduced pickup and delay measurements when enabled.

F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

G. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.4 ADJUSTING

A. Adjust circuit breaker trip settings for coordination with other overcurrent protective devices in system.

B. Adjust circuit breaker trip settings for adequate protection from overcurrent and fault currents.

3.5 CLEANING

A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean overcurrent protective devices per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

3.6 TRAINING

A. Factory authorized service representative shall conduct a 4-hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance, and testing of equipment with both classroom training and hands-on instruction.

B. Contractor shall schedule training with a minimum of 7-days advance notice.

END OF SECTION

SECTION 26 2819

DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Disconnect Switches.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated on specified:
   1. Federal Specifications (FS):
      FS W-F-870; Fuseholders (for plug and enclosed cartridge fuses).
      FS W-S-865; Switch, Box (enclosed), Surface-Mounted.
   2. National Electrical Manufacturer Association (NEMA):
      NEMA KS 1; Enclosed Switches.
   3. Underwriters Laboratories, Inc. (UL):
      UL 512; Fuseholders.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. As a minimum the following characteristics shall be indicated:
      a. NEMA types.
      b. Current rating.
      c. Number of poles.
      d. Fuse provisions.
      e. Enclosure dimensions.
      f. Voltage.
      g. Horsepower rating (if applicable).
      h. Short circuit rating.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Submit Manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. ABB/ General Electric.
   2. Eaton.
   3. Siemens.
   4. Square D.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 DISCONNECT SWITCHES

A. Description: Provide NEMA heavy-duty type switches with dead front construction and padlock provisions for up to three locks in the “OFF” position.

B. Switch interior: Provide switch with switchblades that are fully visible in the “OFF” position when the door is open. Provide UL listed lugs for copper conductors, lugs to be front removable. Provide plated current carrying part.

C. Switch mechanism: Provide switches with a quick-make, quick-break, position indicating, operating handle and mechanism and a dual cover interlock to prevent unauthorized opening of the switch door in the “ON” position or closing of the switch mechanism with the door open. Furnish an electrical interlock to de-energize control wiring when the disconnect switch is opened.

D. Enclosures: Provide switches with hinged cover in NEMA 1 general purpose, sheet steel enclosure for dry locations and NEMA 3R weatherproof galvanized enclosures for exterior, damp, or wet locations, unless otherwise noted on the Drawings. Provide an enclosure treated with a rust-inhibiting phosphate primer and finished in gray baked enamel.

E. Ratings: Provide switches that are horsepower rated for 240 VAC or 600volt AC as required for the circuit involved and that meet “I-SQUARED-T” requirements. Fusible switches to have provisions for the types of fuses specified in Section 26 2816: Overcurrent Protective Devices. UL listed short circuit rating, when equipped with fuses to be 200,000amps RMS symmetrical. Furnish with provisions for RK-1 fuses for switches up to 600amps. 800amp switches and larger to have provisions for Class L fuses.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of disconnects switch installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Coordinate locations of switches and equipment in the field to provide code required clearances in front of switches and to ensure that switches are insight of the controller as described in CEC Article 430.

3.3 INSTALLATION

A. Install disconnect switches where indicated on the Drawings.

B. Install fuses in fusible disconnect switches.

C. Include construction channel and mounting hardware as required to support disconnect switch.

3.4 IDENTIFICATION

A. Provide engraved, machine screw retained type 'NP' nameplate on each disconnect switch. See Section 26 0553: Electrical Identification.

3.5 CLEANING

A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of enclosure of all construction debris, scrap wire, paint splatters, dirt, etc.

END OF SECTION

SECTION 26 2900

MOTOR CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Manual motor starters.
   2. Magnetic motor starters.
   3. Combination magnetic motor starters

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 03: Cast-in-place concrete. Equipment housekeeping pad.
   2. Division 09: Painting. Touch-up of painted surfaces.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
   1. Federal Specifications (FS):
      - FS W-C-375; Circuit Breakers, Molded Case; Branch Circuit and Service.
      - FS W-F-870; Fuseholders (for plug and enclosed cartridge fuses).
      - FS W-P-115; Power Distribution Panel.
      - FS W-S-865; Switch, Box, (Enclosed) Surface-Mounted.
   2. Underwriters Laboratories, Inc. (UL):
      - UL 198; Fuses (applicable subsections).
      - UL 486E; Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
      - UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
      - UL 508; Industrial Control Equipment.
      - UL 508A; Industrial Control Panels.
   3. National Electrical Manufacturer Association (NEMA):
      - NEMA ICS 2; Industrial Control Devices, Controllers and Assemblies.
      - NEMA ICS 6; Enclosures for Industrial Controls and Systems.
      - NEMA AB 1; Molded Case Circuit Breakers.
      - NEMA KS 1; Enclosed Switches.

1.3 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe system operation, equipment and dimensions and indicate features of each component.

3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Include detailed control wiring diagrams for each starter.
5. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
6. Outdoor weatherproof equipment enclosure and accessories.
7. Submit Manufacturer's installation instructions.
8. Complete Bill of Material listing all components.
9. Warranty.

B. Dimensions and configurations of motor control centers shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout if equipment furnished varies in size from that indicated on Drawings for the Engineer's approval.

1.4 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Pictorial parts list and part numbers.
4. Telephone numbers for the authorized parts and service distributors.
5. Include all service bulletins and torque Specifications for all terminations.
6. Final testing reports.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Motor control components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.7 WARRANTY

A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.8 EXTRA MATERIAL

A. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. ABB/ General Electric.
   2. Eaton.
   3. Siemens.
   4. Square D.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 MANUAL MOTOR STARTERS

A. Manual motor starter: AC general purpose Class A manually operated non-reversing or full-voltage controller for induction motors rated in horsepower, with overload relay, red pilot light, auxiliary contacts when indicated on Drawings and pushbutton operator. Starter size and number of poles shall be as required for connections indicated on Drawings. Furnish in conformance with NEMA ICS 2.

B. Fractional horsepower manual starters: AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit and toggle operator. Starter size and number of poles shall be as required for connections indicated on Drawings. Furnish in conformance with NEMA ICS 2.

C. Enclosure: NEMA ICS 6; Type 1

2.3 MAGNETIC MOTOR STARTERS

A. General:
   1. AC general-purpose Class A magnetic controller for induction motors rated in horsepower, conforming to NEMA ICS 2. Furnish with thermal overload protection in all three phases.
   2. All starters shall be such that disconnection of power conductors shall automatically disconnect control power.
   3. Each starter shall have the following accessories:
      a. One N.O. and one N.C. auxiliary contacts.
      b. Heavy-duty oil tight green, push-to-test motor running indicating light.
      c. Heavy-duty oil tight H-O-A switch.
      d. Three phase solid-state power monitor for anti-single phasing protection on motors 20HP and larger. Westinghouse SVM3 series or equal.
   4. All starters shall be full-voltage, non-reversing, (FVNR), minimum NEMA size 1, unless otherwise noted on the Drawings.
   5. Starters other than FVNR shall be equal in quality and by same Manufacturer of starters specified above. Other types of starters, if required, shall be as described on the Drawings.

6. Provide terminal strips and wiring as indicated on the motor starter wiring diagram on the Drawings.

B. Reduced voltage starters: Reduced-voltage part winding type.

C. Combination motor starters: Combine motor starters with molded case circuit breaker or device in common enclosure.

D. Control power transformers (CPT):
1. Each 480volt AC starter shall contain a separately fused, heavy-duty control transformer within each motor starter cubicle to provide 120volt AC, 60 Hz. Control transformer shall be adequate VA rating for all control/indicator components in the cubicle. Connect to load side of the fused switch.
2. Overcurrent protection: Factory pre-wired fuse and fuse holder in the ungrounded leg of the control transformer primary and secondary.

E. Enclosure: NEMA ICS 6; Type 1.

2.4 COMBINATION STARTER OVERCURRENT PROTECTIVE DEVICE

A. Refer to Section 26 2816: Overcurrent Protective Devices.

B. Overcurrent protective devices shall be molded case circuit breakers type with frame and trip ratings as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of motor control installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 GENERAL

A. Install motor control equipment in accordance with Manufacturer's instructions, as indicated on the Drawings and as specified herein.

B. Install equipment where indicated on the Drawings.

3.3 MOUNTING

A. Include construction channel and mounting hardware as required to support motor control equipment.

B. Coordinate locations of control equipment in the field to provide code clearances in front of devices.

3.4 IDENTIFICATION

A. Provide engraved, machine screw-retained type 'NP' nameplate on each motor control device. Refer to Section 26 0553: Electrical Identification.

3.5 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
   1. Assure motor controls installation conforms to specified requirements and operates within specified tolerances.
   2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
   3. Prepare final test report including results, observations, failures, adjustments, and remedies.
   4. Apply label on motor control centers upon satisfactory completion of tests and results.
   5. Verify ratings and settings and make final adjustments to overcurrent protective devices.

B. Engineer witnessed testing: Allow a period of 4-hours for motor control for Engineer review and final check. This review shall be done when the system de-energized, therefore plan accordingly.

C. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

D. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.

E. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.

F. Pre-functional testing:
   1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
   2. Visual and mechanical inspection:
      a. Inspect for physical damage, defects alignment and fit.
      b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
      c. Compare nameplate information and connections to Contract Documents.
      d. Check tightness of all control and power connections.
      e. Check that all covers, barriers, and doors are secure.
      f. Verify that motor controls meet specified requirements.
   3. Electrical tests:
      a. Insulation resistance: 1000volt DC tests for one minute on all 600volt and lower rated equipment, components, buses, feeder and branch circuits and control circuits. Test phase-to-phase and phase-to-ground circuits showing less than 10-megohms resistance to ground shall be repaired or replaced.
      b. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
      c. Ground resistance: Test resistance to ground of system and equipment ground connection.
      d. Test overcurrent protection devices per Section 262816: Overcurrent Protective Devices.

G. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.

H. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

I. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.6 CLEANING

A. Prior to energizing of motor controls, the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer’s approved methods and materials.

B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of motor controls per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.7 TRAINING

A. Factory authorized service representative shall conduct a 4-hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance, and testing of equipment with both classroom training and hands-on instruction.

B. Contractor shall schedule training with a minimum of 7-days advance notice.

END OF SECTION

SECTION 26 4313

SURGE PROTECTIVE DEVICES (SPD)

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Surge protective devices (SPD).

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
   1. American National Standards Institute, Inc. (ANSI)/Institute of Electrical and Electronics Engineers (IEEE):
      ANSI/IEEE C62.1; Standard for Surge Arresters for Alternating Current Power Circuits.
      ANSI/IEEE C62.11; Standard for Metal-Oxide Surge Arrestors for AC Power Circuits.
      ANSI/IEEE C62.41.1; Guide on the Surges Environment in Low-Voltage (1000V and Less) AC Power Circuits.
      ANSI/IEEE C62.41.2; Recommended Practices on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits.
      ANSI/IEEE C62.45; Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
   2. Underwriters Laboratory, Inc. (UL):
      UL 50; Cabinets and Boxes.
      UL 1283 Electromagnetic Interference Filters. [Type 2 only]
      UL 1449; Surge Protective Devices, 4th Edition.
   3. National Electrical Manufacturers Association (NEMA):
      NEMA PB 1.1; General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

1.3 SYSTEM DESCRIPTION

A. Provide surge protective device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchboards, and panelboards.

B. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 4th Edition).

C. SPD units shall be furnished in two Types. Type 1 and Type 2 as outlined below:
   1. Type 1: Permanently connected SPDs installed on the line or load side of main disconnect device(s), at main switchboard. This type closely relates to the devices previously referred to as secondary surge arrestors. These Type 1 SPDs should be specially suited to conduct the high energy impulses from lightning strikes.
   2. Type 2: Permanently connected SPD installed on the load side of the service panel main disconnect device(s). This type most closely relates to devices that were previously classified as Transient Voltage Surge Suppression (TVSS). These Type 2 SPDs are especially suited for distribution boards and panelboard applications.

1.4 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe system operation, equipment and dimensions and indicate features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Shop Drawings: Include elevations, cabinet dimensions, complete component listing and layout within cabinet, amperage ratings and capacities, system characteristics and wiring diagrams.
   5. Furnish critical equipment seismic certification and structural calculations for equipment anchorage as described in Section 26 0010: Basic Electrical Requirements.
   6. Confirmation in writing of SPD compliance with CEC Article(s) 285, 620, 645, 670, 695, and 700.
   7. Submit Manufacturer's installation instructions.
   8. Complete bill of material listing all components.
   9. Warranty.

1.5 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, to include the following.
   1. A detailed explanation of the operation of the system.
   2. Instruments for routine maintenance.
   3. Pictorial parts list and parts number.
   4. Telephone numbers for authorized parts and service distributors.

1.6 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: SPD components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with the Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.8 WARRANTY

A. Units and components offered under this Section shall be covered by a *5*-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. ABB/ General Electric.
2. Eaton.
3. Schneider Electric/ Square D.
4. Siemens.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 GENERAL

A. The SPD’s shall have a critical equipment seismic certification

B. All Specification noted herein apply to the switchboard, and panelboard units, unless otherwise noted.

C. The SPD system utilizes diversion modules to suppress and divert transient voltage and surge currents. The system is designed to provide protection for sensitive electronic devices against the effects of surges, transients, and electrical line noise.

D. Environmental requirements:
1. Operating temperature: -40-degree C to 60-degree C.
2. Relative humidity: 0% to 95%.
3. Operating altitude: 0 to 12,000-feet.
4. Audible noise: Less than 35-dB.

E. Electrical requirements:
1. Unit operating voltage: The SPD system voltage shall be as indicated on the Drawings.
2. Maximum continuous operating voltage "MCOV": The MVOC shall not be less than 125% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors "MOVs" as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection modes: The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

PROTECTION MODES TABLE				
Configuration	L-N	L-G	L-L	N-G
WYE	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

5. Nominal discharge current (In): All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an in less than 20kA shall be rejected.
6. Voltage protection rating (VPR): The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

VOLTAGE PROTECTION RATING TABLE				
System Voltage	**L-N**	**L-G**	**L-L**	**N-G**
120/208	700V	700V	1200V	700V
277/480	1200V	1200V	2000V	1200V
346/600	1500V	1500V	3000V	1500V

F. SPD design:
1. The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV.
3. Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50-dB from 10kHz to 100MHz using the MIL-STD-220A insertion loss test method.
4. No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. SPD shall provide the following integral monitoring options:
   a. Each unit shall have a green/red solid-state indicator light that reports the status of the protection on each phase:

1) For WYE configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. WYE configured units shall also contain an additional green/red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode.
2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators shall indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights shall continue to indicate the status of the protection on all other phases and protection modes.

b. The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
c. The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
d. Surge counter:
1) The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location.
2) The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50amps ± 20amps occurs.
3) A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2-seconds in order to clear the surge count total.
4) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
7. All the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.
8. Safety requirements:
a. The SPD shall minimize potential arc flash hazards by containing no user serviceable or replaceable parts and shall be maintenance free. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.3 SYSTEM APPLICATION

A. The SPD applications covered under this section include switchboards panelboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

MINIMUM SURGE CURRENT CAPACITY TABLE			
Category	**Application**	**Per Phase**	**Per Mode**
C	Service Entrance Locations (Switchboards)	250kA	125kA
B	High Exposure Roof Top Locations (Switchboards and Panelboards)	160kA	80kA
A	Branch Locations (Panelboards)	120kA	60kA

C. All SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.4 PANELBOARDS

A. The SPD application covered under this section includes lighting and outlet panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category A or B environments.

B. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.

C. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.

D. The panelboard shall be capable of re-energizing upon removal of the SPD.

E. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.

F. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.

G. The SPD shall be of the same manufacturer as the panelboard.

H. The complete panelboard including the SPD shall be UL67 listed.

2.5 SWITCHBOARDS

A. The SPD application covered under this section is for switchboard locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.

B. The SPD shall be of the same manufacturer as the switchboard.

C. The SPD shall be factory installed inside the switchboard at the assembly point by the original equipment manufacturer.

D. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.

E. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.

F. The SPD shall be integral to switchboard as a factory standardized design.

G. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.6 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
   1. NEMA 1: Constructed of a polymer (units integrated within electrical assemblies), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
   2. NEMA 4: Constructed of steel, intended for either indoor or outdoor use, to provide a degree of protection from the following:
      a. Against access to hazardous parts.
      b. Of equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust).
      c. With respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water).

2.7 SOURCE QUALITY CONTROL

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of SPD installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. Install SPD in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Set cabinets plumb and symmetrical with building lines in conformance with PB1.2. Furnish and install all construction channel bolts, angles, etc., required to mount the equipment furnished under this Section.

C. As a minimum, provide SPDs on all service entrance switchboards, emergency system switchboards and panelboards, 120/208volt distribution switchboards and 120/208volt panelboards, disconnecting means, safety interlock circuits, in compliance with CEC Article(s) 285, 620, 645, 670, 695, and 700.

D. Conductors from the power source to the SPD shall be minimum #4 AWG copper in switchboards and #8 AWG copper in panelboards (when not direct bus connected). Conductors shall be routed without sharp bends and straight and short as possible. The absolute maximum of 7'-0" long for units in switchboards and 1'-0" long for units in panelboards.

E. Conductors originating from direct bus bar connections shall be individually wrapped with electric tape in half-lapped increments for added protection of the un-protected conductors. Tie-wrap the conductors away from the bus bars without any sharp bends. All holes that the conductors pass through shall be grommets.

F. Cabinets shall be anchored and braced to withstand seismic forces as calculated per Section 260010: Basic Electrical Requirements.

G. SPD's protecting disconnecting means (e.g. enclosed circuit breaker or switch) shall be installed per the manufacturer's installation instructions with conductor lengths kept to a minimum (less than 2'-0" long).

3.3 FIELD QUALITY CONTROL

A. Prefunctional testing:
   1. Visual and mechanical inspection:
      a. Inspect for physical damage, defects, alignment, and fit.
      b. Compare nameplate information and connections to Contract Documents.
      c. Check tightness of all control and power connections.
      d. Prior to energization, verify source neutral is bonded to ground per CEC Articles 250.24(B), 250.28 and 250.30.

END OF SECTION

SECTION 26 5000

LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Interior luminaires (lighting fixtures.)
   2. Exterior luminaires.
   3. Light-emitting diode (LED) assemblies.
   4. Drivers and transformers.
   5. Optical components; including diffusers, refractors, reflectors, and louvers.
   6. Unit battery equipment.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 05: Metals; for fittings, brackets, backing supports, rods, etc. as required for support and bracing of luminaires.
   2. Division 09: Finishes; for ceilings, wall assemblies, acoustical treatment, and field painting of luminaires.

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and Standards except as otherwise indicated or specified:
   1. American National Standards Institute (ANSI):
      - ANSI/IEC 60529; American National Standard for Degrees of Protection Provided by Enclosures (IP Code)
      - C137.0 Lighting System Terms and Definitions.
      - C137.1 0-10V Dimming Interface for LED Drivers and Controls
   2. Underwriters Laboratories, Inc. (UL):
      - UL 66; Fixture Wire.
      - UL 102.3; Standard Method of Fire Test of Light Diffusers and Lenses.
      - UL 844; Luminaires for Use in Hazardous (Classified) Locations.
      - UL 924; Emergency Lighting and Power Equipment.
      - UL924a; Auxiliary Power Supplies (for generator-backed systems.)
      - UL 1598; Luminaires.
      - UL 1838; Low Voltage Landscape Lighting Systems.
      - UL 2108; Low Voltage Lighting Systems.
      - UL 2592; Low Voltage LED Wire.
      - UL 5085-3; Low Voltage Transformers: Class 2.
      - UL 8750; Light Emitting Diode (LED) Equipment for Use in Lighting Products.
      - UL 8754; Holders, Bases, and Connectors for Solid-State (LED) Light Engines and Arrays.
   3. National Electrical Manufacturers Associations (NEMA):
      - SSL-1; Electronic Drivers for LED Devices, Arrays or Systems.

	77;	Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria.
	LE-4;	Recessed Luminaires, Ceiling Compatibility
4.	Illuminating Engineering Society of North America (IESNA):	
	TM-15;	Luminaire Classification System for Outdoor Luminaires.
	TM-21;	Projecting Long Term Lumen Maintenance of LED Light Sources.
	TM-30;	Method for Evaluating Light Source Color Rendition.
	TM-30-Annex E	Recommendations for Specifying Light Source Color Rendition
	LM-79;	Electrical and Photometric Measurements of Solid-State Lighting Products.
	LM-80;	Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.
	LM-84;	Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires.
	LM-86;	Measuring Luminous Flux and Color Maintenance of Remote Phosphor Components
5.	Restriction of Hazardous Substances (RoHS):	
	RoHS 3;	Directive 2015/863 - Cat 5. Lighting: lamps, luminaires, light bulbs.

1.3 SYSTEM DESCRIPTION

A. Provide and install a fully functional and operating lighting system as indicated, complete with light engines, lamps, wiring, and securely attached to support system to meet all seismic code requirements.

B. Where catalog number and narrative or pictorial descriptions are provided, the written description shall take precedence and prevail.

1.4 SUBSTITUTIONS

A. Refer to Section 260010: Basic Electrical Requirements for specific Equipment requirements.

B. Items specified under this Section and Luminaire Schedule are subject to the requirements, with the following qualifications:
   1. Items solely specified by Manufacturer name and catalog number, without qualifiers: Provide as specified – No Substitutions.
   2. Items specified by multiple Manufacturers, without qualifiers: Provide any listed manufacturer – No Substitutions.
   3. Items specified by sole or multiple Manufacturers, followed by “Or Approved Equal” or “Or Approved Equivalent”: Conform to substitution requirements outlined for Equipment.
   4. Items specified by sole or multiple Manufacturers, followed by “Or Equal” or “Or Equivalent”: Products that meet the salient requirements are acceptable to provide.
      a. Equivalency is at the sole judgement of the Architect and Engineer.
      b. Should a submitted, unspecified product fail to meet the requirements of Equivalency, provide specified products at no additional cost to the Owner.

C. Equivalency shall be determined by review of the following luminaire characteristics where applicable. Lack of pertinent data on any characteristic shall constitute justification for rejection of the submittal or substitution.

1. Performance:
   a. Distribution.
   b. Utilization.
   c. Luminance distribution (Average brightness / maximum brightness.)
   d. Spacing to mounting height ratio.
   e. Overall luminaire efficiency.
2. Construction:
   a. Engineering.
   b. Workmanship.
   c. Rigidity.
   d. Permanence of materials and finishes.
3. Installation Ease:
   a. Captive parts and captive hardware.
   b. Provision for leveling.
   c. Through-wiring ease.
4. Maintenance:
   a. Ease of relamping / replacement of LED array.
   b. Ease of replacement of driver/ballast and lamp sockets.
5. Appearance:
   a. Architectural integration.
   b. Light tightness.
   c. Styling.
   d. Conformance with design intent.
   e. When requested, furnish a working sample complete with housing, trim, 8’ cord and plug, and specified lamp.

1.5 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Complete bill of material listing (index) of all luminaires. Index shall be organized in the same sequence as the Luminaire Schedule (alphabetical.) Include in the index:
      a. Type per the Luminaire Schedule.
      b. Manufacturer.
      c. Complete catalog number, including all accessories and appurtenances required for the installation.
      d. Voltage.
   2. Manufacturer’s data sheets/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
      a. Identify luminaire type on each sheet.
      b. Clearly mark on each data sheet the specific item(s) being submitted. Obfuscate or otherwise delete options on data sheets that are not provided.
   3. Driver or transformer and/or lamp data sheets as applicable to submitted item.
   4. Manufacturer's installation instructions.
   5. Warranty.
   6. U.L. labeling information.
   7. Photometric Reports consisting of:
      a. Independent Testing Laboratories, Inc. or equal, photometric test report for each luminaire listed on the Luminaire Schedule. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain candlepower distribution curves in five lateral planes for luminaires with asymmetric distributions and luminance data for vertical angles above 45 degrees from nadir.

b. Coefficient of utilization table.
c. Zonal lumen summary including overall luminaire efficiency.

8. Shop Drawings:
   a. Where noted in the Luminaire Schedule, submit Shop Drawings from Manufacturer detailing modified or custom luminaires indicating dimensions, weights, methods of field assembly, components, features, accessories, methods of support, etc.

1.6 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
   1. An updated index per 1.05-A.
   2. One complete set of final submittals of actual product installed, including product data and shop drawings.
   3. Instructions for routine maintenance.
   4. Pictorial parts list and parts number.
   5. Telephone numbers for authorized parts and service distributors.

1.7 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Luminaires shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.9 WARRANTY

A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Luminaires, Poles, and Exit Signs: as listed in the Luminaire Schedule.
   2. Light-Emitting Diode (LED) Arrays:
      a. Cree.
      b. Nichia.
      c. Citizen.
      d. Lumileds.
      e. Samsung.
      f. Lumenetix Araya.
      g. Xicato.
      h. Bridgelux.
      i. LEDs provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.
   3. LED drivers (DC output):
      a. eldoLED.
      b. Lutron.
      c. Signify Advance.
      d. Osram.
      e. Q-Tran.
      f. Universal Lighting Technologies.
      g. Drivers provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.
   4. Transformers for LED systems (AC output):
      a. Q-Tran.
      b. Hatch.
      c. Semper Fi.
      d. Transformers provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.
   5. Unit battery equipment:
      a. Philips Bodine.
      b. Iota.
      c. Unit battery equipment provided by Luminaire Manufacturers listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 GENERAL

A. Luminaires new and complete with mounting accessories, junction boxes, trims, and lamps.

B. Luminaire assemblies U.L. listed appropriate to mounting conditions and application. All labels affixed to the luminaire shall be in a location not visible from normal viewing angles.

C. Each luminaire family type (downlights, etc.) supplied by only one manufacturer.

D. Recessed luminaires installed in fire rated ceilings and using a fire rated protective cover shall be thermally protected for this application and shall carry a fire rated listing.

E. Luminaires installed under canopies, roofs or open areas and similar damp or wet locations shall be UL listed and labeled as suitable for damp or wet locations.

F. Luminaires shall bear the IP rating appropriate for the application.

G. Luminaires shall be free of light leaks and shall be designed to provide sufficient ventilation of light engines, including ventilation holes where required.

2.3 LUMINAIRE CONSTRUCTION

A. All sheet metal Work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. 20-gauge (0.7-mm or 0.027-inch) minimum.
   1. Finish: Baked white dry polyester powder, unless otherwise specified, with a minimum average reflectance of 85% on all exposed and light reflecting surfaces. Steel components shall be prepared for finishing with a 5-step zinc phosphating process prior to painting.
   2. Luminaire (including all painted component parts) shall be painted after fabrication unless specifically noted in the Luminaire Schedule.

B. Extruded Aluminum Housings: One-piece housing of AA 6063 T5 extruded aluminum with 0.14 minimum thickness smooth and free of tooling lines in one uninterrupted section of 1-foot to 24-foot with the cross sectional dimensions as indicated in the Luminaire Schedule.

C. Die-Cast Aluminum Housings:
   1. Single-piece casting to ensure water tightness.
   2. Low copper (<0.7% Cu) aluminum alloy.
   3. Minimum Class 4 Consumer Grade per NADCA Standards.

D. All surfaces shall be cleaned and dressed to eliminate all exposed sharp edges or burrs.

E. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly.

F. End Plates: Die cast end plates shall be mechanically attached without exposed fasteners. End caps shall be minimum 0.125" thick.

G. All mitered corners or joints shall be accurately aligned with abutting intersecting members. Sheet metal Work shall be properly fabricated so that planes will not deform (i.e. become concave or convex) due to normal expected ambient and operating conditions.

H. Ferrous mounting hardware and accessories shall be finished using either a galvanic or phosphate primer/baked enamel process to prevent corrosion and discoloration of adjacent materials.

I. Fasteners shall be manufactured of galvanized steel.

J. Adjustable Lamp Mechanisms: To have aiming stops which can be permanently set to position lamp vertically and rotationally.

K. Recessed luminaires: Equip with through-wire junction box. Box, driver, and replaceable components shall be accessible from the ceiling opening of the luminaire.

L. Finish:
1. All exposed aluminum surfaces shall be treated with an acid wash and clear water rinse prior to painting. The luminaire shall then be electrostatically painted, or powder coated, and oven baked in the color indicated in the Luminaire Schedule.
2. All exposed steel surfaces shall be treated with an acid wash and clear water rinse, then prime coated. The luminaire shall then be electrostatically painted, or powder coated, and oven baked in the color indicated in the Luminaire Schedule.

M. Door Frames for lensed luminaires: White painted, flat aluminum with mitered corners.

2.4 SUSPENSION

A. Suspension Devices, type as specified in the Luminaire Schedule:
1. Aircraft Cable: Stainless steel type - 3/32" nominal diameter, stranded, with positive pressure, field adjustable clamp at luminaire connection.
2. Rigid Pendant: ½" nominal diameter or as specifically shown on drawings. Supplied by luminaire manufacturer when available as standard product. At luminaire end of stems, provide earthquake type swivel fitting to permit 45-degree swing in any direction away from vertical.
3. Chain hangers: Length to suit mounting height if shown or as field conditions dictate. Use two heavy duty chains with "S" hooks at each suspension point. Length to suit mounting height as shown on Drawings.

B. Suspension system must permit ±13-mm (1/2") minimum vertical adjustment after installation.

C. Supports:
1. Provide internal safety cable from luminaire body to stud in outlet box.
2. Carry luminaire weight to structure and provide horizontal bracing from suspension points to ceiling framing to prevent sideways shifting. Provide diagonal seismic restraint wires per code.

D. Feed Point:
1. Flat-plate canopy to cover outlet box, with holes for support cable and power cord, concealed fasteners to permit splice inspection after installation.
2. At the electrified connection provide straight cord feed.
3. Power cord: white multi-conductor cord, parallel to support cable (aircraft cable); within pendant (rigid pendant); or flexible conduit (chain hanger).

E. Non-feed Points:
1. 13-mm (½") O.D. polished chrome end sleeve, inside threaded ¼"-20, with 50-mm (2") diameter. Flat white plate to cover hole in ceiling. Top of cable with ball swaged on end, to fit inside sleeve.
2. Contractor to provide support above ceiling as required.

F. Suspension method shall allow adjustment to be made in hanging length to allow for variance in ceiling height.

G. All exposed paintable suspension components shall have the same finish and color as the luminaire housing.

2.5 LED ARRAYS

A. Minimum lumen maintenance per LM-80 measurements and TM-21 calculations: L90 at 60,000 hours.

B. Maximum burnout: B90 at 200,000-hours.

C. Free of mercury and toxic materials; RoHS compliant.

D. Linear LED boards: LED pitch shall be consistent throughout the luminaire and shall remain consistent from the end of one board to the start of the next. LED pitch shall be the same from the endcap of the luminaire to the last LED on the board as the LED pitch throughout the luminaire. Luminaire shall have a continuous luminous appearance – bright or dark spots are not acceptable.

E. White LEDs:
   1. TIER 1 (legacy CRI 90)
      a. Informational Note: For applications where color fidelity is critical, such as museums, galleries, high-end residential, etc.
      b. Correlated Color Temperature (CCT); as specified in Luminaire Schedule. Maximum 2-step MacAdam ellipse variation throughout listed life (L70).
      c. Color Rendering Index (CRI); minimum 90 Ra.
      d. R9 value; minimum 80.
      e. TM30 values; Rf >85, 95>Rg>105.
   2. TIER 2 (legacy CRI 80)
      a. Informational Note: For applications where color fidelity is important, such as offices, schools, general interior areas, etc.
      b. Minimum efficacy: 75 lumens per watt.
      c. L70 lifetime: minimum 80,000-hours (extrapolated.)
      d. Correlated Color Temperature (CCT); as specified in Luminaire Schedule. Maximum 3-step MacAdam ellipse variation throughout listed life (L70).
      e. Color Rendering Index (CRI); minimum 80 Ra.
      f. R9 value; minimum 30.
      g. TM30 values; Rf >75, 92>Rg>110.
   3. TIER 3 (legacy CRI 70)
      a. Informational Note: For applications where color fidelity is not critical, such as exterior parking and area lighting, warehouses, etc.
      b. Minimum efficacy: 100 lumens per watt.
      c. L70 lifetime: minimum 100,000-hours (extrapolated.)
      d. Correlated Color Temperature (CCT); as specified in Luminaire Schedule. Maximum 4-step MacAdam ellipse variation throughout listed life (L70).
      e. Color Rendering Index (CRI); minimum 70 Ra.
      f. R9 value; minimum 20.
      g. TM30 values; Rf >70, 80>Rg>120.

F. Warm-Dim White LEDs:
   1. CCT range as specified in Luminaire Schedule.
   2. Color temperature at each “step” shall follow the Planckian Locus (Black Body Curve), +/- 50K.

2.6 LED DRIVERS:

A. LED drivers shall be integral to luminaire housing or remotely located, when specified, within 15 feet of diode assembly.
   1. Luminaires shall be provided with the UL listed or equivalent driver and low voltage power supply as recommended by Manufacturer to insure proper and consistent lamp and luminaire performance. The number of LEDs per luminaire per power supply shall not be exceeded, and LEDs shall not be wired to a high capacity driver unless recommended by Manufacturer.
   2. Light Emitting Diode (LED) control gears shall operate with sustained variations of +/- 10% in voltage and frequency without damage to the driver and have a power factor not less than 90%. Regulations: +/-5% across the listed load range.
   3. Driver input current shall have Total Harmonic Distortion (THD) of less than 20%. The Driver shall have a Class A sound rating unless otherwise specified.
   4. Control gear shall be rated for 50-degree C ambient temperature.
   5. All control gear shall facilitate smooth, flicker-free dimming from 100% to 10%, 1% or 0.1% as noted on the Luminaire Schedule.

2.7 LENSES

A. Acrylic:
   1. Lenses shall be extruded or injection molded crystal clear 100% virgin acrylic (except as indicated otherwise). For lenses with male pattern of pyramids or cones, specified minimum thickness refers to distance from flat surface to base of pyramids (cones) or thickness of undisturbed material. For lenses with female pattern, specified minimum thickness refers to overall thickness of material.
   2. Lenses shall fully eliminate lamp images when viewed from all directions within 45 to 90-degree angles from vertical, where the ratio of lamp spacing to the distance from lamp underside to top of lens does not exceed 1.50. Within the viewing angle from 0 to 45-degrees the ratio of maximum brightness (under a lamp) to minimum brightness (between lamps) shall not exceed 3 to 1.
   3. Finishes (i.e. sandblasting, etching, polishing) shall be performed as described in the Luminaire Schedule.
   4. Plastic electrical light diffusers must meet the requirements of Section 2-5209, CAC, Flame Spread Rating.
   5. Prismatic Acrylic:
      a. Extruded of clear virgin acrylic plastic, 0.125" minimum overall thickness, 0.100” nominal unpenetrated thickness, Pattern 12 with flat sided female prisms running at 45 degrees off panel axis unless otherwise specified in the luminaire schedule. Concave prisms are not acceptable.
   6. Opal acrylic:
      a. Extruded or injection molded of virgin acrylic plastic, 0.080" minimum overall thickness.

B. Glass:
   1. Flat glass lenses shall be heat tempered borosilicate glass unless otherwise noted.
   2. Glass finishes (i.e. sandblasted, etching, polishing) shall be performed as described in the luminaire description.

2.8 LIGHTING TRANSFORMERS

A. Low voltage transformers:
   1. Low voltage transformers shall be core and coil construction, unless otherwise noted.

2. Primary voltage shall be as noted in Luminaire Schedule, secondary voltage 12volt AC, unless otherwise noted.
3. Sound rating shall be the best available. Replace excessively noisy transformers at no cost to the Owner.

2.9 UNIT BATTERY EQUIPMENT

A. LED Emergency Power Supplies
1. Standard Features:
a. Safety compliance to UL 924; CAN/CSAC22.2 No.141-10 and NFPA requirements for 90-minute egress
b. Open circuit / short circuit protection
c. Operating temperature: 32-degree F/0-degree C to 122-degree F/50-degree C
2. Test switch / charging indicator light
3. Emergency reaction time < 1-sec
4. Powder coat steel, stainless or galvan-nealed case
5. Field-replaceable NiCd battery pack (x2) with quick connect
6. Min. lead wire length: 6in UL 1452 solid / #18 AWG 1000volt / 90-degree C

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of luminaire installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Architectural Plans shall govern exact ceiling construction and mounting conditions for all luminaires. Locate as shown on the architectural elevations and reflected ceiling plan.

B. Consult Architectural Drawings for details of ceiling construction, finish, and other applicable details.

C. Contractor shall be responsible for coordination of luminaire mounting and compatibility with ceiling construction.

D. Luminaires in areas where exposed or concealed pipe and ductwork prevents direct access to the structural ceiling shall be provided with appropriate support system to install luminaire below obstructions to avoid conflicts with same.

3.3 ARCHITECTURAL COORDINATION

A. Where luminaires are mounted in architectural coves, soffits, valances, or cabinets and are given an overall length, the Contractor shall verify all lengths in the field prior to releasing order.

B. Where luminaires are surface mounted or suspended to match the length of walls or other architectural elements, the Contractor shall verify all lengths in the field prior to releasing order.

C. Mounting heights specified on drawings:
   1. Wall mounted luminaires: shall be to centerline of luminaire.
   2. Pendant mounted luminaires: shall be to bottom of luminaire unless specifically identified in the Luminaire Schedule or on drawings.

3.4 INSTALLATION

A. Install luminaires in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Contractor shall be responsible for all supports, hangers, and hardware necessary for a complete installation.

C. Luminaires shall be plumb, level, square, in straight lines and without distortion.

D. Remedy light leaks that may develop after installation of recessed or enclosed luminaires.

E. Adjustable luminaires shall be installed with “dead” zone of rotation away from intended aiming point.

3.5 LUMINAIRE SUPPORTS

A. Physical (gravity) supports:
   1. Recessed luminaires in wood framed ceilings shall be supported by 2" x 4" hangers fastened to adjacent ceiling joists.
   2. Recessed downlights in wood frame ceilings shall be supported with Manufacturers supplied bar hangers and shall be installed according to the Manufacturer’s instructions.
   3. Surface mounted luminaires solely supported by recessed boxes in a gypsum board ceiling shall have a 1-1/8" steel bar screwed or welded to the back of the box. This steel bar must be long enough to span two ceiling support channels and shall be attached to the channels by twisting wire around the bar and the support channel. For luminaires weighing over 50-pounds, provide studs in recessed box.
   4. Support surface mounted luminaires more than 18" wide at or near each corner or edge, in addition to support from outlet box.
   5. Support recessed downlights manufactured with built-in brackets by twisting wire around the bracket and two adjacent ceiling support channel runners on either side of the luminaire.
   6. Support outlet boxes as specified in Section 26 0533: Boxes. Provide all boxes with grounding pigtail.

B. Seismic supports:
   1. Recessed luminaires in suspended ceilings shall be supported by connecting two support wires to the luminaire at diagonal opposite corners for luminaires weighing 56 pounds or less. Connect four wires, one at each corner for luminaires weighing more than 56 pounds.
   2. Surface mounted luminaires on suspended ceilings shall be attached to the main ceiling runner with at least two positive clamping devices and shall have an additional support wire attached to each clamping device and to the structure above.
   3. Recessed downlight luminaires in suspended ceilings shall be supported by connecting one support wire to the luminaire housing.

4. All suspended luminaires shall be able to swing 45-degrees from vertical in any direction without obstruction.
    a. Furnish suspended rigid pendant luminaires with universal joint type hanger canopy and longitudinal sway adapter at each stem, to permit 45-degree swivel on 360-degree circle at canopy and 45-degree longitudinal movement at sway adapter.
    b. Submit Drawings of hanger assembly for review prior to ordering.
    c. If suspended luminaire is not free to swing 45-degrees in any direction, without obstructions, provide seismic restraint to prevent contact in conformance with California Uniform Building Code, Section 2330, Seismic Design.
5. All recessed modular luminaires shall be furnished with earthquake clips where installed in tee bar ceiling.

3.6 IDENTIFICATION SYSTEM

A. All concealed junction box cover plates for the lighting branch circuit system shall be clearly marked with a permanent black ink felt pen identifying the branch circuit (both panel designation and circuit number) contained in the box.

3.7 FIELD QUALITY CONTROL

A. Visual and mechanical inspection:
    1. Inspect for physical damage, defects, alignment and fit.
    2. Perform operational test of each luminaire after installed, circuited, and energized.
    3. Perform emergency operational test of all luminaires connected to emergency circuiting by simulating normal power source failure.

B. Contractor shall replace at no cost to the Owner all equipment which is found defective or do not operate within factory specified tolerances.

3.8 ADJUSTING AND AIMING

A. Aiming will occur at night under the direction of the Owner's Representative and the Architect or Engineer. The Contractor shall be responsible for providing the labor and materials for field aiming. This shall include, but not limited to, special rigging or scaffolding, adjusting luminaires in field, testing of various lenses or louvers, as directed by the Architect or Engineer.

B. Aim all directional luminaires, including but not limited to luminaires described in the Contract Documents or by the luminaire manufacturer as "aimable," "adjustable," or "asymmetric" as follows:
    1. To provide the lighting pattern for which the luminaire is designed.
    2. To provide the lighting pattern as shown on the drawings.
    3. To predetermined aiming points as shown on the drawings.
    4. Where aiming cannot be determined, request, in writing, clarification from the Specifier, indicating luminaires needing clarification.

C. Re-aim luminaires as determined by Architect during final project walkthrough.

3.9 CLEANING

A. Clean luminaires prior to Project closeout in accordance with Manufacturer's recommended materials and methods.

B. Remove all debris, fingerprints, and packaging remnants.

END OF SECTION

SECTION 26 6113

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
   1. Fire alarm control panel(s) 'FACP'
   2. Fire alarm annunciators
   3. Fire alarm terminal cabinets 'FATC'
   4. Initiating devices
   5. Notification appliances
   6. Auxiliary equipment control and supervision
   7. DAS monitoring for ERRCS
   8. Printer/terminal
   9. Record Drawings
   10. Pretesting and final testing

B. Work furnish and installed under another Section, but connected under this Section:
   1. Fire sprinkler alarm system flow switches, valve monitors and post indicating valves
   2. Elevator controller for recall
   3. Door hold-open/closure devices
   4. Fire barrier roll-down doors and shutters
   5. Fire/smoke dampers

C. Work furnished and connected to alarm system under this Section, but installed and connected to HVAC system under another Section:
   1. Duct mounted smoke detectors at supply air HVAC equipment 2000 cfm and larger.
   2. In-duct mounted smoke detectors at ducted fire/smoke damper. Except that wiring for damper power, control and monitoring shall be under this contract.

D. Work furnished and installed under another Section: HVAC shutdown wiring via dry contacts in remote mounted programmable relays.

E. Related work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
   1. Division 08: Door Hardware
   2. Division 14: Elevators
   3. Division 23: HVAC System
   4. Division 21: Fire Sprinkler System

1.2 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
   1. American National Standards Institute, Inc. (ANSI):
      ANSI C62.41; Guide for Surge Voltage in Low-Voltage AC Power Circuits
      ANSI/ASME A17.1; Safety Code for Elevators and Escalators

2. National Fire Protection Association (NFPA):
   - NFPA 13; Standards for the Installation of Fire Sprinkler Systems
   - NFPA 72; National Fire Alarm Code
   - NFPA 90A; Standard for the Installation of Air Conditioning and Ventilating Systems
   - NFPA 101; Life Safety Code
3. Underwriters Laboratories, Inc. (UL):
   - UL 38; Manually Activated Signaling Boxes
   - UL 268; Smoke Detectors for Fire Protective Signaling Systems
   - UL 268A; Smoke Detectors for Duct Applications
   - UL 464; Audible Signal Appliances
   - UL 497B; Protectors for Data Communications and Fire Alarm Circuits
   - UL 521; Heat Detectors for Fire Protective Signaling Systems
   - UL 864; Control Units for Fire-Protective Signaling Systems
   - UL 1424; Cables for Power-Limited Fire-Alarm Circuits
   - UL 1480; Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
   - UL 1481; Power Supplies for Fire-Protective Signaling Systems
   - UL 1638 Visual Signaling Appliances Standard
   - UL 1971 Signal Devices for the Hearing Impaired
4. Factory Mutual System (FM):
   - FM P7825 Approval Guide

1.3 DEFINITIONS

A. Addressable device: A fire alarm system initiating, control or monitoring device module component on a signaling line circuit (SLC) with discrete digital identification that can have its status individually identified or that is used to individually control other functions, using site-specific programming at the fire alarm control panel.

B. Alarm signal: A signal indicating an emergency that requires immediate action, such as a signal indicative of fire.

C. Annunciator: A unit containing one or more indicator lamps, alphanumeric displays, or other equivalent means in which each indication provides status information about a circuit, condition, or location.

D. Circuits and pathways:
1. Class A: Performance that includes a redundant pathway and shall be capable of operation past a single open or ground fault condition with monitoring and annunciation of a trouble signal when either type of fault occurs. Any conditions that affect the intended operation of the path are annunciated as a trouble signal.
2. Class B: Performance that does not include a redundant pathway and will not be capable of operation past a single open or ground fault condition but does include monitoring and annunciation of a trouble signal when either condition occurs. Any conditions that affect the intended operation of the path are annunciated as a trouble signal.
3. Class C: Performance that includes one or more pathways and operational capability is verified by means of end-of-line resistors, but the integrity of the individual paths is not monitored. A loss of end-of-line communication is annunciated as a trouble signal.
4. Class D: Performance that includes a fail-safe operation and no fault is annunciated, but the intended operation is performed in the event of a pathway failure.
5. Class E: A pathway that is not monitored for integrity.

6. Class X: Performance that includes a redundant pathway and shall be capable of operation past a single open or ground fault condition or combination open/ground fault condition with monitoring and annunciation of a trouble signal when either type of fault occurs. Additionally, shall be capable of operation past a single short-circuit condition with monitoring and annunciation of a trouble signal when short occurs.

E. Initiating device: A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box or supervisory switch.

F. Initiating device circuit: A circuit to which automatic or manual initiating devices are connected where the signal received does not identify the individual device operated.

G. Notification appliances: A fire alarm system component such as a bell, horn, speaker, light, or text display that provides audible, tactile, or visible outputs or any combination thereof.

H. Notification appliance circuit: A circuit or path directly connected to a notification appliance(s).

I. Signaling line circuit: A circuit or path between any combination of circuit interfaces, control units or transmitters over which multiple system input signals or output signals or both, are carried.

J. Supervisory signal: A signal indicating the need for action in connection with the supervision of guard tours, the fire suppression systems or equipment or the maintenance features of related systems.

K. Trouble signal: A signal initiated by the fire alarm system or device indicative of a fault in a monitoring circuit or component.

1.4 SYSTEM DESCRIPTION

A. The fire alarm system shall be a microprocessor-based direct wired, multi-priority, peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this Specification. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a plug-in programmer.

B. It shall be 24Vdc closed circuit, electronically supervised, common signaling, device indicating, and automatic alarm type. The system shall include all wiring, raceways, pullboxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm and supervisory signal initiating devices, alarm notification appliances and all other accessories required for a complete operating system.

C. Provide system with the following circuit and pathway performance:
1. Initiating devices circuits (IDCs): Class B.
2. Signaling line circuits (SLCs): Class B.
3. Notification appliance circuits (NACs): Class B.
4. Additionally, all notification and communication circuits for partial evacuation systems (EVACS) shall comply with the survivability requirements of NFPA 72, Chapter 12, Level 2 and Level 3.

D. Standby power: The standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for twenty 24-hours and capable of operating the system for 5-minutes of evacuation alarm on all devices, operating at maximum load. The system shall include a charging circuit to automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.

E. Voltage drop:
1. Under all operating conditions, the voltage on the NAC must be sufficient to operate all the notification appliances so that they deliver the proper signal intensity. The worst-case operating condition shall be calculated from when the control unit primary power supply has failed and the battery capacity is at its lowest point. An end of useful battery life starting value of 20.4volts shall be used at the starting voltage unless the manufacturer's instructions indicate that a higher or lower value should be used. The current draw of an appliance at the minimum listed operating voltage (16volts) should be used.
2. The point-to-point Ohm's Law voltage drop calculations of all alarm system circuits shall not exceed 10%.

F. Spare capacity: The system shall be engineered to accommodate 20% spare capacity on each individual loop, and 20% spare on system power supplies.

G. Auxiliary equipment requiring control and monitoring:
1. Flow switches, tamper switches and PIV monitoring
2. Emergency generator monitoring
3. Elevator recall and monitoring
4. Interface and provide fan shutdown control for all supply fans over 2000cfm
5. Interface and provide fire/smoke damper (FSD) control and monitoring
6. Door hold/open release device power and control
7. Interface and control of stairwell door for unlocking purposes when system is in alarm
8. Monitoring of DAS emergency responder radio coverage system (ERRCS)

1.5 SEQUENCE OF OPERATION

A. For system description of output controls and monitoring, based on input signals, refer to Sequence of Operation Matrix on the Drawings.

B. General alarm operation: Upon alarm activation of any area smoke detector, duct smoke detector, heat detector, manual pull station, sprinkler waterflow, etc., the following functions shall automatically occur:
1. The internal audible device shall sound at the control panel and annunciator.
2. The LCD Display shall indicate all applicable information associated with the alarm condition including zone, device type, device location and time/date.
3. All system activity/events shall be documented on the system printer.
4. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.
5. The following notification signals and actions shall occur simultaneously:
   a. Horns shall sound throughout the building.
   b. Activate visual strobes throughout the building.
6. Provide selective paging to each individual floor (zone). In addition to the message/channels detailed above, a dedicated page channel shall be capable of simultaneously providing live voice instructions without interrupting any of the messages listed above shall be provided.
7. Transmit signal to the central station with point identification.

8. All self-closing fire/smoke doors held open shall be released.
9. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

C. Elevator lobby/equipment room detectors: Upon alarm activation of any elevator lobby smoke detector or equipment/control room detectors, the following functions shall automatically occur:
1. Perform general alarm sequence above.
2. Activation of elevator lobby smoke detectors (other than primary floor) shall recall the elevators to primary floor.
3. Activation of elevator lobby smoke detectors located on the primary recall floor shall recall the elevator the alternate floor.
4. Activation of equipment/control room smoke detectors shall recall the elevator to the primary floor.
5. Activation of the equipment room heat detector shall initiate the shunt-trip of service power to the associated elevator equipment.

D. Supervisory operation: Upon supervisory activation of any sprinkler valve supervisory switch, fire pump off-normal, etc., the following functions shall automatically occur:
1. The internal audible device shall sound at the control panel and annunciator.
2. The LCD display shall indicate all applicable information associated with the supervisory condition including zone, device type, device location and time/date.
3. All system activity/events shall be documented on the system printer.
4. Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.
5. Transmit signal to the central station with point identification.

E. Trouble operation: Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:
1. The internal audible device shall sound at the control panel and annunciator.
2. The LCD keypad display shall indicate all applicable information associated with the trouble condition including zone, device type, device location and time/date.
3. All system activity/events shall be documented on the system printer.
4. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
5. Transmit signal to the central station with point identification.

F. Monitor activation: Upon activation of any device connected to a monitor circuit (fire pump, emergency generator status, etc.), the following functions shall automatically occur:
1. The LCD display shall indicate all applicable information associated with the status condition including zone, device type, device location and time/date.
2. All system activity/events shall be documented on the system printer.
3. Any remote or local annunciator LCD/LED's associated with the status zone shall be illuminated.

G. In addition to the above sequence of operation, the FACP shall perform the following functions:
1. Identify every addressable device by location, priority, and device type.
2. Read and display at FACP the sensitivity of addressable smoke and heat detection devices.
3. Remain 100% operational and capable of responding to an alarm condition while in the routine maintenance mode.
4. Be capable of supporting non-addressable as well as addressable devices.

5. Allow individual programmable control of each connected remote or panel-mounted relay.
6. Provide the user with the field programmability to add or change addressable device types and custom messages on-site via the system printer/terminal.
7. Display up to 127 alarms and/or up to 127 trouble indications, one at a time, as a list on the system printer/terminal.
8. Change the status of configured circuits (arming or disarming) and change status of relays.
9. Generate an addressable detector sensitivity report providing a chamber voltage listing (device testing) for each detector. Non-addressable smoke detectors will require manual field-testing and adjustment at each location.

1.6 SUBMITTALS

A. Submit in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Describe system operation, equipment and dimensions and indicate features of each component.
   3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   4. Shop Drawings. A complete set of shop drawings shall be supplied. The shop drawings shall be reproduced electronically in digital format. This package shall include but not be limited to:
      a. All drawings and diagrams shall include the contractor's title block, complete with drawing title, contractor's name, address, date including revisions, and preparer's and reviewer's initials.
      b. Detailed system operational description. Any Specification differences and deviations shall be clearly noted and marked.
      c. A riser diagram that individually depicts all control panels, annunciators, addressable devices, and notification appliances. Field addressable devices and notification appliances may be grouped together by specific type per loop or circuit.
      d. Complete 1/8" = 1'-0 scale floor plan drawing locating all system devices and elevation of all equipment. Floor plans shall indicate accurate locations for all control and peripheral devices as well as raceway size and routing, junction boxes, and conductor size, and quantity in each raceway. All notification appliances shall be provided with a candela rating and circuit address that corresponds to that depicted on the Riser Diagram. If individual floors need to be segmented to accommodate the 1/8” scale requirements, KEY PLANS and BREAK-LINES shall be provided on the plans in an orderly and professional manner. End-of-line resistors (and values) shall be depicted.
      e. Control panel wiring and interconnection schematics. The drawing(s) shall depict internal component placement and all internal and field termination points. Drawing shall provide a detail indicating where conduit penetrations shall be made, so as to avoid conflicts with internally mounted batteries. For each additional data-gathering panel, a separate control panel drawing shall be provided, which clearly indicated the designation, service, and location of the control enclosure.

f. Complete calculations shall clearly indicate the quantity of devices, the device part numbers, the supervisory current draw, the alarm current draw, totals for all categories, and the calculated battery requirements. Battery calculations shall also reflect all control panel component, remote annunciator, and auxiliary relay current draws.
g. System (Load & Battery) calculations shall be provided for each system power supply, each notification appliance circuit and each auxiliary control circuit that draws power from any system power supply.
h. Additionally, Drawings shall include:
1) Symbols legend.
2) Equipment list showing quantity, make, model and CSFM listing number for each device.
3) Wire and cable schedule.
4) Scope of Work with overall system description.
5) Sequence of operation matrix with system inputs signals and output functions.
6) Code summary and Building type.
7) Assignment of Class and/or Style designation for device circuits.
8) Elevation indicating mounting heights for manual pull stations, audible and visual devices, and combination audible/visual devices.
9) Rated penetration details.
10) Typical wiring diagram details of field devices.
11) Detector mounting details at HVAC ducts.
12) Voltage drop calculations for system wiring circuits.

5. Furnish structural calculations for equipment anchorage as described in Section 26 0010: Basic Electrical Requirements.
6. Submit Manufacturer's installation instructions.
7. Complete bill of materials listing all components.
8. Installer's NICET 3 Certification
9. Letter or Certificate from the fire alarm manufacturer stating that the fire alarm contractor is an authorized Strategic Partner of the specified product.
10. Warranty.

B. Contractor shall submit approved Shop Drawings for review by Local Fire Marshal prior to the purchase and installation of equipment. Provide quantities of Drawing sets as required by jurisdiction. Drawings shall be wet stamped and signed by a registered professional Engineer.

C. Record Drawings:
1. Furnish Record Drawings as described in Section 26 0010: Basic Electrical Requirements, utilizing Shop-Drawing submissions with updated field conditions. These Drawings shall include but not be limited to the following:
a. Plot plans and building floor plans, showing point-to-point wiring location of and conduit routing to all devices.
b. Block Diagram/Riser Diagram showing the FACP, system components and all conduit and wire type/sizes between each.
2. Drawings shall be incorporated into the Record Drawing submission.
3. Final acceptance will not be made until the Engineer has approved the Record Drawings.

1.7 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 26 0010: Basic Electrical Requirements, to include the following:

1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Pictorial parts list and part numbers.
4. Schematic Drawings of wiring system, including all initiation and annunciation devices, control panel, annunciators, printer/ terminal, etc.
5. Telephone numbers for the authorized parts and service distributors.
6. Final testing reports.

1.8 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

C. All work in this Section shall be performed (furnished, installed, connected, programmed, and tested) by a qualified fire alarm contractor. The fire alarm contractor shall provide the following documentation to show compliance with the contractor qualifications.
   1. Contractor's License: A copy of the contractor's valid State License. The contractor must be licensed in the State where project is located and have been in business in that State for a minimum of 5-years.
   2. Proof of Experience: Proof that the fire alarm contractor has successfully installed similar fire alarm systems on a previous project of comparable size and complexity. Provide a statement summarizing any pending litigation involving an officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates to this work in the worst-case scenario. Non-disclosure of this item, if later discovered, may result, at the Owner's discretion, in termination of this contract with the contractor bearing all associated costs.
   3. Insurance Certificates: Copy of fire alarm contractor's current liability insurance and state industrial insurance certificates in conformance with the contract document.
   4. Service Capability: The fire alarm contractor shall have in-house Engineering, installation, and service personnel with a maintenance office within 50-miles of the project location
   5. Authorization Letters: Letters from the fire alarm equipment manufacturer stating that the fire alarm contractor is a Factory Authorized Distributor, and is trained and certified for the equipment proposed on this project and is licensed to purchase and install the software required to provide the specified functions.
   6. Certifications:
      a. Provide a copy of the National Institute for Certification in Technologies (NICET) Technician Level 3 Certificate for the employee actively involved in this project.
      b. Documentation that the fire alarm contractor has on staff personnel factory-trained and certified for the equipment proposed for this project.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Fire alarm system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.10 WARRANTY

A. Units and components offered under this Section shall be covered by a ***1***-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

B. The warranty package shall include, but not be limited to the following:
1. Emergency maintenance service.
2. Service by factory trained service representative of system Manufacturer.
3. Replacement of any defective components.

1.11 SYSTEM START-UP

A. Upon completion of installation, a factory trained dealer service representative shall perform initial start-up of the fire alarm system. Sufficient time shall be allowed to properly check the system out and perform required minor adjustments before the Engineer's witnessed test shall begin.

1.12 MAINTENANCE

A. Extra Material:
1. Provide the following fire alarm system components as extra materials, matching the products installed and packaged for storing.
a. Manual pull station: Furnish a quantity equal to 10 percent of the number installed.
b. Detectors: Furnish a quantity equal to 10 percent, for each type of the number installed.
c. Strobes or Horn/strobes: Furnish a quantity equal to 10 percent of the number installed.
d. Horns: Furnish a quantity equal to 10 percent of the number installed.

B. Maintenance Service:
1. For a period of one year following acceptance the equipment Supplier shall have a person(s) familiar with this Project attend four quarterly meetings with the Owner's Representative to review system performance, operation, and any system problems. That person shall provide a written summary of the items discussed in each meeting and a schedule of when the system problems will be corrected. The report is due within 7 working days after each meeting.
2. During the eleventh month following system acceptance, on a weekend day, the equipment Supplier shall perform a complete test of the system, in a manner similar to the acceptance test. A written report shall be submitted to the Owner certifying that each initiating device has been tested. A copy of these test forms shall be submitted to the Engineer for review and acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. EST.
   2. Gamewell/FCI (Fire Control Instruments).
   3. Notifier.
   4. Siemens.

B. Substitutions: Under provisions of Section 26 0010: Basic Electrical Requirements.

2.2 CONTROL PANEL 'FACP'

A. General:
   1. The control panel shall comply with applicable requirements of UL864 and shall provide power, annunciation, supervision, and control for the complete fire alarm system. The panel shall be installed in a surface mounted steel cabinet, containing all modules necessary to operate as indicated herein. The operating controls shall be located behind hinged, locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified.
   2. The panel shall be supervised, site programmable, and of modular design supporting up to 64 network nodes. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, and annunciation nodes. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between nodes. When utilizing a network and multiple wiring faults occur, the network shall re-configure into many sub-networks and continue to respond to alarm events from every panel that can transmit and receive network messages.
   3. The panel module shall control and monitor all local or remote peripherals. It shall support a large 168-character LCD, power supply, remote LCD and zone display annunciators, printers, and support communication standard interface protocol (CSI) devices such as color computer annunciators and color graphic displays, etc.
   4. Each controller shall contain a RS232 programming port for programming locally via an IBM PC. When operational, each controller shall support a printer through the RS232 port and be capable of message routing.
   5. The programmer shall be able to download all network applications from the configuration computer to all the network panels from a single location on the system.
   6. The panels shall have the ability to add an operator interface control/display at each node that shall annunciate, command and control system functions.
   7. The system shall store all basic system functionality and job specific data in non-volatile memory. All site specific and operating data shall survive a complete power failure intact.
   8. The control panel shall contain a standby power supply that automatically supplies electrical energy to the system upon primary power supply failure. The system shall include a charging circuit to automatically maintain the electrical charge of the battery.
   9. All addressable devices shall be individually identified by the system and any quantity of addressable devices may be in alarm at any time up to the total number connected to the system.

10. Dynamic supervision of system electronics, wiring, initiating devices and software shall be provided by the control system. Failure of system hardware or wiring shall be indicated by type and location on the alphanumeric annunciator. Software and processor operation shall be monitored by an independent hardware watchdog, which will indicate their failure. The panel shall provide failsafe operation, i.e. all incoming alarms shall override all other modes of operation.
11. Provide a service mode to permit the arming and disarming of individual initiating or output devices as well as manually operating output devices. Status of these devices shall be displayed upon command from the control panel. The panel shall automatically return to the normal mode in the event the panel remains unattended in the service mode.
12. The panel shall be capable of measuring and adjusting the sensitivity of addressable detectors upon request. An alphanumeric display shall be provided to display custom messages and give readings of detector sensitivity detector by detector. Each device on an addressable initiating circuit shall be checked continuously to include the following:
    a. Sensitivity.
    b. Response.
    c. Opens.
    d. Shorts.
    e. Ground faults.
    f. Functionality.
    g. Status.
13. The panel shall monitor the addressable smoke detectors in such a manner that if the detectors become dirty and reach and maintain 80% of alarm threshold for 5-consecutive hours, a trouble condition indicating exactly which device needs service shall be automatically annunciated. If the device becomes too insensitive for a period of 10-seconds, the trouble indication will read: "Input device response too low".
14. The panel shall report, by specific device number, any device removed from an addressable initiating circuit and all other devices shall continue to function.
15. The panel shall automatically indicate the total quantity of alarms and troubles, which have occurred prior to reset at the control unit.
16. No alarm or trouble indication shall be resettable until it has been acknowledged. It shall not be possible to reset the system until all alarms have been acknowledged.
17. The panel shall be capable of:
    a. Counting the number of addressable devices within a designated area or "zone" which are in alarm.
    b. Counting "zones" which are in alarm.
    c. Counting the number of addressable devices, which are in alarm on the system.
    d. Differentiating among types of addressable devices such as smoke detectors, manual stations, waterflow switches, heat detectors, etc.
    e. Assigning priorities to types of devices, zones, or groups of devices.
    f. Cross-Zoning.
18. Each addressable device shall report its condition to the panel control unit every 3-seconds in a manner such that failure of the connections to or internal electronics of the device will result in a trouble signal that identifies the specific device involved.

B. Signaling line circuits (SLC):
   1. The control panel shall be supervised, site programmable, and of modular design supporting up to 125-detectors and 125-remote modules per addressable SLC. The panel shall support up to 10-SLC's per panel for a total system capacity of 2500-intelligent addressable points. The system shall be designed with peer-to-peer networking capability for enhanced survivability, with support for up to 64 nodes, each with up to 2500-points and an overall capacity of 160,000-points.
   2. The system shall provide electronic addressing of analog/addressable devices.
   3. The system shall have built-in automatic system programming to automatically address and map all system devices attached to the main controller.
   4. The system shall use full digital communications to supervise all addressable loop devices for placement, correct location, and operation. It shall allow swapping of “same type” devices without the need of addressing and impose the “location” parameters on replacement device. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system.
   5. The system shall have a UL Listed detector sensitivity test feature, which will be a function of the smoke detectors and performed automatically every 4-hours.

C. Integrated digital audio:
   1. The system shall be capable of delivering 8-multi-channel audio messages simultaneously over copper and/or fiber media.
   2. The system shall provide a minimum of 100-minutes of custom digital voice & audio message created as a .wav file format. All messages shall be able to be created on-site without any special tools or burning of chips.
   3. All audio messages and live pages shall originate at the one-way audio control unit.
   4. The one-way audio control unit shall store pre-recorded audio messages digitally. These messages shall be automatically directed to various areas in a facility under program control.
   5. The system shall support remote cabinets with zoned amplifiers to receive, amplify and send messages through speakers over supervised circuits.
   6. The one-way emergency audio control shall provide control switches to direct paging messages as follows:
      a. "All Call" to direct the page message to all areas in the facility, overriding all other messages and tones.
      b. "Page to Evacuation Area" to direct the message to the evacuation area(s), overriding all other messages and tones.
      c. "Page to Alert Area" to direct page messages to the area(s) receiving the alert message and tones, overriding all other messages and tones.
      d. "Page to Balance Building" to direct page messages to the areas) in the facility NOT receiving either the evacuation area or alert area messages.
      e. "Page by Phone" switch to select the firefighters telephone system as the source for paging.
   7. Audio Amplifiers (Multi-Channel)
      a. Provide as minimum one 20watt audio amplifier per paging zone.
      b. The system software shall be capable of selecting the required audio source signal for amplification.
      c. To enhance system survivability, each audio amplifier shall automatically provide a local 3-3-3 1000Hz temporal pattern output upon loss of the audio communications with the one-way audio control unit, during an alarm condition.
      d. Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring.
      e. Each amplifier shall include a dedicated, selectable 25 or 70Vrms output.

f. Each amplifier shall also include a notification appliance circuit rated at 24volt DC at 3.5amps for connection of visible (strobe) appliances. This circuit shall be fully programmable, and it shall be possible to define the circuit for the support of audible, visible, or ancillary devices.
g. Provide a standby audio amplifier that will automatically sense the failure of a primary amplifier and replace the function of the failed amplifier.

D. Digital alarm communicator transmitter (DACT):
1. The system shall provide DACT for off premise communications capability, transmitting system events to single or multiple Central Monitoring Station (CMS) receivers.
2. The system shall be capable of providing the CMS with point identification of system events using Contact ID or SIA DCS protocols.
3. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

E. Internal Modular Power Supply:
1. System power supply(s) shall provide multiple power limited 24volt DC output circuits as required by the panel.
2. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions.
3. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.
4. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciate as battery trouble and identify the specific power supply affected.
5. All system power supplies shall be capable of recharging up to 260AH batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.
6. Power supply shall be adequate to supply all system components of the fire alarm system, including FACP modules, initiating devices, notification appliances, remote control and monitoring devices, annunciators, etc. All power connections whether AC or DC shall be separately fused within panel.

F. Storage batteries: Shall be provided and shall be the sealed, lead-calcium types. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 24-hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all components of the system, including all alarm annunciating devices in the total alarm mode for a period of 5-minutes. Batteries shall be sized to deliver 50 percent more ampere/hours than required for the calculated capacities. Battery cabinet shall be a separate compartment within the control panel.

G. Battery charger: Shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 8-hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. Pilot light shall indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided. Charger shall be located in the control panel.

H. Reports:
1. The system shall provide the operator with system reports that give detailed description of the status of system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD and shall be capable of being printed on any system printer.

2. The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any detector.
3. The system shall provide a report that gives a listing of the sensitivity of all the detectors on any given panel in the system, or any given analog/addressable device loop within any given panel.
4. The system shall provide a report to determine the carbon monoxide detectors end-of-life.
5. The system shall provide a report that gives a chronological listing of up to the last 1740 system events.
6. The system shall provide a listing of all the firmware revision listings for all of the installed network components in the system.

I. System Printer
1. The event and status printer shall be a 9-pin, impact, dot matrix printer with a minimum print speed of 232 characters per second.
2. The printer shall be capable of serial or parallel communications protocol.
3. The communications speed for RS-232 communications protocol shall be adjustable from 300 to 9600 Baud.
4. The printer shall list the time, date, type, and user defined message for each event printed.

2.3 ANNUNCIATORS

A. Main control and annunciator panel:
1. Main annunciator shall be located with the FACP.
2. The main display shall be a large 168-character LCD with normal, alarm, trouble, supervisory, disabled point, and ground fault indicators.
3. The main display shall show the first and most recent highest priority system events without any operator intervention. All system events shall be directed to one of four message queues. Messages of different types shall never inter-mixed to eliminate operator confusion. A "Details" switch shall provide additional information about any device highlighted by the operator.
4. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85-dBA at 10-feet.
5. The internal audible signal shall have different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions.
6. The annunciator shall contain the following controls:
   a. System reset switch with indicator
   b. System alarm silence switch with indicator
   c. System panel silence switch with indicator
   d. Programmable switch with indicator
   e. Details switch
   f. System message queue scroll switches.
   g. 10-Digit keypad to enable/disable system and functions.
7. An authorized operator shall have the ability to operate or modify system functions like system time, date, passwords, holiday dates, restart the system and clear control panel event history file.
8. An authorized operator shall be capable of performing test functions within the installed system.

B. Fireman's remote annunciator panel (FRAP):
   1. Remote LCD network alphanumeric annunciators shall display each point in the system.
   2. Network alphanumeric annunciators shall be located as indicated on the plans. This annunciator shall be an integral part of the peer to peer network for survivability.
   3. Annunciator shall contain a supervised, back-lit, liquid crystal display with a minimum of 8-lines and 21-characters per line. The annunciator shall support full ability to serve as the operating interface to the system and shall include the following features:
      a. Matched appearance with other system displays
      b. LCD display shall be configurable to show the status of any or all the following functions anywhere in the system:
         1) Alarm
         2) Supervisory
         3) Trouble
         4) Monitor
   4. Annunciator must be capable of supporting custom messages as well as system event annunciation. It must be possible to filter unwanted annunciation of trouble, alarm, or supervisory functions on a by point or by geographic area. The annunciators shall be mounted in stand-alone enclosures at location as indicated on the plans.

C. Emergency responder radio coverage system (ERRCS) annunciator panel:
   1. The panel shall contain LED lamps for annunciation of the following ERRCS conditions:
      a. Normal AC power available
      b. Signal booster trouble
      c. Loss of normal AC power
      d. Failure of battery charger
      e. Low battery capacity
   2. Black silk-screened lettering describing the above function of each LED lamp
   3. Panel shall operate on nominal 24volt DC power and be battery backed up
   4. The annunciator shall be UL and CSFM Listed
   5. The unit shall be surface mounted
   6. The door shall be tamper-resistant and equipped with a key lock
   7. Lamp test pushbutton

2.4 INTELLIGENT ADDRESSABLE DETECTORS

A. General:
   1. Each detector device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Devices shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.
   2. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location. Setting a device's address by physical means shall not be necessary.

3. The intelligent detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns, and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.
4. Each detector shall be capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller. Maximum total analog loop response time for detectors changing state shall be 0.75-seconds. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data.
5. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging, and humidity.
6. Each detector shall have a separate means of displaying communication and alarm status. A green/red LED shall flash to confirm communication with the analog loop controller and display alarm status.
7. The detector shall be capable of identifying up to 32-diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.
8. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of 5-sensitivity settings.
9. Each device microprocessor shall contain an environmental compensation algorithm, which identifies and sets ambient “Environmental Thresholds” approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24-hour long-term and 4-hour short-term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the “learned” base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour.

B. Ionization smoke detector:
   1. The intelligent ionization detector shall be rated for ceiling installation at a minimum of 30-foot centers and be suitable for wall mount applications.
   2. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 0.61% to 1.91%. The ionization detector shall be suitable for operation in the following environment:
      a. Temperature: 32-degree F to 120-degree F (0-degree C to 49-degree C)
      b. Humidity: 0-93% RH, non-condensing
      c. Installation attitude: 6000-feet
      d. Air velocity: 0 to 75-feet/minimum

C. Photoelectric smoke detector:
   1. Provide intelligent analog photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings.
   2. Each unit shall have a field-replaceable smoke chamber.

3. The photo detector shall be rated for ceiling installation at a minimum of 30-foot centers and be suitable for wall mount applications.
4. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3-feet high and 3-feet wide with air velocities up to 5,000-feet/minimum.
5. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photoelectric detector shall be suitable for operation in the following environment:
   a. Temperature: 32-degree F to 120-degree F (0-degree C to 49-degree C)
   b. Humidity: 0-93% RH, non-condensing
   c. Installation attitude: no limit

D. Fixed temperature/rate-of-rise heat detector:
1. Provide intelligent combination fixed temperature/rate-of-rise heat detectors with low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm.
2. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data.
3. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135-degree F (57-degree C) and a rate-of-rise alarm point of 15-degree F (9-degree C) per minute.
4. The heat detector shall be rated for ceiling installation at a minimum of 50-foot centers and be suitable for wall mount applications.

E. Multi-sensor photoelectric/heat detector:
1. Provide intelligent combination photoelectric smoke and heat detectors with analog photoelectric detector that utilizes a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air to process an alarm.
2. Each unit shall have a field-replaceable smoke chamber
3. Each unit shall provide split sensor programming such that the combination device shall only require one software address, while still providing two distinct inputs. This capability will allow for separate actions to be initiated independently from the two separate elements (smoke & heat) without requiring a separate software address on the loop.
4. The multi-sensor shall be rated for ceiling installation at a minimum of 30-foot centers and be suitable for wall mount applications.
5. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135-degree F (57-degree C) and a rate-of-rise alarm point of 15-degree F (9-degree C) per minute.
6. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photoelectric detector shall be suitable for operation in the following environment:
   a. Temperature: 32-degree F to 120-degree F (0-degree C to 49-degree C)
   b. Humidity: 0-93% RH, non-condensing
   c. Installation Attitude: no limit

F. Photoelectric smoke/carbon monoxide detector:
1. Provide intelligent photoelectric smoke and carbon monoxide detectors with analog photoelectric detector that utilizes a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral electrochemical carbon monoxide cell shall be provided.
2. Each unit shall have a field-replaceable smoke chamber

3. Each unit shall be provided with a field-replaceable carbon monoxide sensor module.
4. The carbon monoxide sensor module shall have a end of life at 6-years. End of life status shall be continuously monitored and reported by the control panel.
5. Each unit shall provide split sensor programming such that the combination device shall only require one software address while still providing two distinct inputs. This capability will allow for separate actions to be initiated independently from the two separate elements (smoke & CO) without requiring a separate software address on the loop.
6. The photoelectric detector shall be rated for ceiling installation at a minimum of 30-foot centers and be suitable for wall mount applications.
7. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photoelectric detector shall be suitable for operation in the following environment:
   a. Temperature: 32-degree F to 120-degree F (0-degree C to 49-degree C)
   b. Humidity: 0-93% RH, non-condensing
   c. Installation Attitude: no limit

G. Standard detector bases:
1. Provide standard detector mounting bases suitable for mounting on a standard 4” octagon or square box. The base shall contain no electronics and support all intelligent detector types.
2. Removal of the respective detector shall not affect communications with other detectors.
3. Terminal connections shall be made on the room side of the base.

H. Relay detector bases:
1. Provide standard detector mounting bases suitable for mounting on a standard 4” octagon or square box. The base shall support all intelligent detector types.
2. Removal of the respective detector shall not affect communications with other detectors.
3. Terminal connections shall be made on the room side of the base. Bases, which must be removed to gain access to the terminals, shall not be acceptable.
4. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
5. The position of the contact shall be supervised.
6. The relay shall automatically de-energize when a detector is removed.
7. The operation of the relay base shall be controlled by its respective detector processor. Detectors operating standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.
8. Form "C" relay contacts shall have a minimum rating of 1amp at 30volt DC and be listed for pilot duty.

I. Duct detector:
1. Provide intelligent addressable analog photoelectric duct smoke detectors that utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging, and humidity.
2. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 0.79% to 2.46%. The duct detector shall be suitable for operation in the following environment:

a. Temperature: -20-degree F to 158-degree F (-29-degree C to 70-degree C)
b. Humidity: 0% to 93% RH, non-condensing
c. Air velocity: 100 to 4000-feet/minimum

3. Provide an air exhaust tube and an air sampling inlet tube, which extends into the duct air stream up to ten feet. The sampling tube can be installed with or without the cover in place and can be rotated in 45-degree increments to ensure proper alignment with the duct airflow.
4. Status LEDs shall remain visible through a clear assembly cover.
5. The unit shall contain a magnet-activated test switch.
6. One integral Form C auxiliary alarm relay shall be provided. The relay contact shall be capable of being individually programmed from the control panel. The contact shall be rated for 2.0amp at 30volt DC.

2.5 INTELLIGENT ADDRESSABLE MODULES

A. General:
1. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Devices shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.
2. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location.
3. The module shall be suitable for operation in the following environment:
a. Temperature: 32°F to 120°F (0°C to 49°C)
b. Humidity: 0-93% RH, non-condensing

B. Single input module:
1. Provide intelligent signal input modules for monitoring of PIV's, tamper switches, flow switches, fan & damper status, generator status, or any other sets of dry contacts required to be monitored.
2. The single input module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4" square box with 1-gang ring.
4. The single input module shall support the following circuit types:
a. Normally Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
b. Normally Open Alarm Delayed Latching (Waterflow Switches)
c. Normally Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
d. Normally Open Active Latching (Supervisory, Tamper Switches)

C. Dual input module:
1. Provide intelligent dual input modules for monitoring of sets of PIV's, tamper switches, flow switches, fan & damper status, generator status, or any other sets of dry contacts required to be monitored.
2. The dual input module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4" square box with 1-gang ring.

4. The dual input module shall support the following circuit types:
   a. Normally open alarm latching
   b. Normally open alarm delayed latching
   c. Normally open active non-latching
   d. Normally open active latching

D. Signal module:
1. Provide intelligent single input signal modules for activation of booster power supplies, audible/visual circuits.
2. The single input signal module shall provide 1-supervised Class B output circuit capable of a minimum of 2-personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4” square box with 2-gang ring.
4. The single input signal module shall support audible/visible signal power selector (polarized 24volt DC at 2amps, 25Vrms at 50watt or 70Vrms at 35watt of audio)

E. Synchronized signal module:
1. Provide intelligent single input signal modules for activation of booster power supplies and/or audible/visual circuits that require synchronization.
2. The single input signal module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4” square box with 2-gang ring.
4. The single input signal module shall support audible/visible signal power selector (polarized 24volt DC at 2amp, 25Vrms at 50watt or 70Vrms at 35watt of audio)
5. Provides UL1971 auto-sync output for synchronizing multiple notification appliance circuits

F. Control relay module:
1. Provide intelligent control relay modules for activation and/or shutdown of fans, dampers, door holder circuits, door locks, shunt trip, elevator recall or any other fail-safe system requiring control or activation.
2. The control relay module shall provide one Form R dry relay contact rated at 2amps at 24volt DC to control external appliances or equipment shutdown.
3. The control relay shall be rated for pilot duty and releasing systems.
4. The control relay module shall be suitable for mounting on a standard 4” square box with 1-gang ring.

G. Manual pull station:
1. Provide intelligent single action, single stage fire alarm pull stations. The fire alarm pull station shall be of metal construction with an internal toggle switch. Provide a locked test feature. Finish the station in red with silver “PULL IN CASE OF FIRE” lettering.
2. The manual station shall be suitable for mounting on a standard 4” square box with 1-gang ring.
3. Provide compatible surface mount red box at all surface mount locations.

2.6 NOTIFICATION APPLIANCES

A. Horns:
1. Horns shall be a low-profile design, finished in red with white lettering and shall not protrude more than 1” off the finished wall surface. In-out screw terminals shall be provided for wiring.

2. Horns shall be provided with a switch selectable audible output of at least two decibel levels. Maximum 84-dBA output at 10-feet when measured in reverberation room per UL 464.
3. Horns shall have two selectable tone options of temporal or non-temporal continuous pattern.
4. Horns shall be suitable for wall mounting and shall mount in a standard 4" square x 2 1/8" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
5. Horns shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 2-1/8" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
6. Where surface mounted horns are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

B. Speakers:
1. Speakers shall be a low-profile design, finished in red with white lettering and shall not protrude more than 1" off the finished wall surface. In-out screw terminals shall be provided for wiring.
2. Speakers shall be provided with a switch selectable audible output of 2watt (90-dBA), 1watt (87-dBA), 1/2watt (84-dBA), and 1/4watt (81-dBA) at 10-feet when measured in reverberation room per UL 464.
3. Wattage setting shall be visible with the cover installed.
4. The moisture-repellent, fire-retardant speakers shall be selectable for 25volt circuits or 70volt circuits.
5. Speakers shall be suitable for wall mounting and shall mount in a standard 4" square x 2-1/8" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
6. Speakers shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 2-1/8" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
7. Where surface mounted speakers are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

C. Strobe lights:
1. Strobes shall be a low-profile design, finished in red with white lettering and shall not protrude more than 1" off the finished wall surface. In-out screw terminals shall be provided for wiring.
2. Strobes shall provide synchronized flash outputs at maximum pulse duration of 0.2-seconds. The light output shall be an even pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
3. The strobe shall have selectable 15, 30, 75 or 110 cd settings for wall or standard ceiling height mounting.
4. The strobe shall have selectable 95, 115, 150 or 177 cd settings for high ceilings.
5. It shall be possible to change the strobe setting without removing the device from the wall or ceiling.
6. Strobes shall be suitable for wall mounting and shall mount in a standard 4" square x 1-½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.

7. Strobes shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 1-½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
8. Where surface mounted strobe lights are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

D. Combination horn/strobe lights:
1. Horns shall be a low-profile design, finished in red with white lettering and shall not protrude more than 1" off the finished wall surface. In-out screw terminals shall be provided for wiring.
2. Horns shall be provided with a switch selectable audible output of at least two decibel levels.
3. Horns shall have two selectable tone options of temporal or non-temporal continuous pattern.
4. Strobes shall provide synchronized flash outputs at maximum pulse duration of 0.2-seconds. The light output shall be an even pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
5. It shall be possible to flash the strobe at a temporal flash rate to match the horn.
6. The strobe shall have selectable 15, 30, 75 or 110 cd settings for wall or standard ceiling height mounting.
7. The strobe shall have selectable 95, 115, 150 or 177 cd settings for high ceilings.
8. It shall be possible to change the strobe setting without removing the device from the wall or ceiling.
9. Horn/strobes shall be suitable for wall mounting and shall mount in a standard 4" square x 1-½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
10. Horn/strobes shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 1-½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
11. Where surface mounted horn/strobe lights are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

E. Combination speaker/strobe lights:
1. Speaker/strobes shall be a low-profile design, finished in red with white lettering and shall not protrude more than 1" off the finished wall surface. In-out screw terminals shall be provided for wiring.
2. Speakers shall be provided with a switch selectable audible output of 2watt (90-dBA), 1watt (87-dBA), 1/2watt (84-dBA), and 1/4watt (81-dBA) at 10-feet. when measured in reverberation room per UL 464.
3. Wattage setting shall be visible with the cover installed.
4. The moisture-repellent, fire-retardant speakers shall be selectable for 25volt circuits or 70volt circuits.
5. Strobes shall provide synchronized flash outputs. The light output shall be an even "Full Light" pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
6. It shall be possible to flash the strobe at a temporal flash rate to match the speaker.
7. The strobe shall have selectable 15, 30, 75 or 110 cd settings for wall or standard ceiling height mounting.
8. The strobe shall have selectable 95, 115, 150 or 177 cd settings for high ceilings.

9. It shall be possible to change the strobe setting without removing the device from the wall or ceiling.
10. Speaker/strobes shall be suitable for wall mounting and shall mount in a standard 4" square x 1-½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
11. Speaker/strobes shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 1-½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
12. Where surface mounted speaker/strobe lights are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

F. Weatherproof horns and strobes and/or combination appliances:
1. Appliances shall be a semi-flush design, finished in red with white lettering. In-out screw terminals shall be provided for wiring.
2. Horns shall be provided with a switch selectable audible output of at least three decibel levels of 99, 95, and 90-dBA.
3. Horns shall have two selectable tone options of temporal or non-temporal continuous pattern.
4. Speakers shall be weatherproof re-entrant type with field selectable taps for 1/8watt to 8watt operation for either 25volt or 70volt. Speakers shall incorporate a sealed back construction for extra protection and improved audibility.
5. Speakers shall provide a 94-dBA sound output over a frequency range of 400 to 4000Hz when measured in reverberation room per UL 1480.
6. Strobes shall provide synchronized flash outputs at maximum pulse duration of 0.2 seconds. The light output shall be an even pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
7. The strobe shall have a 75 cd setting for wall or standard ceiling height mounting.
8. Strobe shall operate over an extended temperature range of -31-degree F to 150-degree F. All inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring.
9. Appliance backbox shall be weatherproof and vandal resistant.

G. Vibrating bell:
1. Provide 10" surface weatherproof vibrating bell.
2. The bell shall be 24volt DC.
3. Bell shall have heavy-duty cast housing with Red finish.
4. Weatherproof boxes shall be provided for outdoor mounting.

H. Remote booster power supplies:
1. Unit shall be a self-contained with 24volt DC power supply and batteries housed in its own locked enclosure. Keys provided shall be identical to the keys provided for all other fire alarm equipment provided.
2. Power supply shall be available in both 10amp or 6.5amp models and 120volt AC.
3. On board LED indicators for each NAC, battery supervision, ground fault and AC power.
4. The power supply shall provide four (4) independent 3amp NACs. Each circuit can be configurable as an auxiliary output.
5. Configurable for any one of three signaling rates: 120SPM; 3-3-3 temporal; or, continuous.
6. Two independent and configurable inputs switch selectable to allow correlation of the two (2) inputs and the four (4) outputs.

7. NACs shall be configurable for either four Class B or two Class A circuits.
8. The unit shall be compatible with SIGA-CC1S for synchronization of multiple power supplies without inter-connect wiring.
9. Brackets shall be provided inside the enclosure to allow mounting the signaling modules. All signaling modules shall be listed to be located inside the booster power supply enclosure.
10. A selectable dip switch shall enable built in synchronization for horns and strobes which may be used to synchronize downstream devices, as well as other boosters and their connected devices.

2.7 AUXILIARY EQUIPMENT CONTROL AND SUPERVISION

A. Fire sprinkler system components: Include single or dual input modules at waterflow and/or tamper switch on each floor of building, fire pump room, etc., for monitoring status:
1. Each waterflow switch will initiate an alarm signal.
2. Each tamper switch will initiate a trouble signal.
3. Each post indicating valve (PIV) will initiate a trouble signal.

B. Emergency generator status: Include single or dual input modules at generator for monitoring the following conditions:
1. Generator running to initiate a trouble signal.
2. Generate malfunction to initiate a trouble signal.
3. Generator output circuit breaker(s) open.

C. Emergency responder radio coverage system (ERRCS) interface: Include the following for interface with the ERRCS:
1. Provide single and dual monitoring modules at the ERRCS head end amplifiers for monitoring the following conditions:
   a. Normal AC power available
   b. Signal booster trouble
   c. Loss of normal AC power
   d. Failure of battery charger
   e. Low battery capacity
2. Include a “Emergency Responder Radio Coverage System” annunciator panel in the FCC as described herein.

D. Supply fan/air handler shutdown: All supply air fan, 2000cfm and greater, shall be furnished with a duct-mounted smoke detector and addressable control relay for shutdown purposes. Upon smoke detection, the fan shall be automatically controlled to the “OFF” position.

E. Fire/smoke dampers (FSDs):
1. FSDs for return air systems: Include spot smoke detector(s) over the openings of all return air FSDs for “OPEN/CLOSE” control upon detection of smoke. Provide one detector if open is 36” wide or less, two if opening is 72” wide or less and three if opening is 108” wide or less.
2. FSDs for supply air systems: Include in-duct smoke detector(s) within ducts adjacent to supply air FSDs for “OPEN/CLOSE” control upon detection of smoke. Provide one detector if open is 36” wide or less, two if opening is 72” wide or less and three if opening is 108” wide or less.
3. FSDs for supply air systems: If the supply air FSDs are controlled with the supply fans, so they close when the fans are not operating, then smoke detection is not required at these FSDs.

4. Passive (non-smoke control related) FSDs: Provide an addressable control relay at each non-smoke control FSD for automatic closure of dampers when system is in alarm. Additionally, provide an addressable dual input monitoring module at each FSD to pick up end switch status monitoring for the “OPEN” and “CLOSED” positions.

F. Door hold-open/closure devices: Provide an addressable control relay for doors with magnetic hold-open/closure devices as well as a 24volt DC power circuit from fire alarm system to release doors when system is in alarm.

G. Roll-down fire doors and shutters: Provide an addressable control relay for fire roll-down doors or shutters for interconnection with fire-fly release devices on doors for closure when system is in alarm.

2.8 FIRE COMMAND CENTER

A. The fire command center room shall be the operations center for firefighter's and shall consist of the following:
1. Fire alarm control panel
2. Main annunciator panel
3. Emergency responder radio coverage system annunciator panel
4. Telephone for fire departments use with access to public telephone system
5. Manual pull station
6. Printer terminal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of fire alarm system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 INSTALLATION

A. General:
1. Install fire alarm system in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
2. The 120volt, 2-wire, 60-cycles AC two-20amp circuits supply required to power the system shall be connected as indicated on the Drawings. Connect to red colored circuit breaker(s) in panelboard. Identify circuit as "Fire Alarm Circuit Control."

B. Conductors:
1. Refer to Section 26 0519: Building Wire and Cable.
2. All circuits shall be rated power limited in accordance with CEC Article 760.
3. All system conductors shall be of the type(s) specified herein.
a. All initiating circuit, signaling line circuit, AC power conductors, shield drain conductors and grounding conductors, shall be solid copper, stranded or bunch tinned (bonded) stranded copper.
b. All wiring shall be color-coded throughout.
c. Signaling line circuits: Shall be #18 AWG minimum multi-conductor jacketed twisted cable or as per manufacturer's requirements.
d. Initiating device circuits: 24volt DC circuits shall be #18 AWG minimum or per manufacturer's requirements.

e. Notification appliance circuits:
   1) Speaker: Twisted pair, not less than #16 AWG or as recommended by the manufacturer.
   2) Horn-strobe or strobe: Non-twisted pair, not less than #14 AWG or as recommended by the manufacturer.

f. 120Vac circuits:
   1) Minimum #10 AWG for panel power circuits.
   2) Minimum #12 AWG for all other circuits.
   3) Each circuit shall have its own dedicated neutral conductor.

g. Fiber optic cable:
   1) Only glass filament cable permitted. Plastic filament fiber optic cables are not acceptable.
   2) Multimode shall be 62.5/125-micron fiber optic cables with ST connectors used at all equipment terminations
   3) Single Mode shall be 8.3-micron fiber micron fiber optic cables with Duplex SC connectors used at all equipment terminations

C. Conduit raceway:
1. All system components listed to UL864 Control Units for Fire Protective Signaling Systems shall be installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
2. All system conduits shall be EMT, 1/2-inch minimum, except for flexible metallic conduit used for whips to devices only, maximum length 6 feet, 1/2-inch diameter, minimum.
3. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.
4. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or by fire damage, and so as not to interfere with other building systems, facilities or equipment, and to facilitate service and minimize maintenance.
5. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures, and device back boxes shall be readily accessible for inspection, testing, service and maintenance.
6. All penetration of floor slabs and firewalls shall be sleeved (1” conduit minimum) fire stopped in accordance with all local fire codes.
7. All junction box covers shall be painted red.

D. Equipment:
1. All devices and appliances shall be mounted to flush mounted boxes where areas are finished. Exceptions being above suspended ceiling, exposed ceiling areas, or equipment rooms to facilitate connections to other equipment.
2. All pull stations shall be mounted 48-inches above the finished floor, as measured on handle.
3. All audio/visual devices shall be mounted at a minimum of 80-inches and no more than 96-inches above the finished floor, as measured on strobe center. Devices shall be mounted no less than 6-inches from the ceiling.
4. No area smoke detectors shall be mounted within 36-inches of any HVAC supply, return air register or luminaire.
5. No area smoke or heat detector shall be mounted within 12-inches of any wall.
6. All fire alarm devices shall be accessible for periodic maintenance.

7. End-of-line resistors shall be furnished as required for mounting as directed by the manufacturer. Devices containing end-of-line resistors shall be appropriately labeled. Devices should be labeled so removal of the device is not required to identify the EOL device.
8. All addressable modules shall be mounted within 36-inches of the monitored or controlled point of termination. This shall include, but is not necessarily limited to, fan shutdown, elevator recall, shunt trip, sprinkler status points, or door release. Label all addressable modules as to their function.
9. Power-limited/non-power-limited CEC wiring standards shall be observed.
10. Relays shall be appropriately labeled on the exterior to indicate “FIRE ALARM SYSTEM” and their specific function (i.e. FAN SHUTDOWN).

3.3 FIELD QUALITY CONTROL

A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting, and adjustment of the fire alarm system.

B. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
1. Assure fire alarm system installation conforms to specified requirements and operates within specified tolerances.
2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
3. Prepare final test report including results, observations, failures, adjustments, and remedies.
4. Apply label on fire alarm system control panel upon satisfactory completion of tests and results.
5. Verify settings and make final adjustments.

C. Engineer witnessed testing: Allow a period of 4 hours for Engineer review and final check.

D. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

E. Prefunctional testing:
1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
2. Visual and mechanical inspection:
   a. Inspect for physical damage, defects alignment and fit.
   b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
   c. Compare nameplate information and connections to Contract Documents.
   d. Check tightness of all control and power connections.
   e. Check that all covers, barriers, and doors are secure.
3. Electrical tests:
   a. The system shall be completely tested prior to final acceptance testing. All points shall be tested from point of initiation to the final point or points of annunciation. All circuits shall be tested for continuity and ability to transmit the required signal correctly to the FACP. Any problem due to wrong wire type, wire twist, impedance, mismatches, noise filtering or shielding shall be completely corrected during pretesting and prior to any final acceptance tests.

b. Testing shall include each device in the system. Coordinate with other trades as necessary for testing.
   1) Sprinkler flow switches: Record time delay from water flow to alarm and adjust as necessary for a 30 to 50-second delay.
   2) Tamper switches: Verify "trouble "signal is received and alarmed on closing of each valve.
   3) Smoke detectors, in-duct smoke detectors and duct mounted smoke detectors: Test with actual or approved artificial smoke. Verify that reset does not occur when devices are cleared of smoke. Verify supervisory circuit function. Perform pressure differential test on all duct mounted smoke detectors.
   4) Door release: Verify that proper alarm activates every held-open door, roll-down doors, and shutters, that doors close completely to the closed position.
   5) Elevator recall: Verify that elevators recall to designated floor by testing elevator lobby detectors with smoke. This is necessary on the ground floor and one other only.
   6) Audible/visual notification: Activate by means of an alarm-initiating device that audible and visual devices are clearly audible and/or visual throughout.
   7) Central station notification: Verify that one set of conductors in the terminal cabinet becomes a short circuit on any "trouble" condition and that the other set becomes a short circuit on any "alarm" condition. Verify that the conductor groups are labeled properly.
   8) Tone and prerecorded message generation: Activate by means of an alarm initiating device on each floor and verify that they are clearly audible in all occupied spaces including elevator lobbies, toilets, core areas, stairwells, mechanical rooms and garage. Adjust power taps at speakers to obtain proper +15-dBA level above ambient noise. Verify the override capability of the microphone paging system.
   9) Verify correct fan and damper control and status annunciation for each life safety fan and damper.
   10) Printer and remote annunciators: Verify that all alarm and trouble conditions print on the printer and annunciate at the remote annunciation panels.
   11) Emergency generator power: Verify these annunciate their respective "Trouble" and "Running" conditions.

c. Test report:
   1) Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.
   2) Submit two typed copies of the test report in a neatly bound folder for review and approval. Failure to comply with this will result in a delay of final testing and acceptance.

F. Functional performance testing:
   1. Refer to Specification Section 26 0800: Electrical Commissioning for requirements of system wide functional performance testing.
   2. After the approval of the test report, provide a schedule of final testing to be done in the presence of the Fire Marshal and Owner's Representative. The schedule must be received by the Engineer a minimum of 2 weeks prior to the Final Test Date and must list the dates and time slots in which the various systems can be tested.

3. Coordination of the Final Test dates with all parties (General Contractor, Mechanical Contractor, Elevator Contractor, Engineer, Owner, and others) shall be the sole responsibility of the Contractor. If a party is required to be present during any phase of testing to activate a device, ensure that the party or a qualified representative of the party is present throughout that phase of the testing.

G. In the event that the system fails to function properly during the testing, as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.

H. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

I. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.4 TRAINING

A. Factory authorized service representative shall conduct a 8-hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance, and testing of equipment with both classroom training and hands-on instruction.

B. Contractor shall schedule training with a minimum of 7-days advance notice.

END OF SECTION

SECTION 27 0500

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not necessarily limited to:
1. Common standards and procedures for the Communications Work.
2. Design, engineer and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of the Communications Systems. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction.

B. Provisions of this Section apply to Communications Work, including the following Sections:
1. Section 27 05 26 – Grounding and Bonding for Communications Systems
2. Section 27 05 29 – Hangers and Supports for Communications Systems
3. Section 27 05 33 – Conduits and Backboxes for Communications Systems
4. Section 27 05 36 – Cable Trays for Communications Systems
5. Section 27 05 48 – Noise and Vibration Controls for Communications Systems
6. Section 27 05 53 – Identification for Communications Systems
7. Section 27 10 00 – Structured Cabling, Basic Materials and Methods
8. Section 27 11 13 – Communications Entrance Protection
9. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
10. Section 27 11 19 – Communications Termination Blocks and Patch Panels
11. Section 27 11 23 – Communications Cable Management
12. Section 27 11 26 – Communications Rack Mounted Power Protection and Power Strips
13. Section 27 13 00 – Communications Indoor Backbone Cabling
14. Section 27 15 00 – Communications Horizontal Cabling

1.2 REFERENCES

A. Usage: In accordance with Section 01 11 00 – Summary of Work .

B. American National Standards Institute (ANSI)
1. ANSI/TIA/EIA-568-C.1-2009 Commercial Building Telecommunications Cabling Standard
2. ANSI/TIA-568-D Optical Fiber Cabling Components Standard (2016)
3. ANSI/TIA/EIA-606-B-2016 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

1.3 DEFINITIONS

A. General Abbreviations used in these specifications. Refer additionally to the abbreviations list appearing on the Drawings.
1. ADA Americans With Disabilities Act.
2. AFC Above Finished Ceiling.
3. AFF Above the Finished Floor.
4. BLDG Building
5. CAT Category
6. CL Centerline
7. DIV Division
8. (E) Existing

9. FBO Furnished By District
10. HR Home Run
11. ID Inside Diameter
12. LAN Local Area Network
13. MAX Maximum
14. NIC Not In Contract.
15. OD Outside Diameter
16. OFE District Furnished Equipment.
17. PSRH Project Standard Receptacle Height.
18. PSSH Project Standard Switch Height.
19. TYP Typical
20. UON Unless Otherwise Noted.

B. Reference to Named Products
1. Selected Item: Item so noted was selected based on comparative testing of similar products. Procedure for determination of equivalence is noted in the specification for the item(s).
2. System Design Basis: Item so noted interacts with other system items to produce total system function. Substitution of this item may require coordinated substitution of other system items.
3. Design Basis: Item so noted was used as basis for system drawings to establish features, size, etc. Use of specified equivalents may require adjustment of physical layout or wiring, but does not affect system function. No preference is implied.

1.4 SUBMITTALS

A. Submit the following according to Conditions of the Construction Contract and Division 1 Specification Sections.

B. General Requirements
1. Submit all materials for review arranged in same order as Specifications, individually referenced to Specification Section, Paragraph and Contract Drawing number. Conform in every detail as applies to each referencing Section.
2. Submit in PDF format.
3. Make each specified submittal as a coordinated package complete with all information specified herein. Incomplete or uncoordinated submittals will be returned with no review action.
4. Progress Schedule: Comply with Division 1.

C. Contractor and Key Personnel Experience.
1. A minimum of 30 days prior to installation, submit documentation of the experience of the low voltage systems, equipment and infrastructure contractor(s) and of their key personnel.
2. Qualifications shall be provided for:
   a. the low voltage systems, equipment and infrastructure contractor(s),
   b. the low voltage systems, equipment and infrastructure installer(s),
   c. and the supervisor(s) (if different from the installers),
   d. the low voltage systems, equipment, and infrastructure project engineer,
   e. custom control system programmer.
3. A copy of the Contractor's C-7 license or C-10 licenses - both if Contractor has both.
4. A copy of testing personnel certification(s)that demonstrate that the proposed personnel have the necessary training and certifications to conform with the proof of performance testing requirements of this Division and that they are properly trained in the use of the testing equipment that will be employed by the contractor.
5. Copies of Contractor's Structured Cabling System (SCS) manufacturer's authorized vendor/installer Certification document(s).

6. Refer to Quality Assurance paragraph in this section for complete requirements.

D. Manufacturer's Product Data:
1. Manufacturer's Product Data Sheets. Collate in sequence of List of Materials:
2. Data sheet for each item in each Communications Section, including all accessories, clearly marked for proposed product.
3. Material Safety Data Sheet, where applies.
4. List of Materials Schedule. For each item, include:
   a. Referencing Specification Section
   b. Referencing Paragraph
   c. Referencing Drawing, if specified only on plans
   d. Manufacturer.
   e. Model number.
   f. Listing, including name of Nationally Recognized Testing Laboratory.
   g. Precede each submittal book with a summary schedule, with columns for each item above and rows for each item submitted, per the example schedule below:
   h.

Specification Section	Paragraph	Contract Drawing Reference	Manufacturer	Model No.	UL/ETL/CLA Listed
27 05 00	2.03C		XYZ	123	Y
27 15 00	2.07A1		AAA	34-56	Y
		T0.1	ZZY	456	Y

E. Field (Installation) Drawings:
1. General
   a. Drawings shall present the proposed installation using the makes and models of devices proposed for use this project; replace vendor neutral nomenclature used in bid set with the actual part numbers to be installed or provide a lookup table in the drawings to permit determining the actual part number.
   b. Where the existing systems and/or infrastructure are used and integrated into the work of the project, indicate them on drawings, including points of interface and demarcation of existing and new work.
   c. Collate, in sequence, at least the following minimum drawings, for each infrastructure and system to be installed under the work of this contract:
2. Drawing index/symbol sheet.
3. Site plans, floor plans and reflected ceiling plans.
   a. General
      1) The identifier for each termination and cable shall appear on the drawings, either directly on the floor plans, through an associated schedule or a unique identifier associated with a fully annotated single line diagram.
      2) Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.
      3) At scale of Contract Documents, show:
      4) Device locations and type
      5) Rough-in.
      6) Mounting height.
      7) Conduit size.
      8) J-hook routes
      9) Wire type.

10) Wire fill.
11) On the floor plans, indicate floor and wall mounted devices and pathway below a height of 7 feet above finish floor. Indicate the locations of the communications rooms and provide reference to the enlarged communications rooms plans.
12) On the reflected ceiling plan, indicate ceiling and wall mounted devices and pathway above a height of 7 feet above finish floor. Indicate the locations of the communications rooms and provide reference to the enlarged communications rooms plans.

b. Communications Infrastructure
1) Provide registered communications distribution designer (RCDD) approved, drawings depicting a complete communication infrastructure in accordance with ANSI/TIA-606-B. The drawings should provide details required to prove that the distribution system shall properly support connectivity from the communications rooms including EF, ER, CD's, BD's, and FD's to the telecommunications work area outlets.
2) The following drawings shall be provided as a minimum:
3) T1- Layout of complete building per floor - Building Area/Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways. Layout of complete building per floor. The drawing indicates location of building areas, serving zones, vertical backbone diagrams, telecommunications rooms, access points, pathways, grounding system, and other systems that need to be viewed from the complete building perspective.
4) T-2 Serving Zones/Building Area Drawings - Drop Locations and Cable Identification (ID'S). Shows a building area or serving zone. These drawings show drop locations, telecommunications rooms, access points and detail call outs for common equipment rooms and other congested areas.
5) A complete jack numbered plan set in District standard jack numbering format in printed and AutoCAD format. Number plans with all jacks for each floor indicated on a single drawing sheet. Data, voice, wireless and security jacks shall appear on the same page. Symbols shall be indicated for the data, wall phone, wireless, inside camera, outside camera, as applies. A four digit jack numbers shall be printed by each jack symbol. Jack plan shall be approved by the District's Representative before the cabling begins.

c. Audiovisual Systems, including MATV Systems, Audiovisual Systems and Public and Mass Notification Systems
1) Indicate:
2) Device locations, orientation and depict integration of systems that need to be viewed from the complete building perspective.
3) For distributed speaker systems, indicate limits of zones of coverage.
4) Vertical and horizontal pathways
5) Equipment rooms and racks
6) Reference to enlarged plans and related details.

4. Enlarged Plans
a. General
1) Indicate at least as much information as is provided in the Contract Documents, supplemented by the dimensions and arrangement of the proposed equipment, trade coordination and field conditions.

b. Communications Infrastructure.
1) Communications Rooms Drawings
2) Provide T3 drawings in accordance with ANSI/TIA-606-B that include telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet, rack, backboard and wall elevations. Include rack details, proposed layout and

anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

3) At scale of Contract Documents, the Contractor shall submit scaled drawing elevations (showing dimensions, mounting locations and associated frames & equipment) for all required assemblies, including but not limited to:
4) Rack locations
5) Wall mounted plywood backboards
6) Wall mounted backbone cabling and major station cable bundles.
7) Wall mounted and tray mounted splice cases
8) Wall mounted copper cable protectors and terminal blocks.
9) Wall mounted fiber optic cable terminations.
10) Clearances
11) Backboard Wire and Cable Management
12) Rack elevations, including
13) Copper cable patch panels.
14) Fiber optic cable patch panels.
15) Rack mounted wire managers
16) Hold clears for equipment provided by Others.
17) Reference to mounting details.
18) Power strips
19) UPS
20) Drawings may also be an enlargement of a congested area of T1 or T2 drawings.

c. Audiovisual Systems, including MATV Systems, Audiovisual Systems and Public and Mass Notification Systems
1) At equipment rooms
2) Rack elevations, showing
3) all equipment occupying the actual number of rack units required
4) blank panels
5) vent panels
6) aux panels
7) power strips
8) UPS
9) Reference mounting details.

5. System Conduit and Riser Diagrams,
a. General:
1) Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment.
2) Single line diagram of structured wiring
3) Grounding and bonding scheme
4) Terminal cabinets.
5) Coordination with floor plans.
6) Wire runs not shown on floor plans.
7) Wire type.
8) Wire fill.
9) Interface to work provided by work of other Sections, District Furnished Equipment, existing equipment and/or future equipment.
10) For Audiovisual Systems, indicate digital or analog signal type and voltage levels (dBmV, microphone, line level, speaker level) or optical signal levels.

6. Detail Drawings

a. Identify each item requiring seismic restraint installation in accordance with CBC Chapter 16. Include floor mounted items weighing more than 400 pounds and wall mounted or suspended items weighing more than 20 pounds.
b. Supports for such items shall be provided support, bracing, and anchorage, designed by the Contractor in accordance with the following criteria:
    1) Design to resist seismic forces in accordance with CBC Chapter 16.
    2) Minimum Design Parameters - As defined for the Project in Division, with respect to Occupancy Category, Site Classification, Seismic Design Category, Importance Factor, Spectral Acceleration and SDI.
c. Mounting details:
    1) Specific details of restraints including anchor bolts submitted under the Section 27 05 29 – Hangers and Supports for Communications Systems for mounting and maximum loading at each location, showing compliance and coordination with Code and the project Architectural, Structural and Mechanical Documents.
    2) Stamped and signed by an Engineer licensed in the Project jurisdiction for work of this type.
    3) Submit an accompanying Engineering analysis stamped and signed by an Engineer licensed in California for work of this type, indicating that the Equipment Enclosure System will comply with California Building Code for the Project Seismic Zone when loaded with the weight of the equipment submitted.
    4) Show calculations on drawings or in bound volume for review by Authorities having jurisdiction.
    5) Show loads, type and strength of connections, sizes, dimensions, materials, etc.
    6) Provide details for:
    7) Floor Mounted Equipment Cabinet and Rack anchorage.
    8) Wall Mounted Racks and Enclosures anchorage, including coordination with backing.
    9) Cable Runway and Cable Tray. Indicate tray type, dimensions, support points, and finishes.
d. For systems with contractor or manufacturer programmed control and human interfaces the Contractor must allow sufficient time for the programming of all software configurable audio, video and control systems. Contractors must evaluate the systems functional requirements and user interface and then allow time in their bid accordingly. The system description as well as an end user interview will provide the Contractor with the necessary information needed to proceed with the programming. Any questions as to the systems functional requirements must be sent in written RFI form to the District. All programming schemes must be submitted to the District for approval before programming starts. This includes the appearance of all user interfaces, touch panel layouts, preset and sub-preset information (acquired through client interviews), and speaker control schemes. The Contractor will also submit a narrative for the control system concept to the District for approval. The Contractor is to interview the District and their representatives to acquire the necessary information needed to allow for the proper programming of this system. The Contractor, after interviewing the District, will then submit a written report stating his interpretation of the client's requirements for approval by District. Only after the Client and District have approved the programming report may the Contractor proceed with the programming of this system. Submit at least:
    1) Narrative of the sequence of operation.
    2) Color, full-size layouts of each touchpanel and/or computer screen (menu) image, cross-referenced to the sequence of operations.
    3) Show chaining of sub-menus.
e. Faceplate and Receptacles

1) Receptacle and jack arrangement for each condition.
2) Labeling of receptacle/jacks and plate
3) Plate material.
4) Plate finish.
5) Connector types.
6) Connector dimensioned layout.

f. Pathway
1) Cable tray installation details, indicating complete system of fittings and radiussed pathways provided.
2) Firestopping. Listed fire stop system documentation supporting proposed systems ability to conform with the project requirements.
3) Penetrations. All conduit and piping wall, ceiling, floor, and roof penetrations, including both fire rated or non-rated, should be submitted for review prior to installation.
4) For cored penetrations through concrete partitions, submit proposed work plan in the form of Coring/Sawcutting Summary Description as described in Section 27 05 33 – Conduits and Backboxes for Communications Systems.
5) Details of flexible raceway connections to be made to vibrating equipment
6) Details of J-Box and sealant application for the typical conditions listed in Section 27 05 48 – Noise and Vibration Controls for Communications System, and a schedule of rooms to receive application of mastic and sealant at J-Boxes
7) An itemized list of all items of equipment to be fitted with flexible electrical connections.
8) Conduit racking details.

g. California Access Compliance Manual and Americans with Disabilities Act (ADA) compliance.

h. Terminal cabinets: Terminations.

F. Schedule Submittals.
1. An Excel spreadsheet listing jack number, floor number, room number and jack type (workstation, wireless, camera, emergency phone, etc.)
2. Voice cable plant: Cut sheets for use by District's Telephone Systems Contractor.

G. Samples
1. Mock-ups of each type of communications outlet faceplate to be furnished for this project. Each faceplate mock-up shall contain the following:
a. Full load of required connectors with eighteen inches (18") of connector type appropriate specified cable terminated on each connector.
b. Required faceplate labeling to include faceplate icons as required by these Division 27 Specifications and the accompanying construction drawing set.

H. Cabling and Equipment Test Plan
1. Submit complete documentation of the proposed test plan and equipment to be used to document that the performance of the cabling, equipment, sub-systems and complete systems installed under the work of this project conform with the performance standards outlined in each specification section.
2. Submit not less than 45 days prior to the proposed test date. Include procedures for certification, validation, and testing.
3. Submit manufacturer's or recognized national test laboratory’s calibration certificate one (1) month before any post-installation testing begins. Date on test unit calibration certificate shall be no longer than one (1) year prior to the date that post-installation testing is scheduled to begin.

4. Submit a copy of the Test Equipment manufacturer's recommended testing procedure for each of the structured cabling system elements listed above in this section.

I. Test Reports
   1. Manufacturer's Field Reports
      a. Factory reel tests
   2. Project Site Test Reports:
      a. Submit following system completion and prior to and as condition precedent to Acceptance Review and Testing of the Work of this Section.
      b. Schedule: Submit test reports in timely manner relative to Project schedule such that the District's Representative may conduct verification of submitted test data without delay of scheduled progress.
      c. Provide test reports as specified within each section of Division 27 requiring performance testing.
      d. Content: Include at least:
         1) Time and date of test.
         2) Personnel conducting test.
         3) Test equipment, including serial and date of calibration.
         4) Test object.
         5) Procedure used.
         6) Results of test
         7) Numerical or graphical presentation.
      e. Submit copy of final results on paper and in electronic form, organized by circuit number, consistent with circuit numbering scheme used in preparing submittal drawings and in labeling receptacles and terminations.
         1) Submit machine-generated documentation and raw data of all test results in electronic form on CD-R media
         2) Where the electronic documentation requires use of a proprietary computer program to view the data, provide the District's Representative with 1 licensed copy of the software.

J. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the District's Representative, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

K. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using format in Article 3 of General Conditions using format in Division 1 Section "Closeout Procedures".

L.

1.5 QUALITY ASSURANCE

A. Procedures: In accordance with Section 01 40 00 – Quality Requirements.

B. Qualifications
   1. Telecommunications Qualifications
      a. Work under this section shall be performed by and the equipment shall be provided by the telecommunications contractor and key personnel. Qualifications shall be provided for:
         1) the telecommunications system contractor,
         2) the telecommunications system installer,
         3) and the supervisor (if different from the installer),
         4) the project engineer,

5) the custom control system programmer.

b. A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

2. Telecommunications Contractor

a. The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment.

1) The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

2) Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

b. Key Personnel

1) Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this project depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

2) Designated Supervisor: Provide a designated Project Manager--can be separate from or the same individual as the Lead Technician mentioned in 1.5-B-5-b-3, in responsible charge of the fabrication shop and on the Project Site during all phases of installation and testing of the work of this specification. The Project Manager shall hold current Avixa (previously Infocomm) CTS-D, CTS-I or CTS and Extron AV Associate certifications and shall be the same individual through the execution of the work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.

3) Project Engineer: Provide a designated Project Engineer in responsible charge of the Design, CAD, In-House testing and on the on-site commissioning of the Project during all phases of the work of this specification. This Project Engineer shall hold a current Avixa (previously Infocomm) CTS- D, Extron XTP/DTP and Extron AV Associate certifications and shall be the same individual through the execution of the work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.

4) All Technicians shall have at least two (2) years direct experience in similar work. The AV technicians assigned to this project shall be fully trained, qualified and carry valid and current industry certifications regarding the, installation, operation and testing of audiovisual systems. At least one Avixa (previously Infocomm) CTS-I or CTS and Extron XTP for Technicians shall be assigned as Lead Technician to the project.

5) Custom Control System Programmer: Provide at least one (1) full time programmer on staff, capable of on-site custom programming of the custom remote control system specified herein. Control System Programmer to hold the following certifications: Avixa (previously Infocomm) CTS-D, CTS-I or CTS along with Extron Control Professional, Extron ProDSP Specialist certifications and 3 years of direct experience.

6) Note that only the key personnel approved by the District's Representative in the successful proposal shall perform work on this project's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from the District's Representative.

3. Minimum Manufacturer Warranty
   a. The District requires the contractor to be trained and certified to provide the following minimum manufacturer's warranty:
      1) Structured Connectivity Solutions 25-Year Extended Product Warranty. A 25 Year extended product warranty shall ensure against product defects, that all approved cabling components exceed the specifications of TIA/EIA 568B and ISO/IEC IS 11801, and provide and end-to-end solution in accordance with the application standards. The warranty shall apply to all passive cabling components. The 25 Year extended product warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for a twenty five (25) year period.
      2) Structured Connectivity Solutions 25-Year Extended Application Assurance. A 25 Year application assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future, by recognized standards or user forums that use the TIA/EIA 568B or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a twenty (25) year period.
      3) In the event that the District sells a building that has been warrantied, the warranties shall be transferable to the new District.
4. Audiovisual Qualifications
   a. Audiovisual Systems work shall be performed by and the equipment shall be provided by the Audiovisual Systems contractor and key personnel. Qualifications shall be provided for:
      1) the Audiovisual Systems contractor,
      2) the Audiovisual Systems installer,
      3) and the supervisor (if different from the installer).
   b. A minimum of 30 days prior to installation, submit documentation of the experience of the Audiovisual Systems and of the key personnel.
5. Audiovisual Systems Installer
   a. The installer of the audiovisual systems shall be a firm regularly and professionally engaged in the business of installation, configuration and testing of the specified audiovisual systems and equipment.
      1) Where the manufacturers of the specified and contractor proposed systems provide mandatory installer and programming training programs, the Contractor's programming and installation staff shall provide documentation to demonstrate their successful completion of the relevant training programs for the types and versions of equipment proposed for installation on this Project.
      2) Where the manufacturer of the specified and contractor proposed systems and equipment lawfully restricts sales of their equipment to a network of dealers, the contractor shall provide documentation to their standing as such a dealer in good standing at the time of bid submittal.
      3) The audiovisual systems contractor shall demonstrate experience in providing successful audiovisual systems of a similar scope and nature of those required by the work of this Project within the past 3 years.
      4) Submit documentation for a minimum of three and a maximum of five successful audiovisual system installations for the audiovisual systems contractor.
   b. Key Personnel
      1) Provide key personnel who are regularly and professionally engaged in the business of the installing, programming, configuring and testing of the specified audiovisual systems and related presentations and equipment.

a) There may be one key person or more key persons proposed for this project depending upon how many of the key roles each has successfully provided.
b) Each of the key personnel shall demonstrate experience in providing successful audiovisual systems of a similar nature scope and extent to those required by the work of this Project within the past 3 years.

C. Test Plan
1. Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the UTP and optical fiber components and accessories 45 days prior to the proposed test date. Include procedures for certification, validation, and testing.

D. Designated Supervisor: Provide a designated supervisor present and in responsible charge in the fabrication shop and on the Project Site during all phases of installation and testing of the Work of this Section. This supervisor shall be the same individual through the execution of the Work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.

E. Reference Documents: At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies.
1. A complete set of the latest stamped, actioned submittals of record.
2. A complete set of manufacturer's original operation, instruction and service manuals for each equipment item.

F. Test Equipment
1. Requirements:
a. Maintain and operate test equipment at the fabrication shop and the job site for both routine and Acceptance Testing of the Work of this Section.
b. Maintain test equipment at the job site while work is in progress from installation of equipment racks until District Acceptance of this Work; thereafter remove all of this test equipment from the job site.
c. Unless otherwise indicated, test equipment shall remain property of the Contractor.
d. Provide all required test cables, jigs and adapters.
e. Provide equipment with traceable calibration, with calibration date not greater than one year prior to the date of the use of the equipment to perform the specified testing.
2. Equipment: Specified in individual Sections.

1.6 REGULATORY REQUIREMENTS

A. Regulations Applicable: Including but not limited to those defined in Section 01 11 00 – Summary of Work.
1. Nothing in the Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules, or regulations.
2. Safety Agency Listing: All devices provided under the Work of this Section which are connected to the Project electrical system shall be listed by a Nationally Recognized Testing Laboratory, and shall be so labeled.
3. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the District's Representative. Equipment, materials, installation, and workmanship shall be in accordance with the

mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.7 DELIVERY, STORAGE AND HANDLING

A. Procedures:
1. In accordance with Section 01 60 00 – Product Requirements and as specified in the individual sections of Division 27.

B. General
1. Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, non-condensing.

1.9 SEQUENCING

A. Comply with Section 01 11 00 - Summary of Work, 01 30 00 – Administrative Requirements, and the following.
1. Reproducibles:
a. 1 set of reproducible bond.
b. CAD files: 1 set.

1.10 OPERATING AND MAINTENANCE DATA

A. Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system.
1. Submit operations and maintenance data in accordance with Section 01 70 00 – Execution and Closeout Requirements and as specified herein not later than 2 months prior to the date of beneficial occupancy.

1.11 PROJECT RECORD DOCUMENTS

A. Comply with Section 01 70 00 – Execution and Closeout Requirements, and the following.
1. Record Drawings
a. CAD.
1) Use a computer aided drafting (CAD) system in the preparation of record drawings for this Project. CAD system shall produce files in AutoCAD® .DWG format, latest version at time of bid. (Campus Standard, no substitution permitted).
b. Except where prohibited by Contract, District's Representative will furnish CAD backgrounds in AutoCAD® .DWG format, latest version at time of bid, for use by the Contractor in preparing Record Drawings.
2. Provide drawings including documentation on cables and termination hardware in accordance with ANSI/TIA/EIA-606-A. The drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. Provide the following drawing documentation as a minimum:
a. Cables - A record of installed cable shall be provided in accordance with ANSI/EIA/TIA-606-A. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit

from the assigned outlet to the entry facility in accordance with ANSI/TIA/EIA-606-A. Include manufacture date of cable with submittal.

b. Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with EIA TIA/EIA-606-A. Documentation shall include the required data fields as a minimum in accordance with EIA TIA/EIA-606-A.

3. Spare Parts
   a. In addition to the requirements of Section 01 70 00 – Execution and Closeout Requirements, provide a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.
4. For each IDF, the contractor shall provide (1) printed copy of the outlet numbering plan for the IDF-serving area. The plan shall be printed on D-size, dated, with contractor contact information, and a framed for hanging on the IDF wall.

1.12 WARRANTY SERVICE

A. In addition to provisions of 01 70 00 – Execution and Closeout Requirements, provide the following.
   1. Response Time: Provide a qualified technician familiar with the work at the Project Site within 24 hours after receipt of a notice of malfunction. Provide the District's Representative with telephone number attended 8 hours a day, 5 days a week, to be called in the event of a malfunction.

B. Provide all additional Warranties as defined in each Communication Systems Section.

1.13 ACCEPTANCE REVIEW AND TESTING PROCEDURES

A. Complete all Work of this Section. Submit Test Report. Submit review copies of Operating and Maintenance Manuals, less reduced set of Record Drawings. Notify the District's Representative in writing that the Work of these Sections is complete and fully complies with the Contract Documents. Request Acceptance Review and Testing. The District's Representative will conduct Verification of Submitted Test Data, and otherwise direct testing and adjustment of this Work. These procedures may be performed at any hour of the day or night as required by the District's Representative to comply with the Project Schedule and avoid conflict with Residents. Provide all specified personnel and equipment at any time without claim for additional cost or time.

B. Personnel: Provide services of the designated supervisor and additional technicians familiar with work of this Section. Provide quantity of technicians as required to comply with Project Schedule.

C. In Addition, Provide:
   1. All tools appropriate for performance of adjustment of and corrections to this Work. Include spare wire and connectors and specified tooling for application.
   2. Ladders, scaffolding and/or lifts as required to access high devices.
   3. All test equipment.
   4. Complete set of latest stamped, actioned submittals of record for reference.
   5. Complete set of Test Reports.
   6. Complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.
   7. Demonstrate: Complete operation of all systems and equipment, including Portable Equipment.
   8. Adjust: As directed by the District's Representative.

9. Correct: In timely manner, failure to comply with the Contract Documents, as reasonably determined by the District's Representative.

D. Temporary Equipment: Provide and operate, without claim for additional cost or time, temporary equipment and/or systems to provide reasonably equivalent function, as determined by the District's Representative, in place of the Work of this Section which is incomplete or found not in conformance with the Contract Documents as of seven (7) days prior to the scheduled completion date. Provide such temporary equipment until Acceptance of the Work of this Section. Thereafter, remove such temporary equipment.

1.14 CLOSEOUT

A. Punch List: Perform any and all remedial work, at no claim for additional cost or time. Where required, retest and submit Test Report. Notify the District's Representative of completion of Punch List.

B. Portable Equipment: Furnish all portable equipment and spares to the District's Representative, along with complete documentation of the materials presented. Where applicable, furnish portable equipment in the original manufacturer's packing.

C. Operating and Maintenance Data: Install framed operating and maintenance instructions. Submit Manuals.

D. Project Record Documents: Submit print and digital copies. Digital files shall be in CAD system shall produce files in AutoCAD® .DWG format, latest version at time of bid.

E. Keys: If applicable, replace construction locks with permanent locks. Provide 5 sets of keys to the District's Representative.

F. Instruction: Conduct specified instruction.

G. Warranty: Submit Warranty dated to run from date of Acceptance of the Work of this Section.

PART 2 - PRODUCTS

2.1 GENERAL

A. Where a particular material, device, piece of equipment or system is specified directly, the current manufacturer's specification for the same shall be considered to be a part of these specifications, as if completely contained herein in every detail.

B. Each material, device or piece of equipment shall comply with all of the manufacturer's current published specifications for that item.

C. Products shall be made by manufacturers regularly engaged in the production of such products.

D. Provide quantity as shown on Contract Drawings, or as otherwise indicated.

E. Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the Work of this Section as if specified in full herein.

F. Provide the manufacturer's latest design/model, permanently labeled with the manufacturer's name, model number and serial number.

G. Where products are of similar type or use, provide products of the same manufacturer, unless otherwise indicated.

H. Components
1. UL or third party certified. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.
2. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance.
   a. The label or listing by the specified organization will be acceptable evidence of compliance.
   b. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the District's Representative.
   c. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.
3. Products shall provide a complete end-to-end system of connectivity and shall be warranted as a system by the manufacturer.

I. Enclosures:
1. Provide steel frames and enclosures designed and wired to eliminate all induced currents.
2. Make bolted connections with self-locking devices.

J. Finishes: Any item or component of the Work of this Section which is visible shall comply with the following.
1. Finishes noted or scheduled on the Contract Drawings take precedence.
2. Where design location requires that products, materials or equipment are visible to the public, no manufacturer's logos larger than 1/2 inch shall be visible. Unless otherwise noted or directed, neatly remove or permanently paint out such logos.
3. Where finishes are not noted or otherwise defined in the Contract Documents, submit manufacturer's standard finish samples for selection by the District’s Representative.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine existing conditions before starting work. Submit conflicts in a timely manner for resolution

3.2 PREPARATION

A. Prepare and sequence the work to minimize disruption to each room environment and existing communications systems.

B. Protection: Cover all computers, electronic equipment, desks, chairs, furniture and other articles when working at ceiling level and/or performing dust producing tasks.

3.3 REPAIR AND RESTORATION

A. Where working in spaces occupied by the District, return to their original positions any furniture or articles relocated to perform the work.

3.4 CLEANING

A. Where working in spaces occupied by the District:
   1. Immediately after completing work within each space, clean up and remove all materials, scrap and dust.
   2. All scrap material in work area shall be picked up and removed from the building at the end of each day. See also Section 01 70 00 – Execution and Closeout Requirements for additional requirements.
   3. All dust resulting from work performed shall be vacuumed up daily.
   4. All scrap material shall be removed from site and disposed of in an authorized disposal site. Refer to Section 01 74 19 – Construction Waste Management and Disposal.

END OF SECTION

SECTION 27 0526

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Section includes grounding and bonding of Communications Work, including but not limited to:
   1. Communications Raceways
   2. Cable Runway
   3. Cable Shields
   4. Protector Fields
   5. Communications cabinets and enclosures.

B. Related Work Under Other Sections
   1. Related Sections:
      a. Section 27 05 00 – Common Work Results for Communications
      b. Section 27 05 29 – Hangers and Supports for Communications Systems
      c. Section 27 05 33 – Conduits and Backboxes for Communications Systems
      d. Section 27 05 36 – Cable Trays for Communications Systems
      e. Section 27 10 00 – Structured Cabling, Basic Materials and Methods
      f. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
      g. Section 27 11 19 – Communications Termination Blocks and Patch Panels
      h. Section 27 11 23 – Communications Cable Management
      i. Section 27 11 26 – Communications Rack Mounted Power Protection & Power Strips
      j. Section 27 13 00 – Communications Interior Backbone Cabling
      k. Section 27 15 00 – Communications Horizontal Cabling

1.2 SYSTEM DESCRIPTION

A. Provide telecommunications system grounding conductor as described herein and indicate on drawings.

B. Except as otherwise indicated, the complete communications installation including the metallic conduits and raceways, cable trays, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically shown or specified.

C. Resistance:
   1. Resistance from the farthest ground bus through the ground electrode to earth shall not exceed 5 Ohms or the requirements of ANSI-J-STD-607-A-2002, whichever is more restrictive.

1.3 REFERENCES

A. American National Standards Institute (ANSI)
   1. ANSI/TIA/EIA-606-B-2016 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   2. ANSI/TIA-607-D-2019 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

3. Underwriters Laboratories (UL)
4. UL 467 (1993); R 2004 Grounding and Bonding Equipment

1.4 SUBMITTALS

A. Conform with the requirements of Section 01 30 00 – Administrative Requirements and Section 27 05 00 Common Work Results for Communications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
   1. Ground Rod:
      a. High strength high carbon steel, with electrolytically bonded jacket of copper on surface
      b. UL spec. 467
      c. ANSI C-33.8-1072.
      d. Manufacturer:
         1) Allied Bolt
         2) Inwesco 12A60
         3) Blackburn
         4) Cooper Power Systems
         5) Weaver.
         6) Erico "Cadweld" Products, Inc.
         7) ITT Blackburn.
         8) Or equal.
   2. Ground Wells:
      a. Christy Concrete Products, Inc.
      b. Forni Corp.
      c. Or equal.
   3. Ground Bushings, Connectors, Jumpers and Bus:
      a. O-Z/Gedney.
      b. Thomas & Betts Corp.
      c. Or equal.
   4. Compression Connector Lug
      a. Panduit
      b. B-Line SB-479 Series
      c. Thomas & Betts
      d. Or equal.
   5. Telecommunications Ground Bus Bar
      a. Description:
         1) Meets EIA/TIA 607.
         2) Provide compression-type lugs.
         3) Material:
            a) ASTM A36 structural steel.
            b) ASTM B187-C11000 copper bar.
            c) Polyster resin fiberglass insulator.
            d) Steel – Yellow Finish.
            e) At least 20 inches wide.
            f) Wall Mountable.
      b. Manufacturer:
         1) B-Line SBTMGB20
         2) CPI 40153-020

3) Or Equal.

6. Rack and Cabinet Grounding
   a. Panduit Structured Ground Kit
   b. Chatsworth Products Inc.
   c. or equal.
7. Bonding Ribbon:
   a. Annealed solid copper 3/8 inch wide x 1/16 inch thick, tin plated.
   b. Manufacturer:
      1) Inwesco 12A55
      2) Corning Cable Systems
      3) Preformed Line Products.
      4) or equal.
8. Bonding Ribbon Clamp:
   a. Soft lead
   b. 1/16 inch thick
   c. Bolt hole for attachment
   d. Manufacturer:
      1) Inwesco 12A56
      2) Corning Cable Systems
      3) Preformed Line Products.
      4) Or equal.
9. Fargo Clamp:
   a. Cast copper, silver plated, furnished with copper bolt.
   b. RUS Listed
   c. Manufacturer:
      1) Allied Bolt
      2) Inwesco 12A57
      3) Corning Cable Systems
      4) or equal.
10. Ground Inserts:
    a. Cast Bronze w 1/4 Copper Rod.
    b. Provide minimum one each maintenance hole or vault.
    c. Manufacturer:
       1) Inwesco 12H69
       2) or equal by vault or manhole manufacturer.
       3) or equal.

2.2 GROUND CONDUCTORS

A. General purpose insulated:
   1. NRTL listed and code sized copper conductor, with dual rated THHN/THWN insulation, color solid green. The jacket may have a yellow stripe.
   2. The jacket shall include markings that indicate conductor, manufacturer, and NRTL listing.
   3. Minimum wire size is #6 AWG UON. Grounding conductors larger than 4 AWG (5 mm) shall be stranded. Use solid conductors for 4 AWG (5 mm) and smaller.
   4. Use stranded grounding conductors at locations subject to vibration or repeated flexing, regardless of size.
   5. Where continuous color-coded conductors are not commercially available, provide a minimum 4 in. long color band with green, non-aging, plastic tape in accordance with NEC. The band shall be located within 152 mm (6 in.) of each termination and splice and at 1.2 m (4 ft.) intervals along its run.
   6. Plenum rated, if run in plenum spaces.

B. Telecommunications Bonding Backbone (TBB)
   1. A TBB shall be provided between the TMGB and each TGB.

2. The TBB shall be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 168 kcmil (No. 3/0 AWG; 12 mm).

C. Bonding Conductor for Telecommunications (BCT)
1. A BCT shall be provided between each TMGB and the building's service equipment (power) ground.
2. The BCT shall be the same size as, or larger than, the largest TBB.

D. Rack Bonding Conductor (RBC)
1. A separate RBC shall be provided between each cabinet or rack and the TGB or TMGB in the room.
2. Each RBC shall be sized as a 6 AWG (4 mm).

E. Unit Bonding Conductor (UBC)
1. Separate UBCs shall be provided for each piece of active equipment in a rack/cabinet that has a ground connection point separate from its power source.
2. The UBCs shall be connected between the active equipment and the RGB of the cabinet/rack.
3. The UBC shall be a minimum 12 AWG (2 mm).

F. Bonding Jumpers
1. Bonding jumpers shall be used wherever two metallic parts meet in an electrically insecure connection. Examples include, without limitation, cable tray sections and cabinet or rack components and doors.
2. Bonding jumpers shall be factory pre-terminated.

G. Outside Plant Applications
1. Grounding conductors shall be bare copper, meeting ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

H. Bonding pigtails: Insulated copper conductor, identified green, sized per code, and provided with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.

2.3 COMPRESSION CONNECTOR LUG

A. Description
1. Connector lug with compression connection to conductor.
2. Copper alloy body.
3. Provide lug size to match conductor being terminated.
4. Provide 2 hole pattern lugs.
5. Provide each lug with silicon bronze hardware, including 2 bolts, 2 split lock washers and 2 nuts.

2.4 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron or steel body with 150 degree Centigrade molded plastic insulating throat and lay-in grounding lug.

2.5 CONNECTIONS TO PIPE

A. For cable to pipe: UL listed bolted connection complying with CEC requirements.

2.6 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES

A. Where required by the Drawings or Specifications, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high pressure compression type connectors.

B. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Cadweld, Thermoweld or equal. Each particular type of weld shall use a kit unique to that type of weld.

C. High-pressure compression type connectors shall be used for cable-to-cable and cable-to-ground rod connections. Connections shall be as manufactured by Thomas & Betts #53000 series, Burndy “Hy-Ground” or equal.

2.7 EXTRA FLEXIBLE, FLAT BONDING JUMPERS

A. Where required by the drawing or specified herein.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide Grounding and Bonding according to the most restrictive requirements of:
1. ANSI-J-STD-607-B-2011.
2. California Electrical Code Article 250 and references therein.
3. California Electrical Code Article 800.

B. In the event of conflicting requirements, California Electrical Code requirements shall prevail.

3.2 BONDED COMPONENTS:

A. Bonding conductors or jumpers are to be installed within each Telecommunications Space between the TMGB/TGB and the following components:
1. The communications building entrance protectors.
2. Metallic shielding of outside cable plant.
3. Metallic shielding of inside cables, where required by Code.
4. Electrical panel board (if in the same room as TMGB/TGB).
5. Building steel (if accessible in the same room as TMGB/TGB or close by external to the room).
6. Telecommunications ladder rack and cable tray.
7. Telecommunications equipment racks and cabinets via the RGBs.
8. Wall-mounted metallic enclosures.
9. Metallic conduit longer that 1 m (3 ft.) and not secured to a grounded enclosure in an electrically continuous manner.
10. Access floor systems.

B. Where a metallic raceway connects two or more Telecommunications Spaces, bond to the Telecommunications Ground Busbar at each end

C. Point of Connection
1. Under Work of this Section, make connections to Communications Ground Busbars provided under Work of Division 26, or by separate project, as applies.

D. Grounding Busbars
1. Install busbars per manufacturer's instructions and at locations shown on the plans. If locations are unclear, apply for and conform to direction from the University's Representative.
2. Locate all busbars so that they are accessible to telecommunications personnel, yet not exposed to casual contact. Other cable types must not be allowed to contact the busbars or pass within 152 mm (6 in.) of the busbar.
   a. TMGBs and TGBs shall be located on or near the wall opposite the entrance, at least 2.1 m (7 ft.) above finished floor (AFF).
   b. RGBs shall be located on the rear of the cabinet/rack. Horizontal RGBs shall be as near the top of the rails as space allows. Vertical RGBs shall be used only in closed cabinets.

E. TMGB
1. The TMGB shall be bonded directly to the closest point of the building's earth grounding electrode system and to building steel. Building steel should be tested to verify its ground conductivity to earth.
2. All metallic raceways for telecommunications cabling located within the same room or space as the TMGB shall be bonded to the TMGB.
3. Insulate the TMGB 51 mm (2") from the wall.
4. For outside plant cables entering a building with a cable shield isolation gap, bond the cable shield (on the building side of the gap) to the TMGB. Outside plant protectors shall be bonded to the TMGB with a No. 4 AWG (5 mm) conductor.
5. Connections to the busbar shall be made with 2-hole lugs.
6. Connections shall be made by cleaning the area of connection on the busbar and on the two-hole lug and then applying a thin coating of anti-oxidant compound.

F. TGB
1. The TGB shall be bonded directly to the TMGB and to building steel. Building steel should be tested to verify its ground conductivity to earth.
2. All metallic racks, cabinets, enclosures and raceways for telecommunications cabling located within the same room or space as the TGB shall be bonded to the TGB.
3. Insulate the TGB 51 mm (2") from the wall.
4. Connections to the busbar shall be made with 2-hole lugs.
5. Connections shall be made by cleaning the area of connection on the busbar and on the two-hole lug and then applying a thin coating of anti-oxidant compound.

G. RGB
1. An RGB shall be installed on/in all racks and cabinets.
   a. The paint or other coating of the cabinet/rack shall be removed and the bare metal cleaned around each point where the RGB contacts the cabinet/rack.
   b. A thin coating of anti-oxidant compound shall then be applied to the contact points before the RGB is bolted down.
   c. The mounting screws should be of the thread-forming type, not self-tapping or sheet metal screws, if possible.
2. Each RGB shall be bonded to the TGB or TMGB in the same room with a dedicated RBC.
   1) Each piece of active equipment in a rack/cabinet that has a ground connection point separate from its power source shall be bonded to the RGB.

H. Routing
1. Bonding conductors shall be routed in as direct a route as possible to the point of termination while adhering to the following: No bonding conductor shall vertically traverse a wall except at wall corners.
2. Must not be daisy-chained among equipment, racks or pathways.

3. Shall have no twists, loops or sharp bends. Conductors shall be routed with smooth wide bends.
4. Should not be spliced. When necessary, use an approved Listed connection and position it in an accessible location.
5. Must be protected from physical damage, by its location or with a non-metallic barrier.
6. Should not be placed in metallic conduit. If it is necessary to place grounding and bonding conductors in metallic conduit that exceeds 1 m (3 ft) in length, the conduit must be grounded at both ends to the same ground point as the conductor.
7. Jacketed conductors run in plenum spaces must be plenum rated.
8. The maximum current on any grounding conductor under normal operation should be less than 1A AC and 500mA DC.
9. Shall be sized per code, depending on the length.

I. Mechanical Connections
1. Except where a manufacturer provided grounding lug is provided, the paint or other coating of the component (rack, cabinet, cable tray, etc.) shall be removed and the bare metal cleaned around each point where a conductor lug is connected.
2. A thin coating of anti-oxidant compound shall then be applied to the contact points before the lug is bolted down.
3. Mounting screws should be of the thread-forming type, not self-tapping or sheet metal screws.
4. Cable trays and conduit shall not be used as a grounding conductor, even if they are so rated.
5. Clean ground bars prior to terminating bonding conductors.
6. Torque threaded fasteners to manufacturer’s recommended values.

J. Bonding Jumpers
1. Install manufacturer’s bonding clips, plates or bonding jumpers:
2. Across the joint where sections of cable tray (mesh or ladder) meet.
3. Between a cabinet’s door and its frame.
4. Between all other separate panels of a cabinet and the frame; such as the top, bottom & side panels and air ducting baffles.
5. Across all frame joints of cabinets and racks, unless the cabinet/rack is factory welded and fully assembled on arrival.

K. Cabinet and Rack Continuity
1. As an alternative to using jumpers across all separate parts and frame joints of a cabinet/rack, one of the following options may be used.
2. Remove the paint or other coating of both parts being joined to create a bare metal area at least the same diameter as the bolt head. Clean both bare metal areas and apply a thin coating of anti-oxidant compound before connecting the parts.
3. Use aggressive Type “B” internal-external tooth lock washers. Torque the bolts per manufacturer’s instructions to create an acceptable bond. Two washers are necessary to accomplish this: one under the bolt head contacting and cutting paint and one under the nut.

L. Grounding Lugs
1. Wires shall be inserted to the full depth of the lug.
2. Space between wire insulation and the body of the compression lug shall be kept to a maximum of 3 mm (1/8 in.)
3. Lug must be sized with wire size.
4. To assure proper die is used with the specified connector, manufacturer's embossed coding systems shall be adhered to.
5. Connectors shall not be modified in any way.
6. Daisy chaining and stacking (piggy backing) of ground lugs is prohibited.

7. Bolts, nuts and washers used to secure ground connections shall match the diameter of the hole.
8. Make compression connections with the lug or fitting manufacturer's recommended tooling, with the tooling set to the recommended force and stroke.

M. Cable Tray and Cable Runway
1. Coordinate with the Work of Section 27 05 36 – Cable Trays for Communications Systems
2. Provide manufacturer's bonding clips, plates or jumpers as required to comply with the UL Classified conditions for use as an equipment grounding conductor.
3. Bond the Cable Runway to the Communications Ground Busbar at the Communications Room served.

N. Cable Shields
1. Comply with California Electrical Code Article 800.

O. Protector Fields
1. Comply with California Electrical Code Article 800.

P. Emergency/Information Telephone enclosures
1. Bond as detailed on Communications Drawings.

Q. Communications Broadband Systems
1. Comply with California Electrical Code Article 820.
2. Ground Broadband passives as shown on Communications Drawings.

3.3 LABELING

A. All labels shall be permanent, computer-generated and nonmetallic, printed with wording in high contrast to the background. Comply with Section 27 05 53 - Identification for Communications Systems.

B. Each telecommunications bonding conductor shall be labeled as close as practicable to its point of termination in a readable position. Labels shall have:
1. The statement, "If this connector or cable is loose or must be removed, please call the building telecommunications manager".
2. An identification label providing the source and destination of the grounding conductor.
3. Conductors contained completely within one room need not have the source and destination label.
4. Instead, label the busbar at each connection with the name of bonded equipment (rack, tray, etc.) connected at that point.

C. The BCT, or the conduit containing it, shall be labeled:
1. At the TMGB with tag or adhesive label that states "Building Conductor for Telecommunications (BCT) to Main Electrical Service Ground Connection".
2. At the main electrical service ground connection with tag or adhesive label that states "Building Conductor for Telecommunications (BCT) to Telecommunications Main Grounding Busbar (TMGB)".

3.4 TESTING

A. All grounding connections shall be tested for continuity and resistance after installation but prior to substantial completion. The telecommunications contractor is to invite the University's Representative to witness a portion of this testing while it is being performed.

B. The test performed shall use an earth ground resistance tester that is configured for a continuity test, otherwise known as a two-point test or a “dead earth” test. Tests shall be conducted between the electrical entrance ground and the TMGB as well as at each TGB. This resistance shall be less than 0.05 Ohms.

3.5 GROUNDING AND BONDING OUTSIDE CABLE PLANT (OSP)

A. Underground Communications Structure Ground Rods
   1. Ground rods shall be installed at new communications handholes, vaults and pullboxes installed by the work of this Project. A ground rod shall be installed at new communications handholes, vaults, manholes and pullboxes installed by the work of this Project, or at existing underground structures used by the work of this Project lacking a ground rod.
      a. Provide two ground rods at maintenance holes.
      b. Elsewhere provide one ground rod.
   2. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 4 inches of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.
   3. Ground rods installed in manholes, handholes, or concrete pullboxes shall be connected to cable racks, cable-pulling irons, the cable shielding, metallic sheath, and armor at each cable joint or splice by means of a No. 4 AWG braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths.
      a. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations.
      b. Grounding electrode conductors shall be neatly and firmly attached to manhole or handhole walls and the amount of exposed bare wire shall be held to a minimum.

B. Underground Cable Bonding
   1. Cables used in underground conduit systems have either an outer metallic sheath or a plastic sheath. Cables with an outer metallic sheath shall be bonded at each Maintenance Hole (MH). Cables with an outer plastic sheath shall be bonded at MHs where a splice is made. When using OSP cable for a LAN drop, splices should not be made.

END OF SECTION

SECTION 27 0529

HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the provision of communications supports and cable hook system as described in this specification, including but not limited to:
   1. Strut supports
   2. Cable Hooks (J-hooks)
   3. Beam clamps
   4. Concrete Fasteners
   5. Touch-Up Materials
   6. Conduit supports.
   7. Equipment supports.
   8. Fastening hardware.

B. Related work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
   1. Section 03 30 00 – Cast-in-place Concrete. Concrete equipment pads.
   2. Section 27 05 00 – Common Work Results for Communications
   3. Section 27 05 26 – Grounding and Bonding for Communications Systems
   4. Section 27 05 33 – Conduits and Backboxes for Communications Systems
   5. Section 27 05 36 – Cable Trays for Communications Systems
   6. Section 27 05 48 – Noise and Vibration Controls for Communications Systems
   7. Section 27 05 53 – Identification for Communications Systems
   8. Section 27 10 00 – Structured Cabling, Basic Materials and Methods
   9. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
   10. Section 27 11 23 – Communications Cable Management
   11. Section 27 13 00 – Communications Interior Backbone Cabling
   12. Section 27 15 00 – Communications Horizontal Cabling

1.2 SYSTEM DESCRIPTION

A. Provide devices specified in this Section and related Sections for support of communications equipment specified for this Project.

B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.3 REFERENCES

A. American Society For Testing and Materials (ASTM)
   1. ASTM A123/A123M-02 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   2. ASTM A153/A153M-04 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

3. ASTM B633-98e1 Specification for Electro-deposited Coatings of Zinc on Iron and Steel.
4. ASTM A653/A653M-04a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. American National Standards Institute (ANSI)
1. ANSI/TIA/EIA-568-C.1-2009 Commercial Building Telecommunications Cabling Standard
2. ANSI/TIA-568-D Optical Fiber Cabling Components Standard (2016)
3. ANSI/TIA-569-C-2012 Telecommunications Pathways and Spaces

C. National Fire Protection Association
1. NFPA 70, National Electrical Code

1.4 SUBMITTALS

A. Conform with the requirements of Section 01 30 00 – Administrative Requirements and Section 27 05 00 - Common Work Results for Communications.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

B. Cable hooks shall be listed and labeled by Underwriters Laboratories (UL) as required.

C. Cable hooks shall have the manufacturers name and part number stamped in the part itself for identification.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. General
1. Supports to be sized to suit load and selected to match mounting conditions

B. Manufacturers
1. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
2. Concrete fasteners:
a. Phillips "Red-Head".
b. Remington.
c. Ramset.
d. Hilti
e. Simpson Strong-Tie
f. or equal.
3. Concrete inserts and construction channel:
a. Unistrut Corp.
b. GS Metals "Globe Strut."
c. Thomas & Betts "Kindorf" Corp.
d. Or equal.
4. Conduit straps:
a. O-Z/Gedney.
b. Erico "Caddy" Fastening Products.

c. Thomas & Betts "Kindorf" Corp.
d. Or equal.

5. Beam Clamps
   a. Cooper B-Line
   b. SuperStrut
   c. Unistrut
   d. or equal
6. Aircraft Cable Sway Braces
   a. Mason Industries
   b. M.W. Sausse/Vibrex
   c. Loos & Company, Inc.
   d. or equal.

C. Concrete Fasteners
   1. Provide expansion-shield type concrete anchors.
   2. Provide powder driven concrete fasteners with washers. Obtain approval by Owner's Representative prior to use.

D. Concrete Inserts
   1. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.

E. Aircraft cable sway braces
   1. Steel rope sized to meet load.

F. Construction Channel:
   1. Construction:
   2. 1-5/8" square galvanized channel formed from U.S.S.G No. 12 or 0.109 inch cold formed steel with 17/32-inch diameter bolt holes, and 1-1/2 inch on center in the base of the channel.
   3. 10 foot sections.
   4. All supporting materials by same manufacturer.

G. Beam Clamps
   1. Malleable iron electro-galvanized steel beam clamps selected to match building structural steel members.

H. Conduit Straps
   1. One hole strap, steel or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.
   2. Use malleable strap with spacers for exterior and wet locations.
   3. Use steel strap without spacers for interior locations.
   4. Steel channel conduit strap for support from construction channel.
   5. Steel conduit hanger for pendant support with threaded rod
   6. Steel wire conduit support strap for support from independent #12 gauge hanger wires.

I. Threaded rods, couplings, screws and nuts:
   1. Electrolytically coated with zinc, 2 oz. zinc per square foot of surface, ASTM A123 or A153.

J. Miscellaneous Parts
   1. Hot dipped galvanized after fabrication; after cutting, de-burring and hole drilling. Coated with zinc, 2 oz. zinc per square foot of surface, ASTM A123 or A153.

K. Paint/Tape for Touch-up:
1. Zinc: CRC "Zinc-It", Glyptal, Enterprise Galvanizing “Galambra”, or equal.

2.2 CABLE HANGERS

A. Ceiling Hung J-Hooks
1. Drawing Reference(s):
2. WMJ
3. ACJ
4. Features/Functions/Construction
5. Specifically intended to carry the load of up to 25 communications cables without applying excess forces to cables at bottom of bundle.
6. Integral broad bottom edge to spread cable load with flat bottom and provide a minimum of 1-5/8 inch cable bearing surface.
7. Integral hanger rod attachment hardware at top.
8. Load rated for application.
9. Incorporates smooth 90-degree radiused edges to prevent snagging cable jackets on installation.
10. Designed so the mounting hardware is recessed to prevent cable damage.
11. Integral mechanical cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable.
12. Suitable for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.
13. Multi-tiered cable hooks to be used where required to provide separate cabling compartments, or where additional capacity is needed.
14. Finishes:
a. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.
b. Cable hooks for corrosive areas shall be stainless steel, AISI Type 304.
15. Manufacturer
a. Cooper B-Line series BCH21, BCH32, BCH64, BCH-HBA.
b. Caddy/Erico CableCat
c. or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. The Owner’s Representative reserves the right to request additional supports where in their sole opinion said supports are required. Any additional supports shall be installed at no additional cost to the Owner.

3.2 EXAMINATION

A. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.3 PREPARATION

A. Coordinate size, shape and location of concrete pads required for equipment installation with Base Building General Contractor.

B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.

C. Where shown on the Drawings or Specifications, install freestanding communications equipment on concrete pads.

3.4 INSTALLATION

A. Furnish and install supporting devices as noted throughout the Communications Systems work.

B. Communications device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.

C. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using precast inserts, expansion anchors, preset inserts or beam clamps.

D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster or gypsum board partitions and walls.

E. Use expansion anchors or preset inserts in solid masonry walls.

F. Use self-drilling anchors, expansion anchor, or preset inserts on concrete surfaces.

G. Use sheet metal screws in sheet metal studs and wood screws in wood construction.

H. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or acoustical ceiling suspension wires.

I. Do not drill structural steel members unless first approved in writing by the Owner’s Representative.

J. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

K. Install surface-mounted cabinets with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.

L. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.5 ERECTION OF METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.6 WOOD SUPPORTS

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.7 ANCHORAGE

A. As part of the project submittals, the contractor to provide engineered shop drawings indicating the proposed design for mounting all work of this Division weighing more than 20 pounds, inclusive of mounting systems, and for equipment mounted at the exterior, inclusive of its effective wind load under the range of conditions experience.
   1. Shop drawings to be accompanied by anchorage calculations indicating that it shall remain attached to the mounting surface after experiencing seismic forces in conformance with CBC Sections 1613A and 1614A.
   2. Structural Calculations shall be prepared and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.

3.8 DISTRIBUTION PATHWAY VIA CEILING HUNG CABLE HOOKS (J-HOOKS):

A. Void, Plenum or Suspended Ceiling Exposed Cable Installation. Where drawings specifically show or permit use of exposed cable installation in voids, conform to the most restrictive requirements of Code, TIA-569-B and this Section.

B. Provide support for all cabling. Do not place or attach directly to T-bar grid, concealed spline grid, flexible or rigid ductwork, HVAC registers, sprinkler piping or fixtures, light fixtures or building structure. Conform to the California Electric Code.

C. Placement:
   1. All pathways created by ceiling hung cable hooks shall be reviewed by the Owner's Representative prior to installation.
   2. Ceiling hung cable hooks and cabling supported by same shall not obscure access to access doors, hatches, air dampers, valves, filter sections, VAV boxes, cable trays, junction boxes, pull boxes or similar areas of access required by other trades.
   3. All ceiling hung cable hooks shall be mounted close enough together such that upon completion of the station cable installation a minimum amount of cable droop occurs between adjacent rings. The distance between supporting rings shall not exceed 48 inches or as required by the current edition of TIA-569-B.
   4. Refer to the separation requirements listed in Section 27 15 00 – Communications Horizontal Cabling for minimum distances from electrical power and other electro-magnetic sources.
   5. All cable hook pathways shall be dedicated for use by voice/data cabling. Any cables required for other low voltage systems shall be routed with a separate suspension system.

END OF SECTION

SECTION 27 0533

CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide telecommunications pathways in accordance with EIA TIA/EIA-569-B, as specified in this Section and as shown on the plans. Provide system furniture pathways in accordance with UL 1286. Provision of all low voltage Communications Systems Pathway and Electronic Security and Safety System Pathway, including:
   1. Rigid steel conduit and fittings.
   2. PVC insulated rigid steel conduit and fittings.
   3. Intermediate metal conduit and fittings.
   4. Electrical metallic tubing and fittings.
   5. Flexible metallic conduit and fittings.
   6. Liquidtight flexible metallic conduit and fittings.
   7. Miscellaneous conduit fittings and products.
   8. Junction Boxes
   9. Floor Boxes
   10. Hinged cover enclosures.
   11. Pullboxes and Terminal Cabinets.

B. At Hazardous Occupancies, installation conforms to the requirements of California Electric Code for Class and Division rating of spaces.

C. All conduits and suspension system for conduits for communications cabling shall be dedicated for voice/data cable routing, and shall not be shared with any other cabling system.

1.2 RELATED WORK IN OTHER SECTIONS:

A. Related work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
   1. Section 01 73 29 – Cutting and Patching.
   2. Section 27 05 00 – Common Work Results for Communications.
   3. Section 27 05 26 – Grounding and Bonding for Communications Systems
   4. Section 27 05 29 – Hangers and Supports for Communications Systems
   5. Section 27 05 36 – Cable Trays for Communications Systems
   6. Section 27 05 48 – Noise and Vibration Controls for Communications Systems
   7. Section 27 10 00 – Structured Cabling, Basic Materials and Methods
   8. Section 27 13 00 – Communications Interior Backbone Cabling
   9. Section 27 15 00 – Communications Horizontal Cabling

1.3 REFERENCES

A. Usage: In accordance with Section 01 11 00 – Summary of Work.
   1. American National Standards Institute (ANSI)
      a. ANSI C80.1 1994 Rigid Steel Conduit - Zinc Coated
      b. ANSI C80.3 1991 Electrical Metallic Tubing - Zinc Coated
   2. National Electrical Manufacturers Association (NEMA)

a. NEMA 250-2003 Enclosures for Electrical Equipment (1000 Volts Maximum)
b. NEMA FB 1 (ANSI/NEMA FB 1-2003) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
c. FB 2.10 2000 Selection and Installation Guidelines For Fittings For Use With Non-Flexible Metallic Conduit Or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, And Electrical Metallic Tubing).
d. FB 2.20 2000 Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable
e. NEMA ICS 6 1988 (Rev. 1) Enclosures for Industrial Control and Systems
f. NEMA OS 3-2002 Selection and Installation Guidelines for Electrical Outlet Boxes.
g. NEMA RN 1-1998 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
h. NEMA TC 7 2000 Smooth Wall Coilable Polyethylene Electrical Plastic Duct
i. NEMA TC 13 2000 Electrical Nonmetallic Tubing (ENT).
j. NEMA TC 14 1984(R 1986) Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings

3. Underwriters Laboratories, Inc. (UL)
a. UL 1 2000 Flexible Metal Conduit
b. UL 6 2004 Electrical Rigid Metal Conduit - Steel
c. UL 50 (1995; R 1999, Bul. 2001) Enclosures for Electrical Equipment
d. UL 360 1986 (Bul. 1991) (R 1993) Liquid-Tight Flexible Steel Conduit
e. UL 514A 1991 (R 2004) Metallic Outlet Boxes
f. UL 514B 1989 (R 2004) Conduit, Tubing and Cable Fittings
g. UL 514C 1996 (R 2000) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
h. UL 651 1989 (R 1989) (Bul. 1993) Schedule 40 and 80 Rigid PVC Conduit.
i. UL 797 1993 (R 2004) Electrical Metallic Tubing - Steel
j. UL 1242 1983 (R1993) (Bul. 1993) Intermediate Metal Conduit.
k. UL 1286 (1999; R 2001, Bul. 2002) Office Furnishings
l. UL 1479 Fire Tests of Through Penetration Firestops
m. UL Fire Resistance Directories

1.4 SUBMITTALS

A. Conform with the requirements of Section 01 30 00 – Administrative Requirements and Section 27 05 00 - Common Work Results for Communications.

1.5 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

B. Only products and applications listed in this Section may be used on the project unless otherwise submitted and approved by the Owner’s Representative.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide the following types of conduit systems listed by their commonly used generic name.

2.2 RACEWAY

A. Manufacturers:
1. Raceway:
a. Allied Tube and Conduit Co.
b. Triangle PWC, Inc.
c. Western Tube and Conduit Corp.
d. Spring City Electrical Manufacturing Co.
e. Occidental Coating Co. (OCAL).
f. Alflex Corp.
g. American Flexible Metal Conduit Co.
h. Anaconda.
i. Or equal.
2. Fittings:
a. Appleton Electric Co.
b. OZ/Gedney.
c. Thomas & Betts Corp.
d. Spring City Electrical Manufacturing Co.
e. Occidental Coating Co. (OCAL).
f. Carlon.
g. or equal.

B. Rigid Steel Conduit.
1. Drawing and Spec Reference: RSC.
2. Construction:
a. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.
b. Standard threaded couplings, locknuts, bushings, and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.
c. Three piece couplings: Electroplated, cast malleable iron.
d. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150 degree C minimum.
e. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
f. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150 degrees C.
g. All fittings and connectors shall be threaded.

C. Coated Rigid Steel Conduit:
1. Drawing and Spec Reference: CRSC.
2. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
3. Fittings:
a. Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.
b. Fittings over-sleeve to extend 1 conduit diameter or 1-1/2" beyond fitting, whichever is less.
4. Performance:
a. Tensile Strength: 3500 psi.
5. Approvals:
a. NEMA RN1 (Type 40 - 40 mils thick)

b. CalTrans Type 2

6. Manufacturers:
   a. Plastibond by RobRoy Industries.
   b. Occal-40 by Occidental Coating Company.
   c. KorKap by Plastic Applicators.
   d. Ocal-Blue
   e. or equal.

D. Intermediate Metal Conduit
1. Drawing Reference: IMC
2. Conduit: Hot dip galvanized steel meeting the requirements of CEC Article 345 and conforming to ANSI C80.6 and UL 1242.
3. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

E. Electrical Metallic Tubing.
1. Drawing and Spec Reference: EMT.
2. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 specifications and shall meet UL classifications.
3. Set screw type couplings: Electroplated, steel or cast malleable iron, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of case hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
4. Set screw type connectors: Electroplated steel or cast malleable iron UL listed concrete tight with male hub and insulated plastic throat, 150 degree C temperature rated. Setscrew shall be same as for couplings.
5. Raintight couplings: Electroplate steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.
6. Raintight connectors: Electroplated steel or cast malleable iron, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.

2.3 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

A. General
1. UL 514B.
2. Listed in UL Electrical Construction Materials List.

B. Conduit Fittings, Insulated Throat Grounding Bushings
1. Description
   a. Threaded for Rigid Steel Conduit and Intermediate Metal Conduit.
   b. UL Listed for use with copper conductors.
   c. Thermoplastic insulated liner for 105 degrees Celsius.
   d. Body of malleable iron, zinc plated; or die cast zinc.
2. Manufacturer
   a. Thomas & Betts (Steel City) BG-801 Series
   b. O-Z/Gedney
   c. or equal.

C. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.

D. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.

E. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.

F. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate .75-inch deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless steel jacket clamps. Unit shall comply with UL467 and UL514.
   1. Manufacturer:
      a. OZ/Gedney Type DX
      b. Steel City Type EDF
      c. or equal.

G. Fire rated penetration seals:
   1. UL classified.
   2. Conduit penetrations in fire rated separation shall be sealed with a UL classified assembly consisting of fill, void or cavity materials.
   3. The fire rated sealant material shall be the product best suited for each type of penetration, and may be a caulk, putty, composite sheet or wrap/strip.
   4. Penetrations of rated floors shall be sealed with an assembly having both F and T ratings at least equal to rating of the floor.
   5. Penetrations of rated walls shall be sealed with an assembly having an F rating at least equal to the rating of the wall.

H. Standard products not herein specified:
   1. Submit for review a listing of standard electrical conduit hardware and fittings not herein specified prior to use or installation, i.e. locknuts, bushings, etc.
   2. Listing shall include manufacturers name, part numbers, and a written description of the item indicating type of material and construction.
   3. Miscellaneous components shall be equal in quality, material, and construction to similar items herein specified.

I. Hazardous area fittings: UL listed for the application.

2.4 JUNCTION AND DEVICE BOXES

A. 5” Square Junction Box
   1. Drawing References: As indicated on Symbol Schedule
   2. Construction
      a. 5 in. Square x 2.875 in. Deep Metal backbox with an integral cable management system.
      b. Use on Class 2 and Class 3 Remote-Control, Signaling and Power-Limited Circuits only.
   3. Manufacturer
      a. Randl Industries, Inc. 5 Square Telecommunications Outlet Box T-55017 with D-51G000 one gang ring.
      b. Or equal.

B. Flat Panel Wall Box
   1. Drawing reference: FPWB
   2. Features, functions and construction:
      a. Box provides means to install audiovisual, network and power receptacles flush in wall behind flat-panel display. With box cover installed, connectors are concealed and cables, both power and communications pass through slot at base of cover plate into connection points on back of flat-panel.
      b. Cover plate protrudes less than 1/2" from face of wall.
      c. 16 gauge box construction with 1/16" inch thick minimum cover plate, white finish baked enamel or powder coat, field paintable
      d. Box incorporates provisions to mount up to two electrical device boxes for provision of duplex power receptacles either from above or below.
      e. Additionally box mounts manufacturers low-voltage conduit entry box which accommodates manufacturer's line of audiovisual connector inserts. Design of FPWB permits installation of up to two low-voltage conduit entry boxes, which may be mounted either above or below the FPWB.
      f. Manufacturers audiovisual insert line shall support at least the following receptacles:
         1) BNC, in combinations of 1 to 5 BNC's, color-coded for composite, component analog and RGBHV video formats, as required.
         2) RCA, in combinations of 1 to 3 RCA's color-coded for Composite and component analog video formats, as required.
         3) S-Video.
         4) XLR, 3 and 4 pin
         5) DB-15
         6) DB-9
         7) Neutrik Speakon.
         8) DVI
         9) HDMI
         10) 1/4" and mini TRS.
      g. Provide with manufacturer's connector inserts as required to terminate cabling types and applications indicated on the single-line diagrams. Punch blank panel inserts and provide other receptacle types as required or indicated to fulfill the requirements of the contract documents. Fill remaining openings with blank inserts.
   3. Manufacturers:
      a. FSR Inc. PWB-100, with connectors and inserts from manufacturer's IPS series.
      b. Wiremold EFSB4 Wall Box.

2.5 CABINETS AND ENCLOSURES

A. Terminal Cabinets:
   1. Drawing Reference: As Scheduled.
   2. Construction:
      a. Zinc Coated Sheet Steel, code gauge with standard concentric knockouts for conduit terminations.
      b. Interior dimensions not less than those scheduled.
      c. Finish: Manufacturer's standard gray baked enamel finish.
      d. Covers: Trim fitted, continuous hinged steel door, flush catch – lockable and keyed to match. Screw fastened doors not acceptable.
         1) Door face to be not less than 95% of panel interior dimensions.
      e. Provide with 3/4" fire retardant treated ply backboard.
   3. Mounting:

a. Flush cabinets shall be furnished with concealed trim clamps and shall be not less than 4 inches deep.
b. Surface cabinets shall be furnished with screw cover trim, flush hinged door and shall not be less than 6 inches deep.
c. Interior Applications:
1) NEMA 250 Type 1, unless otherwise noted. Refer to plans and schedules.
d. Exterior Applications:
1) NEMA 250 Type - As Scheduled, not less than NEMA 3R.

4. Manufacturers:
a. B-Line Electrical Enclosures
b. Circle AW Products.
c. Hammond
d. Henessey.
e. Hoffman.
f. Myers Electric Products
g. Rittal.
h. or equal.

2.6 FLOOR BOXES, POKE-THROUGHS AND MONUMENTS

A. Floor Box, Cast Iron, Recessed Devices, with Lid Designed to meet UL Scrub Water Listing
1. Drawing Reference: FC3
2. Construction
a. Use in above grade and on-grade floor applications.
b. Boxes shall have the ability to accept a component that will allow the box to be installed in polished concrete or terrazzo floors.
c. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors.
d. Dimension: 15-1/8” L x 11-3/16” W x 6” H
e. Eight (8) independent wiring compartments that allow for up to eight (8) duplex receptacles, communication and/or audio/video services.
f. Removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments.
g. The compartments shall be removable from the top of the floor box with two (2) cable guides to organize and maintain the cables egress out of the box.
h. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2” [12.7mm] post-concrete pour adjustment.
i. The box shall be able to accept 2-3/4” x 4-1/2” standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, data connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.
3. Manufacturers
a. Wiremold EFB8S-OG Floor Box. Provide EFB610xxxxx Cover Assemblies to match floor conditions. The Architect will select the finish. Provide internal device brackets to match specified communications devices and plates. Coordinate electrical rough-in with requirements of Division 26. Provide rough-in as required to mount specified communications fill.
b. or equal (No known equal).

B. AV and Data Floor Box, High Capacity
1. Plan Reference: FC6

2. Features
   a. UL Listed
   b. Box
      1) Size at least 13.5 inches by 12 inches by 6 inches deep.
      2) Two compartments, with standard electrical plate mounting brackets.
      3) The back boxes contain two identical angled mounting brackets and either side can be configured up to six gangs per side.
   c. Knockouts of 2 inch and concentric combination of 1 inch, 1.25 and 1.5 inch.
   d. At least 11 gage steel.
   e. Within cover, provide a lift-off, full-access door, open area approximately 6.5 inches by 8 inches.
   f. Within the lift-off, full-access door, provide a hinged, fold-back cable exit port.
   g. Open area of cable pass-through approximately 2 inches by 2 inches.
   h. Flush in closed position.
3. Approvals:
   a. UL listed.
4. Manufacturers
   a. FSR Inc.FL-600P-xxx-6. Cover assemblies to match floor conditions. The Architect will select the finish. Provide manufacturer's “Pour Pan” FL-GRD2 or FL-GRD4 to protect from moisture at installations at grade level. Coordinate electrical rough-in with requirements of Division 26. Provide rough-in as required to mount specified communications fill.
   b. Or equal (No known equal).

PART 3 - EXECUTION

3.1 CONDUIT APPLICATION

A. General: Install the following types of conduits and fittings in the locations listed, unless otherwise noted in the drawings:
   1. Exterior, Exposed:
      a. Type RSC for applications up to 8 feet AFF or to first pull box, whichever is first, applications subject to physical abuse or for applications greater than 4" diameter.
   2. Interior, Exposed, Wet and Damp Locations:
      a. Type RSC.
      b. At interior locations over 8 feet above finished floor, EMT acceptable.
   3. Interior, Hazardous Locations
      a. Type RSC
      b. Type IMC, where permitted by the CEC.
   4. Interior, exposed or concealed, dry locations:
      a. RSC, if subject to physical abuse.
      b. EMT, if not subject to physical abuse.
   5. Interior, concealed, damp locations, including in masonry walls.
      a. RSC
   6. Embedded in Concrete
      a. RSC or rigid non-metallic conduit.
      b. PVC Type DB-120.
   7. Transition from walls to open plan furniture systems:
      a. Liquidtight

3.2 GENERAL REQUIREMENTS

A. Refer to the manufacturer's instructions and conform thereto.

B. Distribution Pathway via EMT Raceway:
1. The EMT conduit is to be installed meeting the NEC handbook Article 348 Installation Specifications.
2. Provide escutcheon plates for all through wall conduit stubs.
3. All ends of conduits shall be cut square, reamed and fitted with insulated bushing.
4. All conduit which passes through fire walls shall be sealed with fire stop putty after all station wire has been installed.

3.3 MOUNTING AND INSTALLATION – DEVICE BOXES

A. Conform to the more restrictive of NEMA OS 3-2002 and the following.

B. Provide backboxes at all communications systems devices. Installation of device plates directly to wall surface without use of a backbox, unless specifically directed on plans, is unacceptable.

C. The distance between pull boxes shall not exceed 150 feet or more than two 90 degree bends.

D. Align boxes plumb with floor and surrounding construction. At door frames, locate 4" from frame. Verify placement with Owner’s Representative details to ensure that box clears all trim, etc.

E. Support and fasten boxes securely. At stud walls use rigid bar hangers, attached to hanger with stud and nut.

F. At existing locations, provide cutting, patching and finishing as required to maintain or restore finishes so that resulting installation is integrated into the Architectural decor of the particular location.

G. Mounting Height: the mounting height of a wall-mounted outlet box is defined as the height from the finished floor to the horizontal center line of the cover plate.

H. Mount outlet boxes with the long axis vertical. Three or more gang boxes shall be mounted with the long axis horizontal.

I. Install wiring jacks and outlet devices only in boxes which are clean; free from excess building materials, dirt, and debris.

J. Install wiring jacks and outlet devices after wiring work is complete.

3.4 TERMINAL CABINETS, JUNCTION BOXES AND PULL BOXES

A. General
1. Thoroughly examine site conditions for acceptance of cabinets and enclosures installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

B. Set cabinets and enclosures plumb and symmetrical with building lines. Furnish and install all construction channel bolts, angles, etc. required to mount all equipment furnished under this Section of the Specifications.

C. Cabinets and enclosures shall be anchored and braced to withstand seismic forces calculated in accordance with standards referenced in Section 27 05 29.

D. "Train" interior wiring, bundle and clamp using specified plastic wire wraps. Separate power and signal wiring.

E. Replace doors or trim exhibiting dents, bends, warps or poor fit that may impede ready access, security or integrity.

F. Terminate conduit in cabinet with lock nut and grounding bushing.

G. Cleaning
1. Touch-up paint any marks, blemishes or other finish damage suffered during installation.
2. Vacuum clean cabinet on completion of installation.

3.5 SUPPORT

A. Provide supports for raceways as specified in Section 27 05 29 – Hangers and Supports for Communications Systems.

B. All raceways installed in exposed dry locations shall be grouped in a like arrangement and supported by means of conduit straps, wall brackets or trapeze hangers in accordance with Code and the requirements of the this Section and Section 27 05 29 – Hangers and Supports for Communications Systems. Fasten all hangers from the building structural system.

C. Provide supports and mounting attachments per the most restrictive of Code and the following.

Raceway Size (inches)	No of cables in run	Location	Support Spacing (feet)	
			RSC	EMT
Horizontal Runs				
½, 3/4	1-2	Flat Ceiling Wall Runs	5	5
½, 3/4	1-2	Where access limited to building structure	7	7
½, 3/4	3≥	Any location	7	7
1≥	1-2	Flat ceiling or wall	6	6
1≥	1-2	Where access limited to building structure	10	10
1≥	3≥	Any locations	10	10
Any	Any	Concealed	10	10
Vertical Runs				
½, 3/4	Any	Exposed	7	7
1, 1-1/4	Any	Exposed	8	8
1-1/2≥	Any	Exposed	10	10

D. Install no more than one coupling or device between supports.

E. Conduit support
1. As specified in Section 27 05 29 – Hangers and Supports for Communications Systems

F. The Owner's Representative reserves the right to request additional supports where in their sole opinion said supports are required. Any additional supports shall be installed at no additional cost to the Owner.

3.6 PENETRATIONS

A. Gypsum Wall Board Penetrations: Provide circular penetrations maximum 1/8" inch larger than outer diameter of conduit being used. On both sides of the wall fill space between conduit and wall with joint compound, depth to match gypsum board thickness.

B. Install UL listed fire-stop system whenever a raceway penetrates a firewall in conformance with the manufacturer's directions, the published systems assembly requirements, CBC Section 709 and 710 and CEC 300-21, whichever is the most restrictive. At cable tray penetrations, provide pillow type removable fire stop per CBC Section 709 and 710, the published systems assembly requirements and the manufacturer's directions, whichever is the most restrictive.

C. All communications systems conduit openings in walls and floors are the responsibility of the Contractor. Install sleeves shown on the drawings when the concrete is poured. Any openings required after the concrete has set maybe core drilled.

3.7 RACEWAY INSTALLATION, GENERAL

A. Raceway runs are shown schematically. Install concealed unless specifically shown otherwise. Supports, pull boxes, junction boxes and similar generally not indicated. Provide where designated.
1. Install exposed conduit and raceway parallel and perpendicular to nearby surfaces or exposed structural members, and follow the surface contours. Level and square conduit and raceway runs.
2. Raceway runs shall be mechanically and electrically continuous between all each equipment rack and utility demarcation point, receptacle and/or surface raceway strip, as applies.
3. Each conduit shall enter and be securely connected to a cabinet, junction box, pull box, or outlet by means of a locknut on the outside and a bushing on the inside or by means of a liquid-tight, threaded, self-locking, cold-weld type wedge adapter.
4. Bends
a. All bends or elbows shall have a minimum radius as follows:

Conduit Size	Min. Radius (Inches)
3/4"	8
1"	12
1-1/4"	18
2"	24
2-1/2"	24
3"	30
3-1/2"	30
4"	30

5"	36
6"	42

b. Use factory elbows or machine bends for conduit bends 1-1/4" and larger.

5. Make bends and offsets so the inside diameter is not effectively reduced. Make bends in parallel or banked runs from the same center line so that the bends are parallel.
6. Install at least one (1) 3/8", 200 pound strength nylon pull cord in all empty raceways.
7. Raceways crossing building expansion joints or in straight runs exceeding 100 feet shall be provided with UL listed expansion fittings.
8. Install conduit seals and drains to prevent accumulated moisture in conduits from entering Communications System enclosures.
9. Conduit fill shall not exceed 40% of the conduit's cross-sectional area.

B. Do not install conduit in concrete slabs unless specifically directed by Owner's Representative. Embedded conduits in concrete slab walls, and columns shall be installed in center third between upper and lower layers of reinforcing steel as directed by the Owner's Representative. Space conduits 8" on center except at cabinet locations where slab thickness shall be increased as directed by the Owner's Representative.

C. All conduits to be kept 12" away from steam or hot water lines. Install horizontal conduit and raceway runs below water and steam piping.

D. Conduit dropping down to equipment shall be as straight as possible without any offsets, parallel or perpendicular to walls, ceilings and other building features.

E. Conduit installed on any equipment shall be run symmetrical with the equipment and in such a manner as to:
1. not to be exposed to damage;
2. not interfere with access to components of the equipment that will interfere with maintenance operation or;
3. not to be in a manner that the Owner deems detrimental to its operation.

F. Whenever an installation such as that listed occurs, the Contractor shall make all necessary changes at no additional cost to the Owner.

G. All cut ends of conduit, scratches, tool marks, etc. on any metallic raceway installed in the ground or on the exterior of the building shall be treated with two coats of specified Touch Up Paint/Tape.

H. Exposed conduit and metallic surface raceway installed in finished spaces shall be painted to match surrounding surfaces using paint and methods directed by the Owner's Representative.

I. All raceways stubbing up into equipment or racks shall be sealed. Raceways with conductors shall be plugged with duct-seal. Spare raceways shall be capped. Prevent foreign matter from entering conduit and raceway; use temporary closure protection. Replace conduits containing concrete, varnish or other foreign material.

J. Complete installation of conduit and raceway runs before starting installation of cables/wires within conduit and raceway.

K. Use specified conduit and raceway fittings that are of types compatible with the associated conduit and raceway and suitable for the use and location. Join and terminate conduit and

raceway with fittings designed and approved for the purpose of the conduit and raceway system and make up tight.

L. Where chase nipples are used, align the raceway and coupling square to the box and tighten the chase nipple so no threads are exposed.

M. Horizontal conduit or EMT runs, where required and permitted, shall be installed as close to ceiling or ceiling beams as practical.

N. Conduit and EMT connected to wall outlets shall be run in such a manner that they will not cross water, steam or waste pipes or radiator branches.

O. Conduit and EMT shall not be run through beams, purlins or columns except where permission is granted by Owner's Representative in writing.

P. Bond installed metallic raceway in accordance with the requirements of the CEC.

END OF SECTION

SECTION 27 0536

CABLE TRAYS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Cable Trays for Communications Cabling
   1. Cable Trays
   2. Cable Runways

B. Cable Tray Support

1.2 RELATED WORK UNDER OTHER SECTIONS

A. Section 27 05 00 – Common Work Results for Communications

B. Section 27 05 26 – Grounding and Bonding for Communications Systems

C. Section 27 05 29 – Hangers and Supports for Communications Systems

D. Section 27 05 33 – Conduits and Backboxes for Communications Systems

E. Section 27 05 48 – Noise and Vibration Control for Communications Systems

F. Section 27 05 53 – Identification for Communications Systems

G. Section 27 10 00 – Structured Cabling, Basic Materials and Methods

H. Section 27 13 00 – Communications Interior Backbone Cabling

I. Section 27 15 00 – Communications Horizontal Cabling

1.3 REFERENCES

A. Usage: In accordance with Section 01 11 00 – Summary of Work.
   1. National Electrical Manufacturers Association (NEMA)
      a. NEMA FG 1 1-1998 Fiberglass Cable Tray Systems
      b. NEMA VE 1 1-1998 Metal Cable Tray Systems.
      c. NEMA VE 2 2001 Metal Cable Tray Installation Guidelines

1.4 SUBMITTALS

A. Conform with the requirements of Section 01 30 00 – Administrative Requirements and Section 27 05 00 Common Work Results for Communications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 01 60 00 – Product Requirements.

PART 2 - PRODUCTS

2.1 CABLE TRAY AND CABLE RUNWAY

A. Ladder Type Cable Tray (To be installed at Telecom Room 317, Bldg 2)
1. Drawing and spec reference: CT xx-y, where "xx" denotes nominal width of cable runway in inches and “y” denotes nominal depth.
2. Construction:
a. Two longitudinal aluminum members (side rails) with transverse members (rungs) mechanically fastened to the side rails.
b. Rungs 9" on center, unless otherwise noted and shall be capable of easy removal, reinstallation, or replacement if necessary.
c. Rung spacing in radiused fittings shall be 9” o.c. as measured at the center of the tray’s width.
d. UL Classified splice kits.
e. Accessories. Provide with a complete system of accessories, including radiused corners at vertical and horizontal bends, section splice plates, expansion plates, blind-end plates, etc. Provide waterfall drop-outs at each end of cabling racks and cabinets indicated on the plans scheduled or indicated to terminate open wiring systems.
3. Approvals:
a. ASTM A513
b. National Electrical Code, Article 318
c. NEMA VE1 Class 12C minimum, or to suit indicated cable and raceway loads, whichever is greater.
4. Manufacturers:
a. B-Line Redi-Rail Aluminum Ladder Type Cable Tray with a complete system of accessories, including Ladder Drop-outs
b. Legrand
c. or equal.

B. Solid Bottom Cable Tray (To be installed at Hallways #132, #203, #210, #211 and #227)
1. Drawing and spec reference: CTS xx-y, where "xx" denotes nominal width of cable runway in inches and “y” denotes nominal depth.
2. Construction:
a. Two longitudinal steel members (side rails) with solid bottom.
b. Pre-Galvanized Steel
c. Paint the cable tray
1) Color: White, RGB value 229 225 216. Coordinate finish with Architect.
3. Approvals:
a. ASTM A653SS Gr. 33 G90 (Pre-Galvanized)
b. National Electrical Code, Article 318
c. NEMA VE1 Class 12C minimum, or to suit indicated cable and raceway loads, whichever is greater.
4. Manufacturers:
a. B-Line Series 1 Non-Ventilated Bottom Type Cable Tray with a complete system of accessories
b. Legrand
c. or equal.

C. Cable Runway (To be installed at Bldg 1 - MPOE, IDF Room 141 and IT Room 235)
1. Drawing and spec reference: CR*, where "*" denotes nominal width of cable runway in inches.
2. Construction:
a. Solid Steel Side Bar per ASTM A-36 or Tubular Steel Side Bar per ASTM A-513.

b. 1.5" x 0.375 minimum tubular side stringers.
c. UL Classified splice kits.
d. Designed to support at least 100 pounds per foot load with a Safe Working Load deflection of ½" or less.

3. Finish: Telco gray powder coat or gold on zinc plating.
4. Approvals:
   a. ASTM A513
   b. UL Classified as an equipment grounding conductor.
   c. California Electrical Code, Article 318
5. Manufacturers:
   a. B-Line Telecom-Saunders SB-17.
   b. Chatsworth Products Inc. 11275 series.
   c. PW Industries
   d. or equal

D. Basket Cable Tray, Open Wire Frame (To be installed in Radio Room 319, Bldg 2)
1. Drawing and spec reference(s): CTW xx-y , where xx denotes the tray width and y the depth of the tray, in inches.
2. Construction
   a. Welded wire mesh with continuous safety edge wire lip.
   b. Mesh forms grid at nominally 2" by 4"
   c. Carbon Steel
   d. Electroplated zinc galvanized
   e. All bends, seams and joints field fabricated from basic straight section pieces and splice components as supplied by the manufacturer.
   f. Provide a complete system of accessories, including bonding and grounding connections, conduit connectors, to terminate conduits extended to basket edge, radius shields to protect cabling at inside corners, and waterfall drop-outs at each end of cabling racks and cabinets indicated on the plans scheduled or indicated to terminate open wiring systems.
   g. Provides pathway complying with ANSI/TIA-569C and NEMA Publications VE1 & VE2
   h. Meets requirements of National Electrical Code, Article 318
3. Approvals:
   a. NEMA Publications VE1 & VE2
4. Manufacturers:
   a. B-Line Wire Basket Runway
   b. Cablofil

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Provide all required supports, fittings and accessories for a complete system as described in NEMA VE-2, by Code, manufacturer recommendation or as shown on the plans, whichever is most restrictive.

B. Bond sections to one another and to building ground.

C. Access Clearance. Maintain access for use by District's personnel to tray as described below. Coordinate installation with work of structural, mechanical, plumbing/fire protection and electrical trades to maintain required access.
1. Unless shown otherwise on the plans, provide a clear access of at least 24" wide along one side of each tray for use by District's personnel.

2. Unless shown otherwise on the plans, installation to maintain at least 12" vertical clearance over the top of each tray for use by District's personnel.

3.2 SUPPORT

A. Support in accordance with the most restrictive of the following:
1. Contractor’s engineered means of engineered support submitted in accordance with the requirements of 27 05 00 – Common Work Results for Communications and Section 27 05 29 – Hangers and Supports for Communications Systems.
2. California Building Code, including but not limited to requirements of Volume 2, Chapter 16, Division IV, Section 1632 and Table 16-O.
3. Metallic Cable Tray: NEMA VE 2-2001, or latest edition
4. Fiberglass Cable Tray: NEMA FG-1-1998, or latest edition.

B. Provide lateral sway bracing as required by Code.

END OF SECTION

SECTION 27 0543

UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials, transportation and equipment to complete the furnishing, installation, assembly, and set up of the Communications System Raceway, Conduit and Backbone work indicated on the drawings and specified herein. Notwithstanding any detailed information in this Section, provide complete, contiguous working raceway systems.

B. Communications Outside Plant Ductwork - refer to the drawings for demarcation of the work of this Project.
   1. Communications Outside Plant Ductwork.
   2. Communications Manholes
   3. Communications Pullboxes
   4. Connection of underground ductbanks to campus buildings

1.2 RELATED WORK IN OTHER SECTIONS:

A. Section 31 23 17 – Trenching, Backfilling, and Compacting

B. Section 03 30 00 – Cast-In-Place-Concrete

C. Section 27 05 00 – Common Work Results for Communications Systems.

D. Section 27 05 26 – Grounding and Bonding for Communications Systems

E. Section 27 05 33 – Communications, Raceways, Boxes and Fittings

1.3 REGULATORY REQUIREMENTS

A. In addition to requirements of Division 1, comply with the following.
   1. Public Utilities Commission of the State of California.
      a. Rules for Overhead Electric line Construction, General Order No. 95 inclusive of all Decisions or Resolutions thereto authorized with Date Effective up to and including 30 days prior to the bid opening day.
      b. Rules for Underground Electric Line Construction, General Order No. 128 inclusive of all Decisions or Resolutions thereto authorized with Date Effective up to and including 30 days prior to the bid opening day.

1.4 REFERENCES

A. Usage: In accordance with Division 1.

B. BICSI
   1. 2004 Customer Owned Outside Plant Design Manual

C. American National Standards Institute (ANSI)
   1. ANSI C80.1 1990 Rigid Steel Conduit - Zinc Coated

D. State of California, Business, Transportation and Housing Agency, Department of Transportation (CalTrans)

1. Standard Specifications, July, 1999, or latest edition.
2. Standard Plans, July 1999 or latest edition.

E. National Electrical Manufacturers Association (NEMA)
   a. NEMA 250-2003 Enclosures for Electrical Equipment (1000 Volts Maximum)
   b. ANSI/NEMA FB 1-2003 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
   c. FB 2.10 2000 Selection and Installation Guidelines For Fittings For Use With Non-Flexible Metallic Conduit Or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, And Electrical Metallic Tubing).
   d. FB 2.20 2000 Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable
   e. NEMA FG 1 1-1998 Fiberglass Cable Tray Systems
   f. NEMA ICS 6 2001 Industrial Controls and Systems Enclosures
   g. NEMA RN 1 1998 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   h. NEMA TC 2 2003 Electrical Polyvinyl Chloride (PVC) Conduit
   i. NEMA TC 3 1999 PVC Fittings for Use with Rigid PVC Conduit and Tubing
   j. NEMA TC 6&8 2003 PVC Plastic Utilities Duct for Underground Installations
   k. NEMA TC 7 2000 Smooth Wall Coilable Polyethylene Electrical Plastic Duct
   l. NEMA TC 9 1999 Fittings for ABS and PVC Plastic Utilities Duct for Underground Application
   m. NEMA TC 14 1984(R 1997) Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings
   n. NEMA TC 19 2001 Nonmetallic Riser U-Type Guards
   o. NEMA VE 1 1-1998 Metallic Cable Tray Systems.
   p. NEMA VE 2 2001 Cable Tray Installation Guidelines
2. Underwriters Laboratories, Inc. (UL)
   a. UL 6 2004 Electrical Rigid Metal Conduit - Steel
   b. UL 360 1986 (R 2003) Liquid-Tight Flexible Steel Conduit
   c. UL 514A 1991 (R 2004) Metallic Outlet Boxes
   d. UL 514B 1989 (R 2004) Conduit, Tubing, and Cable Fittings
   e. UL 514C 1988 (R 1996) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
   f. UL 651 1989 (R 1995) Schedule 40 and 80 Rigid PVC Conduit.

1.5 SUBMITTALS

A. Conform with the requirements of Division 1 and Section 27 05 00 Common Work Results for Communications.

1.6 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Division 1.

1.7 SEQUENCING

A. Not Used.

PART 2 - PRODUCTS

2.1 DUCTBANK CONSTRUCTION

A. PVC Conduit
   1. Drawing and Spec Reference: PVC.
   2. Construction:

a. 4" trade diameter, unless otherwise noted.
b. Poly-vinyl chloride.
c. Schedule by Application
   1) Straight segments, Schedule 40.
   2) Flat elbows, Schedule 40.
   3) Vertical elbows sweep up to grade, Schedule 80.
   4) Above grade, Schedule 80.
d. Elbows.
   1) Where innerduct liner is scheduled – CRSC.
   2) Elsewhere, Schedule 80.
   3) 90° C rated.
   4) Solvent welded joints, joints by pipe manufacturer.
e. Application.
   1) Soil Backfill/Direct Burial
      a) RUS Type II, Type C or Type DB
      b) Schedule 40.
   2) Concrete Encasement:
      a) PVC Type DB-120,
      b) RUS Type I, Type B or Type EB
      c) Any meeting Soil Backfill/Direct Burial.
   3) Boring
      a) HDPE.
      b) RUS Type Flexible Plastic.
f. Performance:
   1) Tensile Strength: 7,000 psi at 73.4° F.
   2) Flexural Strength: 11,000 psi.
   3) Compressive Strength: 8,600 psi.
g. Approvals:
   1) RUS Listed for Telephone Cable Installation 5-99 Edition, or latest release thereof.
   2) NEMA TC-2, PVC Type EPC-40 and EPC-80.
   3) NEMA TC-3.
   4) NEMA TC14 Fiberglass Conduit.
   5) UL 514 fittings.
   6) UL 651.
   7) ANSI C33.91.
h. Manufacturers:
   1) RUS Listed:

Manufacturer	RUS Listed for	Manufacturer Part Number
Allwire, Inc.	Flexible plastic	ALLDUCT
American Pipe & Plastics	Plastic	Type B, C, and D
	Plastic	Type EB and DB
	Plastic	PVC Multi-Duct (2,3,4 and 6-way)
Americon International	Flexible plastic	HDPE Duct
	Plastic	PVC Type C
Apache Plastics, Inc.	Plastic	Type EB and Type DB
ARMCO	Plastic	Smooth-Cor Type B and Type C
Arnco	Flexible plastic	HDPE Conduit
Bay Plastics, Inc.	Plastic	Type B and Type C
Bristolpipe	Plastic	Type B, C, and D
	Plastic	Type EB and Type DB
Can-Tex	Plastic	Type EB and Type DB
	Plastic	Type B, C, and D

Carlon	Plastic	Type EB and Type DB
	Plastic	Type B, C, and D
	Plastic	Multi-Gard
Certain-Teed Products Corp.	Plastic	Type EB and Type DB
CIBA-GEIGY	Fiberglass	T & D Conduit
Condux International, Inc.	Concrete	Condux
	Plastic	Type EB and Type DB
CSR Polypipe	Flexible plastic	HDPE Duct
Dura-line	Flexible plastic	HDPE Duct
Eagle Pacific Industries, Inc.	Plastic	Type EB and Type DB
	Flexible plastic	HDPE Coiled Duct
Endot Industries	Flexible plastic	HDPE Duct
Freedom Plastics, Inc.	Plastic	Type C
Hercules, Inc.	Flexible plastic	Corflo plastic conduit
Hurlbut Plastic Pipe	Plastic	Type C
Ingomar Plastic Pipe	Plastic	Type B and Type C
J-M Manufacturing Company	Plastic	Types C, EB, and DB
Kyova	Plastic	Type EB and Type DB
SCP National Plastics, Inc.	Plastic	Type EB and Type DB
	Plastic	Type B and Type C
Northern Pipe Products	Plastic	Type B, C, and D
OMNI	Flexible plastic	HDPE Duct
Petroflex	Flexible plastic	HDPE Duct
	Flexible plastic	Corrugated HDPE Duct
Phillips Products Co., Inc.	Flexible plastic	Driscon 3200
Phone Ducs	Plastic	Multiple plastic conduit (4, 6, & 9 Way)
PLEXCO	Flexible plastic	PLEXCO Duct
PWPipe	Plastic	Type EB and Type DB
Pyramid Industries, Inc.	Plastic	Type EB and Type DM
	Flexible plastic	HDPE Conduit
Quail Plastics	Plastic	Type EB and Type DB
Queen City Plastics	Plastic	Type EB and Type DB
River City Plastics	Plastic	Type EB and Type DB
Sedco	Plastic	Type EB and Type DB
Southern Pipe, Inc.	Plastic	PVC Types EB, DB, and Sch. 40
Tamaqua Cable Products	Flexible plastic	HDPE Duct
Tridyn Industries	Plastic	Type EB and Type DB
Vassallo Industries	Plastic	Type B and Type C
Wesflex	Flexible plastic	Flex-Con

2) or equal

2.2 FITTINGS

A. Couplings, adaptors, transition fittings, etc., shall be molded PVC, slip on, solvent weld type conforming to NEMA TC3 for Schedule 40 or 80 and NEMA TC 9 for type EB or DB.

B. Fitting Types
1. Expansion Fittings, 12", Metallic:
2. Function: At road or bridge expansion joints requiring up to 12" of expansion compensation.
3. Approvals:
a. CalTrans

4. Construction
   a. Steel, hot dip galvanized.
   b. Nylon wear bushings
   c. O-ring seal
   d. Bonding jumper
5. Manufacturers:
   a. O-Z Gedney Type AX, Type AX-8, and Type EX fittings with Type BJ Bonding Jumper.
   b. TVC/Vikimatic VB0285X series.
   c. Or Equal.

C. Expansion Fittings, 6", Non-metallic:
1. Function: At road or bridge expansion joints requiring up to 6" of expansion compensation.
2. Construction
   a. Fiberglass
   b. Provide bonding jumper.
3. Manufacturers:
   a. TVC Communications HW or Extra Heavy Wall Expansion Joint.
   b. Vikimatic
   c. FRE Composites, Inc.
   d. Or Equal.

D. Caps, Underground Conduit Stubs
1. Provide at each location indicated for future expansion.
2. Wateright.
3. Manufacturers:
   a. Carlon E985N
   b. Vikimatic

E. Refer to Section 27 05 33 – Communications, Raceways, Boxes and Fittings for additional fittings.

2.3 UNDERGROUND STRUCTURES

A. Vaults, PullBoxes and Manholes, Precast, General
1. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes, boxes and handholes.
2. Construction
   a. General
      1) Castings shall be free from warp and blow holes that may impair strength or appearance.
      2) Structures shall be precast to the design and details indicated, precast monolithically and placed as a unit, or structures may be assembled in sections, designed and produced by the manufacturer in accordance with the requirements specified.
      3) Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.
      4) Structure top and wall shall be of a uniform thickness of not less than 4 inches except at knockouts.
      5) The minimum concrete cover for reinforcing steel shall be 2 inches.
      6) All steel, except reinforcing steel, shall be hot dip galvanized after fabrication.
      7) Knockouts & Windows

a) Thin-walled knock-out panels designed for future duct bank entrances are permitted.
b) Sides of precast windows shall be a minimum of 4 inches from the inside surface of adjacent walls, floors, or ceilings.
c) Form of the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope.
d) Provide welded wire-fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes.
e) Provide additional reinforcing steel comprised of at least 2 No. 4 bars around window openings.

8) Extension Rings
a) Provide extension rings as-required to extend from finished grade to communications utilities.

9) Bottom and Drain Sumps
a) Provide solid concrete bottom surface.
b) Provide drain sumps for precast structures a minimum of 12 inches in diameter and 4 inches deep.

3. Joints:
a. Provide tongue-and-groove or shiplap joints on mating edges of precast components.
b. Design joints to firmly interlock adjoining components and to provide waterproof junctions, and adequate shear transfer.
c. Seal joints watertight using preformed plastic strip conforming to AASHTO M198, Type B.

4. Frames and Covers
a. Covers to match across all utilities.
b. Provide fiber composite lids at pedestrian rated covers, H-20 steel slip resistant covers otherwise.
c. Labeling
1) Provide labeling as follows:
a) “Communications”
b) Owner's Manhole or Vault No, as shown on drawings or provided to Contractor prior to vault order placement.
2) Labeling shall be:
a) Cast in concrete lids
b) Written in weld on steel lids
c) Alternatively, for pedestrian grade vault lids and for the vault number only, provide 1/8” min. thickness lamacoid label, rivet attached to box top in recess area below surface of lid.

5. Pulling-In-Irons
a. Steel bars bent in the form indicated and cast in the walls and floors.
b. Install a pulling-in iron in the wall opposite each duct line entrance at walls, not less than 6 inches above or below, and opposite the conduits entering the manhole.
c. Pulling-in irons shall project into the manhole approximately 4 inches, or be cast in a pocket. Iron shall be hot-dipped galvanized after fabrication.
d. Provide cable racks, including rack arms, minimum two (2) 12” arms each manhole or vault face.

B. Underground Pull Boxes and Vaults, Concrete
1. Drawing and Specification References:
a. PB1P
b. PB1T
c. PB2P
d. PB2T
e. PB3T

2. Minimum Size
   a. As scheduled on the drawings. Provide scheduled or larger size.
3. Lid Construction:
   a. As scheduled on the plans
4. Cover Components
   a. PB1 and PB2 Size: One piece construction
   b. PB3 Size: Two piece hinged lids with torsion spring lifters.
5. Pulling-In-Irons
   a. Steel bars bent in the form indicated and cast in the walls and floors.
   b. Install a pulling-in iron in the wall opposite each duct line entrance at walls, not less than 6 inches above or below, and opposite the conduits entering the manhole.
   c. Pulling-in irons shall project into the manhole approximately 4 inches, or be cast in a pocket. Iron shall be hot-dipped galvanized after fabrication.
6. Provide cable racks, including rack arms, minimum two (2) 12” arms each vault face.
7. Manufacturers:
   a. Brooks Products
      1) 1P & 1T: 5 Series and extension rings as required
      2) 2P & 2T: 67 Series and extension rings as required
      3) 3T: 400 Series with 11C Type Lid.
   b. Jensen PreCast
      1) PB1P: P9 with FL9D lid, P9BA base and extension rings as required.
      2) PB1T P9 with P9-61 lid, P9BA base and extension rings as required
      3) PB2P: P36 with FL36D cover, P36BA base and extension rings as required
      4) PB2T: P36 with P36-61D lid, P36BA base and extension rings as required
      5) PB3T: 35TA
   c. Utility Vault Company, Inc./Oldcastle Precast
      1) PB3T: PTS-3660, with H-20-44 loading cover, with 3660-06 and 3660-12 extensions as required.
   d. Associated Concrete Products
   e. Forni Corporation.
   f. Or equal.

C. Manhole/Maintenance Hole
1. Drawing and Specification Reference:
   a. MH: Maintenance Hole, 4 feet 6 inches by 8 feet 6 inches inside.
2. Construction:
   a. SBC Reference Specification PTS-65 for overall size and shape.
      1) Arrange duct bank entry per latest BICSI outside plant manual, not SBC standard
      2) Provide non-metallic racking and cable support arms, not SBC standard metallic arms.
      3) Increase wall thickness where indicated installation depth exceeds rating of PTS-65 assembly.
   b. Ladder
      1) Provide 1 ladder per maintenance hold
      2) Steel, hooks to rungs at top of maintenance hold neck, long enough to reach bottom of maintenance hole.
3. Manufacturers
   a. Utility Vault Company, Inc. 38-PTS-65, with cover with nameplate "Communications", with 3606 and 3612 extensions as required, with ladder.
   b. Jensen PreCast PTS-65
   c. Associated Concrete Products
   d. Forni Corporation.
   e. Or equal.

2.4 MISCELLANEOUS UNDERGROUND PRODUCTS

A. Cable Warning Tape
   1. Provide
      a. 6 inches wide minimum.
      b. 5 mil plastic.
      c. Metallic backing at least 10 feet o.c.
      d. 1 mil metallic foil core.
      e. Orange in color
      f. Suitable for buried applications.
      g. Continuously imprinted with the words "WARNING - COMMUNICATIONS CABLE BELOW" or similar at not more than 48 inch intervals.
   2. Manufacturers:
      a. Carlon Telecom Systems.
      b. Vikimatic
      c. Or equal.

B. Pull Rope
   1. At least 3/4 inch diameter polyethylene or polyester.
   2. 2500 pound strength.
   3. Manufacturers:
      a. Carlon Telecom Systems.
      b. Vikimatic
      c. Or equal.

C. Length Marked Tape
   1. Provide 1/2 inch flat tape with sequential markings in whole feet.
   2. Manufacturers:
      a. Carlon Telecom Systems.
      b. Greenlee
      c. Vikimatic
      d. Or equal.

D. Conduit Plugs
   1. Provide universal blank duct plug type, with eye for tying rope and tape.
   2. Manufacturers:
      a. Carlon Telecom Systems.
      b. Condux International, Inc.
      c. Or equal.

E. Line Marker Post
   1. Orange polyethylene, post height 4 feet above surface.
   2. Soil anchor.
   3. Manufacturers:
      a. Carlon Telecom Systems.
      b. Vikimatic
      c. Or equal.

F. Conduit Spacer, Trench
   1. Construction
      a. Non-metallic.
      b. Sized to snap around conduits as shown on Drawings.
      c. Interlocking.
   2. Manufacturers:
      a. Underground Devices Wunpeece.
      b. GS Industries Underground Products Spacer System.
      c. Or equal.

G. Pulling In Irons
   1. 7/8" Diameter
      a. 6" exposed length minimum after imbedment
      b. RUS approved
   2. Manufacturer
      a. Cooper Power Systems
      b. Or equal.

H. Cable Racks & Supports
   1. Construction:
      a. Non-metallic
      b. 12" minimum rack arms
      c. Snap into vertical strut sections provided with new manhole, pullboxes and vaults, or into Owner’s existing vaults, where indicated.
   2. Approvals
      a. RUS
      b. NEMA
   3. Manufacturers:
      a. Underground Devices
      b. Inwesco
      c. Cooper Power Systems
      d. Or Equal

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Refer to the most restrictive of the Code, the manufacturer's instructions, these specifications and the relevant NEMA, CalTrans or RUS guidelines and conform.

3.2 CONDUIT APPLICATION

A. General: Install the following types of conduits and fittings in the locations listed, unless otherwise noted in the drawings:
   1. Underground Ductbanks, Concrete Encased
      a. PVC

B. Exterior, Exposed:
   1. Type RSC for applications up to 8 feet AFF or to first pull box, whichever is first, applications subject to physical abuse or for applications greater than 4" diameter.
   2. EMT acceptable in all other applications not noted above up to 4", where used in conjunction with specified Raintight (compression) couplers.

C. Embedded in Concrete
   1. RSC or rigid non-metallic conduit.
   2. PVC

D. In Utility Tunnel
   1. RSC
   2. CRSC
   3. IMC

3.3 RACEWAY INSTALLATION, GENERAL

A. Refer to Section 27 05 33 – Conduits and Backboxes for Communications Systems

3.4 UNDERGROUND CONSTRUCTION:

A. Duct and Conduit Placement.
1. Duct lines shall have a continuous slope downward toward underground structures and away from buildings with a minimum pitch of 3 inches in 100 feet.
2. Except at conduit risers, accomplish changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter and larger.
3. Excavate trenches along straight lines from structure to structure before ducts are laid or structure constructed so the elevation can be adjusted, if necessary, to avoid unseen obstruction.

B. Duct Bank.
1. Duct Entrance Arrangement - Conform to Table 3.27 and applicable arrangement diagrams 3.57-3.64 of 2004 BISCI Customer Owned Outside Plant Design Manual.
2. Terminate conduits in end-bells where duct lines enter underground structures.
3. Stagger conduit joints by rows and layers to strengthen the duct bank.
4. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers and top spacers to provide a completely enclosed and locked-in duct bank. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of duct bank. Before pouring concrete or backfilling, as applies, anchor duct bank assemblies to prevent the assemblies from floating. Anchoring shall be done by driving reinforcing rods adjacent to every other duct spacer assembly and attaching the rod to the spacer assembly.
5. As each section of a duct line is completed from structure to structure, for conduit sizes 3 inches and larger draw a flexible testing mandrel approximately 12 inches long with a diameter less than the diameter of the conduit through a conduit. After which, draw a stiff bristle brush having the same diameter of the conduit through the conduit, until conduit is clear of particles of earth, sand, and gravel; then immediately install end plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through the conduit, until conduit is clear of particles of earth, sand, and gravel; then immediately install end plugs.
6. Unless otherwise noted, exterior communications conduit runs shall be buried a minimum of **30**" below finished grade or as required to conform to local utility requirements. Where new trenching is required, backfill and compaction requirements shall be as defined in other Sections.
7. Where concrete encasement indicated, construct underground duct lines of individual conduits encased in concrete. Do not mix different kinds of conduit in any one duct bank. Ducts shall not be smaller than shown. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 inches, except separate light and power conduits from communications conduits by a minimum concrete thickness of 4 inches. The top of the concrete encasement shall not be less than 18 inches below grade except that under roads and pavement concrete be a minimum of 24 inches below grade.

C. Where conduit runs under existing roads, cut and patch the pavement as indicated.

D. Conduit Plugs and Pull Rope. New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weephole or screen to allow water drainage. Provide a 3/8 inch nylon pull rope having 3 feet of slack at each end of unused or empty conduits.

E. Partially Completed Duct Banks. During construction wherever a construction joint is necessary in a duct bank, prevent debris such as mud, sand and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 feet back into the envelope and a minimum of 2 feet beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 inches from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 1 foot apart. Restrain reinforcing assembly from moving during concrete pouring.

F. Connections to Existing Manholes. For duct line connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and bend out to tie into the reinforcing of the duct line encasement. Chip out the structure wall to form a key for the duct line encasement.

G. Mark locations of future provision underground raceways by pre-cast reinforced concrete pullbox set flush in ground with stamped brass disk identification plate tied to conduit end with “Ty-Wrap”, “Quick-Wrap” or equal.

H. In existing facilities underground construction, the Contractor shall promptly repair any indicated utility lines or systems damaged by Contractor operations. Damage to lines or systems not indicated, which are caused by Contractor operations, shall be brought to the immediate attention of the Owner’s Representative. If the Contractor is advised in writing of the location of a non-indicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In any event, the Contractor shall immediately notify the Owner’s Representative of any such damage.

I. At twelve inches below grade, place specified warning tape continuously.

END OF SECTION

SECTION 27 0548

NOISE AND VIBRATION CONTROLS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provisions of:
1. Flexible communications raceway connections to vibrating machinery
2. Sealing of communications device boxes related installed in sound rated walls.
3. Coordination of airtight installation requirements at Mechanical and Electrical Rooms and/or duct enclosures.

PART 2 - PRODUCTS

2.1 FLEXIBLE COMMUNICATIONS CONNECTIONS:

A. Make communications connections to vibrating equipment flexible as follows:
1. For conduit over 1" O.D. make communications connections to vibrating equipment via a flexible expansion/deflection conduit coupling sized as required. Coupling shall have flexible and watertight outer jacket, internal grounding strap, plastic inner sleeve to maintain smooth wireway, and end hubs with threads to fit standard threaded metal conduit.
2. Manufacturers:
a. XD Xpansion Deflection Coupling by Crouse-Hinds of Syracuse, N.Y.
b. Type DF Expansion and Deflection fitting by Spring City Electrical Mfg. Co.
c. or equal.

2.2 J-BOX MASTIC:

A. At all electrical boxes penetrating sound isolating partitions, STC 40 or greater, utilize sheet form adhesive mastic as directed elsewhere herein

B. Manufacturers:
1. Insul-Pad by Dottie Corp.
2. Duct-Seal by Gardner Bender, Inc.
3. or equal.

2.3 RESILIENT PENETRATIONS:

A. For conduit:
1. Sleeves: Sleeves of appropriate gage galvanized sheet metal shall be formed to at least the thickness of the penetrated construction and 3/4" to 1" larger in each cross-sectional dimension than the penetrating element.
a. Manufacturers:
1) Century-Line Sleeves by Thunderline Corporation
2) Custom by Contractor
3) or equal.
2. Batt: Glass fiber of batt or mineral wool, 1 to 3 lb./cu. ft. density.
a. Manufacturers
1) Certain-Teed
2) Johns-Manville

3) or equal.

3. Acoustical Sealant:
   a. Manufacturers
      1) DAP
      2) Pecora
      3) or equal.
4. Firestop Sealant:
   a. Where required, resilient firestop caulking may be used in lieu of Acoustical Sealant when installed in strict conformance with the manufacturer's directions. Fully hardened firestop caulk shall develop a Shore A hardness of no greater than 35. Refer to the requirements of Section 27 05 33.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS, CONNECTION TO VIBRATING EQUIPMENT

A. The Contractor shall not install any vibrating equipment or conduit attached thereto which makes rigid contact with the "building" unless it is approved in this specification or by the Owner's Representative. "Building" includes, but is not limited to slabs, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.

B. Prior to installation, the Contractor shall bring to the Owner' Representative's attention any conflicts between trades which will result in unavoidable rigid contact at equipment, conduit, piping, ducts, etc., as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.

3.2 INSPECTION OF CONDITIONS:

A. Examine related Work and surfaces before starting Work of this Section. Report to the Owner's Representative, in writing, conditions which will prevent proper provision of this work. Beginning the Work of this Section without reporting unsuitable conditions to the Architect constitutes acceptance of such conditions by Contractor. Perform any required removal, repair, or replacement of this Work caused by unsuitable conditions at no additional cost to the Owner.

B. Coordination
   1. Coordinate with the work of the Base Building Construction Contract. Coordinate Work of this Section with all other impacted trades.

3.3 INSTALLATION REQUIREMENTS, FLEXIBLE ELECTRICAL CONNECTIONS

A. The installation of flexible electrical connections to vibration isolated equipment shall in no way impair or restrain the function of the vibration isolation installed by the work by Others.
   1. Using gross slack. Install flexible conduit in a grossly slack loop form or shallow "U" form. Install stranded conductors with sufficient slack to accommodate maximum possible movement.
   2. Using flexible coupling. The flexible coupling shall be free and not in contact with any nearby building construction and shall be installed slack, and free of strain in any direction. Install stranded conductors as above

3.4 INSTALLATION REQUIREMENTS, J-BOX MASTIC

A. Application: All Communications Systems work in sound isolating assemblies, including but not limited to residential rooms, offices, mechanical rooms, electrical rooms and related to utilize backboxes for all services, including but not limited to low voltage communication. Installation of backboxes to conform with following:
   1. Space outlet boxes on opposite faces of the wall by more than 24" o.c. Where daisy chainned conduits indicated on the plans, connect such boxes by slack flexible conduit (2 times longer than distance between outlets).
   2. Cutouts for electrical boxes and penetrating piping/conduit shall be no more than 1/4" oversize.

3.5 INSTALLATION REQUIREMENTS, RESILIENT PENETRATIONS

A. Penetrations included in this Section of the Specifications include all communications conduit connected to vibrating equipment within 30 feet of such equipment

B. Method for round or rectangular penetrations.
   1. Cut a clean opening in the penetrated construction very nearly the size of the sleeve for each penetrating element. Provide lintels above, relief structure below and vertical framing between and to the sides, as required. Provide the above, escutcheon plates and such related construction as is necessary to make the penetrated structure as solid and massive near the penetrations as the surrounding construction.
   2. Set the metal sleeve into the penetrated construction in an airtight manner around its outer periphery, using grout, dry packing, plaster or drywall compound full depth and all around - but only to a maximum width of ½" - or the requirements of the above paragraph shall not have been satisfied.

3.6 MECHANICAL AND ELECTRICAL ROOMS REQUIREMENTS

A. All mechanical and electrical rooms, plenums, duct shafts and drywall duct enclosures and other enclosures of high noise sources shall be constructed airtight. This means that every precaution shall be taken to maintain construction completely airtight around a room so designated. Construction joints, duct penetrations, electrical boxes, frames, supports, cabinets, doors, access panels, fixtures, etc., all shall be built or installed in such a manner as to prevent sound transmission through any construction enclosing a room horizontally or vertically. Appropriate lintels, frames, blocking, escutcheons, grouting, gaskets, packing, caulking, taping, filling, etc., all shall be employed to prevent sound transmission. Refer to requirements of this Section for Resilient Penetrations.

END OF SECTION

SECTION 27 0553

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. Provide all labor, materials, tools, and equipment required for permanent intelligible labeling on, or adjacent to, all cabling, connectors, innerduct, faceplates, jacks, receptacles, controls, fuses, circuit breakers, patching jacks, and racks.

B. This section includes minimum requirements for the following:
   1. Labeling Communications Cabling
   2. Labeling Closet Hardware
   3. Labeling Work Stations
   4. Labeling Pathways, Spaces, Grounding and Bonding.

C. Refer to detailed plans for additional requirements.

D. Clearly and distinctly indicate the function of the item.

E. Coordinate with Record Drawings

1.2 REFERENCES:

A. Usage: In accordance with Section 01 11 00 – Summary of Work.

B. American Society for Testing and Materials (ASTM)
   1. ASTM D 709(2001) Laminated Thermosetting Materials

C. Electronic Industries Alliance (EIA)
   1. ANSI/TIA/EIA-606B (2016) - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

D. Underwriters Laboratories (UL)
   1. UL 969 (1995; R 2001) Marking and Labeling Systems

1.3 QUALITY ASSURANCE

A. Identification and administration work specified herein shall comply with the applicable requirements of:
   1. ANSI/TIA/EIA-606-B-2016 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
   2. ANSI/TIA-569-C-2012 Telecommunications Pathways and Spaces
   3. ANSI/TIA/EIA-568-C.1-2009 Commercial Building Telecommunications Cabling Standard.
   4. BICSI Telecommunications Distribution Methods Manual, 13th Edition.
   5. UL 969 (1995; R 2001) Marking and Labeling Systems.

1.4 SUBMITTALS

A. Conform with the requirements of Section 01 30 00 – Administrative Requirements and Section 27 05 00 - Common Work Results for Communications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 01 60 00 – Product Requirements.

PART 2 - PRODUCTS

2.1 COMMUNICATION CABLING LABELS, INTERIOR

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.

C. Provide vinyl substrate with a white printing area and black print. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.

D. Shall be flexible vinyl or other substrates to apply easy and flex as cables are bent.

E. Shall use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing.

F. Manufacturers:
1. Cable Type – Silver Satin
   a. Brady TLS2200 labels – PTL-31-427, PTL-32-427
   b. Brady Laser tab labels – LAT-18-361, LAT-53-361
   c. Hubbell
   d. Leviton
   e. Panduit.
   f. or equal.
2. Cable Type – 4 pair UTP
   a. Brady TLS2200 labels – PTL-31-427,PTL-32-427
   b. Brady Laser tab labels – LAT-18-361, LAT-53-361
   c. Hubbell
   d. Leviton
   e. Panduit.
   f. or equal.
3. Cable Type – 4 pair STP
   a. Brady TLS2200 labels – PTL-21-427
   b. Brady Laser tab labels – LAT-19-361
   c. Hubbell
   d. Leviton
   e. Panduit.
   f. or equal.
4. Cable Type – 25 pair copper
   a. Brady TLS2200 labels – PTL-21-427
   b. Brady Laser tab labels – LAT-19-361
   c. Panduit.
   d. or equal.
5. Cable Type – 50 pair copper
   a. Brady TLS2200 labels – PTL-33-427
   b. Panduit.
   c. or equal.
6. Cable Type – 100 pair copper
   a. Brady TLS2200 labels – PTL-34-427
   b. Brady

c. Panduit.
d. or equal.

7. Cable Type – 2 strand fiber
   a. Brady TLS2200 labels – PTL-19-427
   b. Brady Laser tab labels– LAT-17-361
   c. Panduit.
   d. or equal.
8. Cable Type – 4-12 strand fiber
   a. Brady TLS2200 labels – PTL-21-427
   b. Brady Laser tab labels – LAT-19-361
   c. Panduit.
   d. or equal.
9. Cable Type – RG-6 Coax
   a. Brady TLS2200 labels – PTL-31-427, PTL-32-427
   b. Brady Laser tab labels –LAT-18-361, LAT-53-361
   c. Panduit.
   d. or equal.
10. Cable Type – RG-59 Coax
   a. Brady TLS2200 labels – PTL-31-427, PTL-32-427
   b. Brady Laser tab labels – LAT-18-361, LAT-53-361
   c. Panduit.
   d. or equal.
11. Cable Bundles
   a. Brady TLS2200 labels – PTL-12-109
   b. Panduit.
   c. or equal.

2.2 COMMUNICATIONS CABLE LABELS, OUTSIDE PLANT

A. Cable Tags in Manholes, Handholes, and Vaults
   1. Provide tags for communications cable or wire located in manholes, handholes, and vaults.
      a. The tags shall be polyethylene.
      b. Machine printed - Do not provide handwritten letters.
   2. Polyethylene Cable Tags
      a. Provide tags of polyethylene that have an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F.
      b. Provide 0.05 inch (minimum) thick black polyethylene tag holder.
      c. Provide a one-piece nylon, self-locking tie at each end of the cable tag.
      d. Ties shall have a minimum loop tensile strength of 175 pounds. The cable tags shall have black block letters, numbers, and symbols one inch high on a yellow background.
      e. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.
   3. Manufacturers:
      a. Panduit
      b. Brady
      c. or equal.

2.3 CLOSET HARDWARE LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.

C. Where insert type labels are used provide clear plastic cover over label.

D. Manufacturer:
1. Copper Patch Panels
   a. 4 port group
      1) Brady Laser tab labels – 2.8” x 0.375” LAT-43-707
      2) Hubbell XPLPPA series
      3) Leviton
      4) Panduit.
      5) or equal.
   b. 6 port group
      1) Brady Laser tab labels – 3.6” x 0.375”, LAT-44-707
      2) Hubbell
      3) Leviton
      4) Panduit.
      5) or equal.
   c. Individual port
      1) Brady
         a) TLS2200 labels – 0.5” x 0.375”white, PTL-44-422
         b) Laser tab labels – 0.5” x 0.375” white, LAT-45-707
         c) TLS2200 labels – 0.5” x 0.375”clear, PTL-44-430
         d) Laser tab labels – 0.5” x 0.375” clear, LAT-45-712
         e) TLS2200 labels – 0.5” x 0.5” white, PTL-7-422
         f) Laser tab labels – 0.5” x 0.5” white, LAT-46-707
         g) TLS2200 labels – 0.5” x 0.5” clear, PTL-7-430
         h) Laser tab labels – 0.5” x 0.5” clear, LAT-46-712
      2) Hubbell
      3) Leviton
      4) Panduit.
      5) or equal
   d. Patch Panel Name Label.
      1) Hubbell XOLPPID Series
      2) Brady
      3) Leviton
      4) Panduit
      5) or equal.
2. Non-keystone based fiber patch panels
   a. Hubbell XPLFOSEPAW
   b. Brady
   c. Leviton
   d. Panduit
   e. as provided with Patch Panel by the manufacturer
   f. or equal.
3. 110 blocks
   a. Brady Laser tab labels – 7.9” x 0.475” (200.6mm x 12.07mm), LAT-177-124
   b. Hubbell XPL110 series.
   c. Leviton
   d. Panduit.
   e. or equal.

2.4 GROUNDING AND BONDING, PATHWAY, AND SPACE LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.

C. Manufacturers:
1. Brady Corporation
a. TLS2200 labels
1) PTL-20-422, Size 2.0” x 1.0”
2) PTL-22-422, Size 3.0” x 1.0”
3) PTL-37-422, Size 3.0” x 1.9”
4) PTL-23-422, Size 4.0” x 1.0”
5) PTL-38-422, Size 4.0” x 1.0”
b. Laser tab labels
1) LAT-13-747, Size 1.875” x 0.833”
2) LAT-24-747, Size 1.75” x 1.0”
3) LAT-32-747, Size 3.0” x 0.9 “
4) LAT-33-747, Size 2.0” x 1.437”
5) LAT-34-747, Size 3.0” x 1.437”
c. Continuous tape for TLS2200
1) PTL-8-422, Size 0.5” white polyester
2) PTL-8-430, Size 0.5” clear polyester
3) PTL-8-439, Size 0.5” white vinyl
4) PTL-42-439, Size 1.0” white vinyl
5) PTL-43-439, Size 1.9” white vinyl
2. Panduit.
3. or equal.

2.5 WORKSTATION LABELS

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.

C. Where insert type labels are used provide clear plastic cover over label.

D. Manufacturers:
1. Brady Corporation
a. Desi-strip inserts
1) TLS2200 labels –1.9”x0.375” white, PLT-40-412
2) Laser tab labels –1.9”x0.375” white, LAT-176-124
b. Location ID
1) TLS2200 labels - 1.0” x 0.375” white, PTL-16-422
2) Laser tab labels –1.0” x 0.375” white, LAT-47-707
3) TLS2200 labels- 1.0” x 0.375” clear, PTL-16-430
4) Laser tab labels –1.0” x 0.375” clear, LAT-8-712
5) TLS2200 labels- 1.0” x 0.5” white, PTL-17-422
6) Laser tab labels –1.0” x 0.5” white, LAT-7-707
7) TLS2200 labels- 1.0” x 0.5” clear, PTL-17-430
8) Laser tab labels- 1.0” x 0.5” clear, LAT-7-712
9) TLS2200 labels- 1.5” x 0.375” white, PTL-45-422
10) Laser tab labels- 1.5’ x 0.375” white, LAT-47-707
11) TLS2200 labels- 1.5” x 0.375” clear, PTL-45-430
12) Laser tab labels-1.5” x 0.375” clear, LAT-47-712
13) TLS2200 labels- 1.5” x 0.5” white, PTL-29-422
14) Laser tab labels- 1.5” x 0.5” white, LAT-47-707
15) TLS2200 labels- 1.5” x 0.5” clear, PTL-29-430
16) Laser tab labels-1.5” x 0.5” clear, LAT-47-712
c. Outlet/Jack ID
1) TLS2200 labels -0.5” x 0.375" white, PTL-44-422
2) Laser tab labels – 0.5” x 0.375” white, LAT-45-707

3) TLS2200 labels - 0.5” x 0.375” clear, PTL-44-430
4) Laser tab labels –0.5” x 0.375” clear, LAT-45-712
5) TLS2200 labels - 0.5” x 0.5” white, PTL-7-422
6) Laser tab labels- 0.5” x 0.5” white, LAT-46-707
7) TLS2200 labels - 0.5” x 0.5” clear, PTL-7-430
8) Laser tab labels - 0.5” x 0.5” clear, LAT-46-712

d. General Use Labels
1) TLS2200 labels - 0.375” cont. white, PTL-46-422
2) TLS2200 labels - 0.375” cont. clear, PTL-46-430

2. Hubbell
a. Location ID
1) Desi-Strip Style
a) XPLFP10W
2) Adhesive
a) XPLFPA10W, XPLFPA10W,
b. Outlet/Jack ID
1) XPLIPA10W, XPLIPA10C
2)
3. Leviton
4. Panduit.
5. or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Apply labeling to clean surfaces free of oil, dust, solvents or loose material.

B. Apply after Project painting in area of application is complete.

C. Apply to locations where labeling will not be damaged, covered over or in the way of the ordinary maintenance and operation of the installed communications infrastructure or system.

D. Apply labeling right side up, parallel to major edges of surfaces to which it is applied. When no line is evident, apply parallel to floor line. Correct conditions of labeling applied out of true.

E. Protect installed labeling from damage.

F. Replace labeling that is defaced, illegible or peeling off of the surface to which it is applied.

3.2 WORKSTATION JACK, CABLE AND PATCH PANEL ASSIGNED CIRCUIT NUMBERS

A. The Owner will provide the Contractor copies of the Contract Drawings showing station outlets with Owner assigned data & voice jack ID numbers. Label all installed work according to this master set.

B. The cover plate area directly above and beneath the jacks are the labeling areas. In the top area, using the specified means, label the faceplate number assigned on the contract documents.

C. For above-ceiling outlets, in addition to the outlet labeling, the contractor shall provide an outlet label on the nearest T-bar suspension beam.

3.3 IDENTIFICATION & LABELING

A. Pathways
1. Pathways shall be marked at each endpoint and at all intermediate pull or junction boxes. In the case of partitioned pathways (i.e. innerduct) each partition shall have a unique identifier.
2. Label pathways using the appropriate abbreviation and a number.
3. Use adhesive type labels.

B. Labels shall be affixed at the entry to all telecommunications rooms and spaces (Includes entrance facilities, communication equipment rooms, communication equipment spaces and work areas)
1. Use adhesive type labels for all communications space labeling,
2. Affix labels to entrance doors – coordinate location with Owner's Representative.

C. Cables
1. Horizontal and Indoor Backbone Cables shall be marked within 12” of each endpoint or to innerduct in which the cable is installed.
2. Except where installed in innerduct or conduit, all backbone fiber optic cable shall have affixed to the outer jacket, labels of a bright color that contain at least the legend "FIBER OPTIC CABLE." These labels must be affixed at separations no greater than 10 ft.
3. Within every manhole/vault/pullbox and within 4 ft of the entrance into a building every backbone cable’s assigned identifier shall be affixed to either the cable’s outer jacket or to innerduct in which the cable is installed.
4. Any cable installed in conduit shall be labeled at all intermediate pull or junction boxes.
5. Label cables using the appropriate circuit ID.
6. Use adhesive type labels for all communications cable labels.
7. Affix labels to cables – marking cable is not permitted.
8. Where cable is fully encased in innerduct label the outside of the innerduct with the cable label and, where the contents are fiber optic cabling, the "FIBER OPTIC CABLE" label.
9. Labels for backbone cables shall be:
    a. WHITE for voice copper feeder
    b. YELLOW for data fiber feeder
    c. RED for FA fiber feeder
    d. BLUE for AV fiber feeder

D. Patch Panels
1. Fiber patch panels shall be marked using adhesive labels indicating the range of circuits installed to it. All fiber optic cable patch panels shall be labeled with both the pair count of every fiber pair, the cable’s assigned identifier, and where shown on the plans, the patch panel's assigned identifier.
2. If not shown on the Contract Documents, Owner's Representative will provide specific circuit ID information.
3. Category rated patch panels shall be labeled with an identifier, individual ports shall be labeled to indicate circuit and identification of station plate in which the circuit terminates.

E. 110 blocks
1. Each cable termination position on 110 blocks shall be labeled with number designators.
    a. All backbone copper cable termination blocks shall be labeled with both the pair count of every 5th pair and the cable’s assigned identifier.

2. Where insert type labels are used install clear plastic cover over reprinted or Laser printed type label.

F. Workstations
1. All faceplate labels shall indicate the faceplate number and the circuit ID for each cable that it houses
2. For faceplates where insert type labels are used install clear plastic cover over preprinted or Laser printed type label.
3. For faceplates without insert type labels use adhesive type labels affix labels to faceplate – marking faceplates is not permitted.
4. Patch cords cords installed under the work of this Project shall be labeled at each endpoint using the appropriate circuit ID.
5. Use adhesive type labels for all communications cable labels.
6. Affix labels to cables – marking cable is not permitted.

G. Grounding and Bonding
1. The TMGB(s) (telecommunications main ground bar) shall be labeled as such with an adhesive type label(s) affix label(s) to TMGB.
2. The conductor connecting the TMGB (telecommunications main ground bar) to the building ground shall be labeled at each end with an affixed label in a visible location as close as practicable to the bonding point at each end of the conductor.

H. Firestopping
1. Each firestopping location shall be labeled at each location where firestopping is installed, on each side of the penetrated fire barrier, within 12 in. of the firestopping material.

END OF SECTION

SECTION 27 1000

STRUCTURED CABLING, BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section defines commons means and methods for the work of the following Sections:
   1. Section 27 11 13 – Communications Entrance Protection
   2. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
   3. Section 27 11 19 – Communications Termination Blocks and Patch Panels
   4. Section 27 11 23 – Communications Cable Management
   5. Section 27 11 26 – Communications Rack Mounted Power Protection and Power Strips
   6. Section 27 13 00 – Communications Interior Backbone Cabling
   7. Section 27 15 00 – Communications Horizontal Cabling

B. Related work specified in other Sections
   1. Section 26 00 50 – Basic Electrical Materials and Methods

1.2 RELATED DOCUMENTS

A. Section 27 05 00 – Common Work Results for Communications applies to the work of this Section.

1.3 REFERENCES

A. In Addition to the requirements of Section 27 05 00 – Common Work Results for Communications, conform to the applicable portions of the following standards agencies:
   1. American Society For Testing and Materials (ASTM)
      a. ASTM A228/A228M-02 Steel Wire, Music Spring Quality.
   2. Bellcore
      a. TR-NWT-000253Intermediate Reach, 1,OC3
   3. Telecommunications Industry Association/Electronic Industries Association (TIA/EIA)Telecommunications Industry Association/Electronic Industries Association (TIA/EIA)
      a. EIA/TIA-526-7 OFSTP-7 - Optical Power Loss of Installed Single-Mode Fiber Cable Plant (r12/2008)
      b. ANSI/TIA/EIA-568-C.1-2009 Commercial Building Telecommunications Cabling Standard
      c. ANSI/TIA-568-D Optical Fiber Cabling Components Standard (2016)
      d. ANSI/TIA-569-C-2012 Telecommunications Pathways and Spaces
      e. ANSI/TIA/EIA-606-B-2016 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   4. Federal Communications Commission (FCC)
      a. The Code of Federal Regulations, Title 47, Telecommunications, Chapter 1 - FCC Part 68 (1982 issue or latest revision) (47 CFR 68) .
   5. Institute of Electrical and Electronic Engineers
      a. IEEE 100-00 The Authoritative Dictionary of IEEE Standards Terms
   6. Insulated Cable Engineers Association (ICEA)
      a. ICEA S-56-434 (1983, 5th Ed.) Polyolefin Insulated Communication Cables for Outdoor Use.
      b. ICEA S-83-596(2001) Fiber Optic Premises Distribution Cable
   7. National Electrical Manufacturers Association (NEMA)

a. NEMA WC 63.1(2000) Twisted Pair Premise Voice and Data Communications Cables

8. National Fire Protection Association (Nfpa)
   a. NFPA 70 National Electrical Code
9. Underwriters Laboratories, Inc. (UL)
   a. UL 444(2002; Bul. 2002, 2003) Communications Cables
   b. UL 910(1998) Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air
   c. UL 1286(1999; R 2004) Office Furnishings
   d. UL 1666(2000; R 2002) Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

1.4 DEFINITIONS

A. Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in
   1. ANSI/TIA/EIA-568-C.1
   2. ANSI/TIA/EIA-606-B
   3. IEEE Std 100 and
   4. in this Section.

B. Campus Distributor (CD) - A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect (MC).)

C. Building Distributor (BDF) - A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

D. Floor Distributor (FD) - A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

E. Telecommunications Room (TR) - An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

F. Entrance Facility (EF) (Telecommunications) An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.

G. Entrance Room (ER) (Telecommunications) - A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

H. Open Cable - Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

I. Open Office - A floor space division provided by furniture, movable partitions, or other means instead of by building walls.

J. Pathway - A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.5 SUBMITTALS

A. Conform with the requirements of Section 01 30 00 – Administrative Requirements and Section 27 05 00 - Common Work Results for Communications.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 01 60 00 – Product Requirements, Section 27 05 00 – Common Work Results for Communications Systems and the following:

B. Shipping Conditions:
1. All cable shall be shipped on reels or manufacturer supplied “handy boxes”.
2. The diameter of the drum shall be at least 13 times the diameter of the cable.
3. The reels shall be substantial and so constructed as to prevent damage during shipment and handling.
4. Secure the outer end of the cable to the reel head so as to prevent the cable from becoming loose in transit.
5. Project the inner end of the cable into a slot in the side of the reel, or into a housing on the inner slot of the drum, in such a manner and with sufficient length to make it available for testing.
6. The inner end shall be fastened so as to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable.

C. Storage:
1. Retain factory cable protection until installation. Supplement with heavy gauge plastic sheeting if factory protective membrane is pierced prior to installation. Tape ends and seams water and dust tight.
2. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent.
3. Protect cable reels from physical damage from site construction vehicles or from settling into the soil.
4. Equipment, other than cable, to be delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

1.7 PERFORMANCE STANDARDS

A. Voice Copper Plant:
1. To USOC Standards. The voice cabling plant provided will be directly connected to the Public Switched Network in accordance with the rules set forth by the FCC Part 68 and other appropriate authorities.
2. Where specified termination jack is indicated as Category 6A RJ-45, and specified distribution cabling similarly specified as Category 6A, conform to Category 6A standards below.

B. Category 6A Copper Data Service Cabling Plant:
1. To EIA/TIA standards referenced herein for Category 6A. Performance requirement is for circuit end-to-end.

C. Fiber Optic Cabling:
1. Optical Budget, any end to end link - not to exceed the sum of the following:
a. The specified cable performance, pro-rated for total link distance.
b. Single Mode:
1) 0.06 dB for each fusion splice

1.8 TESTING

A. General
1. Test and report on each intermediate cabling segment separately, including station cabling, horizontal distribution (each segment, if multiple) and telecommunications room wiring.
2. Test each end to end cable link.
3. Submit machine-generated documentation and raw data of all test results on Contractor-provided, and Owner's Representative approved, forms; and in electronic format approved by the Owner's Representative.
4. Provide machine-generated data on an appropriate disk media (CD-ROM CD-R format) to be transferred to the Owner's computers.
   a. Where the machine-generated documentation requires use of a proprietary computer program to view the data, provide the Owner with 1 licensed copy of the software.
5. Provide registered testing software used for the actual tests to the Owner for review of test data.

B. Test Equipment:
1. Provide in conformance with the applicable requirements of 27 05 00 - Common Work Results for Communications .
2. Test systems using at least one (1) each of the following test measurement devices or their functional equivalents:
   a. Category 6A Cable Pair Tester – Fluke/Microtest , Agilent or equal.
   b. Outside Plant Voice Cabling Plant tester - capable of detecting shorts, opens, reversals, mis-wiring and crosstwists. (Siemon STM-8, Fluke or equal).
   c. Tone Test Sets.
   d. Optical power meter (HP, Corning Cable Systems, Fluke or equal).
   e. Site portable communications systems (walkie-talkie, cell phone or similar).
   f. Any other items of equipment or materials required to demonstrate conformance with the Contract Documents.

C. Station Wiring, General
1. Test station wire only after all pairs of station wire in an work area have been terminated at both ends, and no work of this Section or other Sections may cause physical disturbance to the wiring.
2. Correct any and all transpositions found. Retest.
3. If any conductor in a station wire tests either open or short, then the entire station wire is to be removed, replaced, and re-tested.

D. Inside Category 6A Cabling.
1. Using the listed Category 6A cable test set, test and submit report on the parameters specified for Category 6A cabling in this Section. Report whether tested link passes or fails the Category 6A standards in Part 2 of this Section.
2. As a minimum, all cables shall be tested with a Level III test set for Category 6A compliance with the following tests: wire map, length, insertions loss, NEXT loss, PSNEXT loss, ELFEXT, PSELFEXT, return loss, propagation delay and delay skew.
3. Note exceptions to required Category standards. Remedy and retest.

E. Telephone: Outside Plant, Inside Riser Wire:
1. General:
   a. A new cable shall be tested only after all wires within the cable have been terminated at both ends.
   b. For unshielded cable, "measurements to ground" means an electrical connection to the Telecommunications Ground Bus, building steel, electrical metallic conduit or a water pipe.
   c. The Contractor shall correct all defects possible.

d. If the maximum number of unrepairable defective pairs exceeds 4% of the cable's pair count, the cable shall be deemed unacceptable and shall be replaced. Replace, re-terminate and retest new cable at no additional cost to the Owner.

2. Test procedures:
   a. TEST #1 – Continuity:
      1) Meter set for 20 ohm full scale ohm reading. Each pair shall be shorted at one end and the loop resistance value read at the other.
      2) The difference between the largest and the smallest resistance reading from each pair in the cable shall be no more than 10 percent of the largest reading.
   b. TEST #2 - Balance, Polarity and Conductor Transpositions:
      1) Upon passing Test #1, the tester at one end of cable shall ground tip side of each pair in turn. The tester at other end of cable reads resistance to building ground of same conductor.
   c. REQUIREMENT: Reading for each tip conductor in pair of approximately one-half the loop resistance value from Test #1.
3. Test Report:
   a. Submit Test Report. Documentation shall include loop resistance regarding any opens, shorts, transpositions found, as well as corrective action taken to correct any found opens, shorts, or transpositions.

F. Fiber Optic Cabling.
1. Perform fiber optic cable testing on all installed fiber optic cabling. Submit test results. Notify Owner’s Representative in writing at least 48 hours in advance that fiber optic cable testing shall commence. Submit calibration certification for testing equipment to be used.
2. Submit test report no later than five days after the cables are tested.
3. Test and submit Power Meter attenuation assessments test results on each fiber, in each cable, and in both directions under final installation conditions. Submit with the following information:
   a. Date of test
   b. Name of test personnel
   c. Fiber cable type and part number
   d. Fiber number
   e. TX wavelength
   f. TX location
   g. RX location
   h. TX model and serial number
   i. RX model and serial number
   j. Attenuation in dB
4. Acceptance Tests
   a. Power Meter Attenuation Test
      1) Perform on all fiber cabling segments.
      2) Method: Perform the following measured attenuation tests using the method B of ANSI/EIA/TIA-526-14A for multimode strands and ANSI/EIA/TIA-526-7 for singlemode strands. Measure the attenuation of the fiber optic network inclusive of all splices and patch points called for on the Drawings.
      3) Measure attenuation between all the coupling points (when applicable) using the insertion method.
      4) Perform a reference measurement in dBm to determine the injection power level of the stabilized source. Reference cable shall have the same core diameter as strands under test. Connect the optical source directly to the optical power level meter using 2 reference cables and a coupler.

5) Connect the optical source to the strand under test using 1 of the 2 reference cables attached to the strand's terminal coupler.
6) Connect the optical power level meter to the other end of the strand under test through its terminating coupler using the other reference cable.
7) Obtain the measured attenuation (in dB) by subtracting the reference level (dBm) from the received level (dBm).
8) Periodically during the acceptance tests, check and document the reference level.
9) Test each fiber link for overall attenuation from end to end in both directions.
10) Perform the attenuation acceptance test at the 850 nm wavelength for multi-mode and 1310 nm for single-mode.

b. OTDR Distance and Attenuation Assessments
1) Perform on all cabling segments 1000 feet or longer.
2) Perform in accordance with the requirements of:
a) ANSI/EIA/TIA-568-B.1
b) ANSI/EIA/TIA-568-B.3
c) TIA/EIA-455-59-A
3) Test and submit strip charts and/or tracer recordings on all strands in each tube in every cable in both directions. Submit with the following information:
a) Date of test
b) Name of test personnel
c) Test wavelength
d) Pulse duration(s) and scale range(s)
e) Index of refraction
f) Fiber cable type and part number
g) Fiber tube and/or fiber strand number
h) Direction of test
i) Overall distance
j) Attenuation in dB

c. Maximum back reflection of 26 dB.

PART 2 - PRODUCTS

2.1 COMMUNICATIONS CABLES AND RELATED

A. GENERAL:
1. Cabling shall be UL listed for the application and shall comply with EIA TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3 and NFPA 70.
2. Ship cable on reels and/or in boxes bearing manufacture date for UTP in accordance with ICEA S-90-661 and optical fiber cables in accordance with ICEA S-83-596 for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.
3. Comply with applicable Code for insulation, jacket, marking and listing for applicable use.
a. At risers and plenums, provide type CMP or OFNP cabling.

PART 3 - EXECUTION

3.1 GENERAL

A. All system cabling and terminations be installed in accordance with the manufacturer's instructions and as shown.

B. All necessary interconnections, services, and adjustments required for a complete and operable system shall be provided. All installation work must be done in accordance with the safety requirements set forth in the general requirements of ANSI C2 and NFPA 70.

C. Coordinate insulation displacement (quick connect) terminal devices with wire size and type. Comply with manufacturer's recommendations. Make connections with automatic impact type tooling set to recommended force.

D. Tin terminated shield drain wires and insulate with heat shrinkable tubing.

E. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections. No wire or cable shall be supported by a connection point. Provide service loops where harnesses of different classes cross, or where hinged panels are to be interconnected.

F. Correct unacceptable wiring conditions including but not limited to:
   1. Deformed, brittle or cracked insulation.
   2. Torn or worn cable jacket.
   3. Excessively scored cable jackets.
   4. Insulation shrunken or stripped further than 1/8" away from the actual point of connection within a connector, or on a punch block.
   5. Ungrommeted, unbushed, or uninsulated wire or cable entries.
   6. Deformation or improper radius of wire or cable.

3.2 SPLICING

A. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.
   1. At designated splices, maintain conductor color code across all splices.
      a. All shielded cables shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels or equipment enclosures.
      b. Within buildings, make splices only in designated terminal cabinets and/or on designated equipment backboards.

3.3 PULLING IN

A. Verify that all raceway has been de-burred and properly joined, coupled, and terminated prior to installation of cables. Verify that all raceway is clear of foreign matter and substances prior to installation of wire or cable.

B. Inspect all conduit bends to verify proper radius. Comply with Code for minimum permissible radius and maximum permissible deformation.

C. Do not subject wire and cable to tension greater than that recommended by the manufacturer. Use multi-spool rollers where cable is pulled in place around bends. Do not pull reverse bends.

D. Provide a box loop for all wire and cable routed through junction boxes or distribution panels. Cable loops and bends shall not be bent at a radius greater than that recommended by the manufacturer.

3.4 SUPPORT

A. Separation. Conform to the following table with respect to separation from power and radio frequency (RF) sources. Provide at least twice the listed separation at fluorescent light

fixtures, ballasts and similar high intensity Electromagnetic Field sources, including but not limited to motors, transformers and copiers.

Separation of Telecommunications Cabling and Pathways from 480 V or Lower Power Lines

Condition	Minimum Separation Distance		
	< 2kVA	2-5 kVA	> 5kVA
Unshielded power lines or electrical equipment in proximity to open or nonmetal pathways.	5 in.	12 in.	24 in.
Unshielded power lines in proximity to a grounded metal conduit pathway.	2.5 in.	6 in.	12 in.
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway.	N/A	3 in.	6 in.

B. Support: Provide support for all cabling. Conform to the restrictions of the National Electric Code and Section 27 05 29.

END OF SECTION

SECTION 27 1116

COMMUNICATIONS CABINETS, RACKS, FRAMES AND ENCLOSURES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Communications racks and cabinets.

B. Communications Rack Mounted Power Protection and Power Strips

1.2 RELATED WORK IN OTHER SECTIONS

A. Section 27 05 26 – Grounding and Bonding for Communications Systems
   1. Bonds racks and cabinets.

B. Section 27 05 33 – Conduits and Backboxes for Communications Systems
   1. Signal systems raceways at communications rooms

C. Section 27 05 36 – Cable Trays for Communications Systems
   1. Signal systems cable tray at communications rooms

D. Section 27 11 26 – Communications Rack Mounted Power Protection and Power Strips
   1. Installation of rack mounted power strips, protection and distribution units.

E. Section 27 13 00 – Communications Indoor Backbone Cabling
   1. Inside Backbone Terminations at communications rooms.

F. Section 27 15 00 Communications Horizontal Cabling
   1. Rack mounted horizontal patch panels.

1.3 REFERENCES

A. American National Standards Institute (ANSI)
   1. EIA/ECA-310-E (2005) Cabinets, Racks, Panels, and Associated Equipment
   2. ANSI/TIA-607-D-2019 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

B. International Conference of Building Officials (ICBO)
   1. AC156 ICBO ES Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components (Jul. 2004)

C. Telecordia Technologies
   1. Network Equipment Building System (NEBS) GR-63-CORE (Seismic Zone 4)

1.4 SUBMITTALS

A. Conform with the requirements of Section 01 30 00 – Administrative Requirements and Section 27 05 00 - Common Work Results for Communications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 01 60 00 – Product Requirements and Section 27 10 00 – Structured Cabling, Basic Materials and Methods.

PART 2 - PRODUCTS

2.1 GENERAL

A. KEYS
1. Key all boxes, cabinets, enclosures, panels, controls, doors and related provided for similar usage within a system identically.

2.2 EQUIPMENT ENCLOSURE SYSTEMS

A. General:
1. Provide enclosure systems including, but not limited to enclosures, cabinets, cases and related panels and accessories as specified herein. Provide size and quantity as shown on drawings or scheduled.
2. Provide color as shown on drawings. If no color is shown on drawings, submit manufacturer's standard color chips for selection.
3. Provide enclosure systems conforming to the CBC, latest edition, for seismic design.
4. Equipment Enclosures: Each rack provided with frame angles tapped 10-32, ANSI/EIA 310-D Universal Spaced.

B. Equipment Rack, Undercounter, Pullout and Pivoting
1. Drawing Reference: R18
2. Features/Construction:
a. EIA compliant 19” rotating slide-out equipment rack intended for permanent installation and integration into a millwork or cabinet opening.
b. Overall dimensions of rack shall be not more than 19.25” wide x 20” deep
c. Provide the following quantity of rack spaces:
1) R18E: 12 RU
2) R18G: 14 RU
3) R18M: 20 RU
d. Rack shall support up to a 300 pound loading, in closed and pull-out operation.
e. Rack shall pull out 19” on integrated ball bearing slides and rotate 90º for equipment servicing. When rotating rack, locking detent shall allow rack to lock in place at 0, 60 and 90 degrees of rotation.
f. Rackrail shall be 11-gauge steel with tapped 10-32 holes in universal EIA spacing. Rackrail shall be finished in black e-coat with marked rackspaces.
g. Rough-in pan shall be 14-gauge steel.
h. Finish on assembly shall be durable flat black powder coat.
i. Trim/locking panel shall lock SRSR in closed position and be 11-gauge aluminum with brushed black anodized finish.
j. Unless otherwise noted, completely enclose interior of enclosure, or ensembles of enclosures with equipment, blank or vent panels
3. Manufacturers
a. Middle Atlantic SRSR–4-14.
b. Or equal (no known equal).

C. Relay Rack, Integrated Vertical Wire Chase, Zone 4 rated
1. Drawing Reference(s)
a. R15
2. Construction

a. Capacity: 1,000 lb and meet Telecordia Technologies GR-63-CORE Network Equipment Building Systems (NEBS) Zone 4 requirements.
b. Mounting Channels: Punched on the front and rear flange with the EIA-310-D Universal hole pattern
c. Supports 19” EIA-310-D compliant rack-mount equipment like patch panels and
d. network switches
e. #12-24 threaded equipment mounting rails
f. Equipment mounting rails to have marked and numbered rack-mount spaces (U). Numbering start at bottom of the rack.
g. Fully bonded rack with two masked grounding locations and includes a two mounting hole. Ground Terminal Block for easy connection to the Telecommunications Grounding Busbar.
h. Overall width shall be no more than 24”.
i. 44 EIA Rack Units minimum.
j. Provide fifty (50) 12-24 rack mounting screws per rack.
k. Separate front and rear 6”W x 6.38”D cable managers attach with included offset brackets to align with the front and rear of the rack.

3. Manufacturers, Zone 4 rated assembly - subject to minimum panel opening criteria scheduled above:
   a. CPI Seismic Frame Two Post Rack 13853-703 with Seismic Frame Two-Post Vertical Cabling Section 13704-703 (District Standard).

D. Four-Post Server Rack
1. Drawing reference: R28
2. Construction
   a. Manufacturer tested Zone 4 assembly meeting Telcordia Technologies Network Equipment Building System (NEBS) document GR-63-CORE seismic zone 4 test procedure.
   b. Design equipment load not less than 1000 pounds.
   c. Height: 83.9", 43U
   d. Width:23.6"
   e. Depth: 41.3"
   f. Front Door: Single, Perforated Metal
   g. Rear Door: Double, Perforated Metal
   h. Latches: Two-Point, Keyed Lock
   i. Finish/ Color: Black
   j. Top Panel: Standard Top Panel
   k. Side Panels: Solid, 2 Each
   l. Where enclosure bays are ganged into ensembles, provide manufacturer’s ganging kit to maintain frame alignment.
3. Manufacturers:
   a. CPI Z4-Series Seismic Frame Cabinet System z4-21N-113C-C12 (District Standard)

2.3 RACK PANELS AND ACCESSORIES

A. Rack Mounting Screws:
1. Screws 10-24; length as required for at least 1/4" excess when fully seated; oval head with black plastic non marring cup washer or equivalent ornamental head; nickel, cadmium or black plated; Phillips, Allen Hex, Square-Tip or Torx drive. Slotted screws are not acceptable.

B. Vertical Lacer Strips
1. 44RU high vertical steel strips with points for attachment of velco cable ties at at least 6” o.c.
2. Manufacturer:

a. CPI

C. Horizontal Lacer Bars
1. EIA 19” Width steel strips or bars suitable to provide support to large cable dressed horizontally through racks
2. Size to suit load and mounting width.
3. Manufacturer:
a. CPI.

PART 3 - EXECUTION

3.1 MOUNTING

A. Unless otherwise noted, all floor supported equipment racks shall be bolted to the structure in accordance with the requirements of the CBC and the contractors approved structural engineering submittal demonstrating the method to be used to conform to these requirements.

B. Rows of identical racks shall be bolted together, in addition to being bolted to the floor, and bonded to form a single electrical ground plane.

C. Wall mounted equipment racks and cabinets shall similarly be bolted to structural members in accordance with the requirements of the CBC and the contractors approved structural engineering submittal demonstrating the method to be used to conform to these requirements.

3.2 EQUIPMENT ENCLOSURE (RACK) AND EQUIPMENT BACKBOARD FABRICATION

A. Combustible material, other than incidental trim of indicated equipment, is prohibited within equipment racks.

B. Provide permanent labels for all equipment and devices.

C. Floor racks to be bolted floor unless otherwise indicated.

D. Access shall not require demounting or de-energizing of equipment. Install access covers, hinged panels, or pull-out drawers to insure complete access to terminals and interior components.

E. Provide a permanent label on the front of each equipment rack including the rack designation, and the circuit breaker number and associated electrical distribution panel designation servicing same.

F. Where wiring of mixed types are called for on the plans, maintain separation of wiring classifications as specified in the individual sections of the Communications Work. Separately dress, route and land microphone, audio line level and data cables and related on the right side of the equipment enclosure, as viewed from the rear; dress, route, and land loudspeaker level, data and control cables on the left side of the equipment enclosure, as viewed from the rear.

G. Provide vertical wire management of cabling within the rack independent of the adjustable EIA mounting rails. Vertical wiring management provided by the contractor within the rack shall not prevent such rails from being moved as required by the Owner.

H. Dress and support cabling at a minimum of 24 inch on center.

I. Access shall not require demounting or de-energizing of equipment or cabling. Install access covers, hinged panels, or pull-out drawers to insure complete access to terminals and interior components.

J. Fasten removable covers containing any wired component with a continuous hinge along one side, with associated wiring secured and dressed to provide an adequate service loop. Provide an appropriate stop locks to hold all hinged panels and drawers in a serviceable position.

K. Provide permanent labels for all equipment and devices. Where possible, fasten such labels to the rack frame or to blank or vent panels which will remain in place when active equipment is removed for possible service.

3.3 SIGNAL GROUNDING & BONDING PROCEDURES

A. Comply with National Electrical Code and the California Electric Code. Bond equipment racks to ground in accordance with the California Electric Code and ANSI/ EIA/ TIA 607 and Section 27 05 26

B. Unless otherwise noted maintain a unipoint ground scheme.

C. Equipment enclosures shall not be permitted to touch each other unless bolted together and electrically bonded.

END OF SECTION

SECTION 27 1119

COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section defines material standards for:
   1. Copper Termination Assemblies, including
      a. Rack and cabinet mounted copper patch panels
      b. Backboard, rack and cabinet mounted terminal blocks
   2. Fiber Termination Assemblies, including:
      a. Fiber connectors
      b. Rack and cabinet mounted fiber patch panels

1.2 RELATED WORK UNDER OTHER SECTIONS

A. Section 27 05 00 – Common Work Results for Communications

B. Section 27 05 26 – Grounding and Bonding for Communications Systems

C. Section 27 10 00 – Structured Cabling, Basic Materials and Methods

D. Section 27 11 13 – Communications Entrance Protection

E. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures

F. Section 27 11 23 – Communications Cable Management

G. Section 27 13 00 – Communications Indoor Backbone Cabling

H. Section 27 15 00 – Communications Horizontal Cabling

1.3 REFERENCES:

A. ELECTRONIC INDUSTRIES ALLIANCE (EIA)
   1. EIA/ECA-310-E (2005) Cabinets, Racks, Panels, and Associated Equipment

1.4 SUBMITTALS

A. Conform with the requirements of Section 27 05 00 - Common Work Results for Communications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 27 10 00 – Structured Cabling, Basic Materials and Methods.

PART 2 - PRODUCTS

2.1 COPPER CABLE TERMINATION DEVICES AND RELATED

A. Data Patch Panels, Category 6A Rated, Rack Mounted
1. Drawing References:
a. ***C6APP (Angled), where *** refers to port count.
2. Functions/Features:
a. 19" EIA rack mountable.
b. Bent in center, with jacks arranged on angled planes to each side of bend to force patch cables to dress toward racks edges.
c. 48 ports per EIA rack unit (3.50").
d. Industry standard RJ-45 jacks inserted in openings in steel plate
1) Arranged in rows on steel panel,
2) Jacks on front,
3) Terminations on rear.
4) Patch panel and Port identifier label space on front – label per Section 27 05 53 - Identification for Communications Systems.
e. Each opening to be filled with jacks as specified in Section 27 15 00 - Communications Horizontal Cabling. Match the color coding specified.
3. Manufacturer
a. Commscope CPPA-UDDM-M-2U-48
b. Or equal

2.2 FIBER CABLE TERMINATION DEVICES AND RELATED:

A. Fiber Optic Connectors and Related:
1. General
a. Connectors to comply with:
1) EIA/TIA-4750000-C
2) EIA/TIA-604-3A
2. Fusion Splice System
a. Insertion Loss:
1) ≤0.03 dB - manufacturer's rating for typical splice – multimode
2) ≤0.06 dB - manufacturer's rating for typical splice – singlemode.
b. Manufacturer
1) Corning Cable Systems Model X77 Micro Fusion Splicer
2) AFL Telecommunications.
3) or equal.
3. Connectors:
a. LC with manufacturer installed fiber pigtails unless otherwise noted or scheduled. Contractor to fusion splice the supplied pigtail to the fiber backbone cabling installed under the work of this Project.
b. Connector performance per TIA- 568.C.3 and the following.
1) Insertion Loss:
a) Laser Optimized Multimode:
(a) Less than or equal to 0.75 dB per mated pair
b) Singlemode, Ultra Polish
(b) Less than or equal to 0.75 dB per mated pair
c) Singlemode, Angle Polish
(c) Less than or equal to 0.30 dB per mated pair
2) Return Loss
a) Singlemode, Ultra Polish, greater than or equal to 55 dB
b) Singlemode, Angle Polish, greater than or equal to 65 dB
3) Manufacturer, Connector

a) Corning Cable Systems (Design Basis)
b) or equal.

B. Fiber Patch Panel:
1. Drawing References:
a. *** FPP, Fiber Patch Panel where *** refers to the fiber port count.
2. Features/Functions/Performance:
a. 19" EIA rack mount.
b. Suitable for housing fiber optic mechanical splices in a neat and orderly fashion.
c. Stores a minimum of one meter of cable without kinks or twists.
d. Suitable for use with connectors with manufacturer supplied fiber pigtails as required herein above, fusion spliced to building and outside plant backbone cabling.
e. Provides individual strain relief for each splice.
f. Suitable for reentry, if required for future maintenance or modification, without damage to the cable or splices
g. All required splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors shall be provided.
h. Incorporates cable tie downs and routing rings.
i. Quick-Release Hinges — Spring loaded quick release hinges enable easy removal of front and rear doors for complete access to fiber connections
j. Enhanced Labeling — Label virtually any port configuration hinged labels. The labels hang on the front door for improved visibility. When the door is opened, labels flip down allowing ready viewing of the label and corresponding ports.
k. Rotating Grommets — Rotating grommets facilitate loading and retention of jumpers and fiber while minimizing microbending stress when using the sliding tray.
l. Complete Access — Management tray has a positive stop in both front and rear working positions providing complete access for moving, adding, changing, or cleaning of fiber connections
m. Maximum Capacity — Enables a maximum amount of fibers to be patched or patched and spliced in a 2, 3, and 4 RMS enclosure without compromising the accessibility. This allows more efficient utilization of rack space.
n. Top and bottom access holes located at the rear of the enclosure allow fibers to be routed between tandem enclosures without having to run fibers outside of the enclosure.
o. Color coded front panel patch connector - color yellow at singlemode strands and color blue at multimode strands. Provide manufacturer’s blank cover inserts at unused openings.
p. High Density - FPP can terminate between 18 to 36 strands per rack unit. Higher density assemblies not acceptable unless otherwise indicated on the plans.
3. Manufacturer:
a. Corning Cable Systems Pretium Connector Housing (PCH) with splice trays, strain relief and Closet Connector Housing (CCH) inserts as required (Design Basis).
b. or equal.

PART 3 - EXECUTION

A. Refer to Section 27 13 00 Communications Indoor Backbone Cabling for requirements for termination of Riser and Outside Plant Cabling within IDF's, and BDF's.

B. Refer to Section 27 10 00 – Structured Cabling, Basic Materials and Methods and Section 27 15 00 – Communications Horizontal Cabling.

END OF SECTION

SECTION 27 1123

COMMUNICATIONS CABLE MANAGEMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Section includes provision of cable management for cabling installed under the work of this Project as well as patch cords at equipment racks

B. Scope includes:
1. Innerduct
   a. Interior
   b. Outside Plant
2. Cable End Spillway
3. Backboard Cable Management
4. Patch Panel Cable Management at racks and cabinets

1.2 RELATED WORK IN OTHER SECTIONS

A. Section 27 05 33 – Conduits and Backboxes for Communications Systems

B. Section 27 05 36 – Cable Trays for Communications Systems

C. Section 27 05 53 – Identification for Communications Systems

D. Section 27 10 00 – Structured Cabling, Basic Materials and Methods

E. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures

F. Section 27 11 19 – Communications Termination Blocks and Patch Panels

G. Section 27 13 00 – Communications Indoor Backbone Cabling

H. Section 27 15 00 – Communications Horizontal Cabling

1.3 REFERENCES

A. American Society For Testing and Materials (ASTM)
1. ASTM D2239-03 Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

B. Underwriters Laboratories (UL)
1. UL 910 Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables used in Spaces Transporting Environmental Air (Nov. 1998)

1.4 SUBMITTALS

A. Conform with the requirements of Section 01 30 00 – Administrative Requirements and Section 27 05 00 - Common Work Results for Communications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 01 60 00 – Product Requirements and Section 27 10 00 – Structured Cabling, Basic Materials and Methods.

PART 2 - PRODUCTS

2.1 INNERDUCT

A. Woven Mesh Innerduct
1. Drawing Reference: WMID
2. Features/Functions
a. Three inch wide woven mesh assembly contains at least three continuous pullable sleeves, each can accommodate a cable of at least 1” diameter.
b. Systems providing fewer than 3 integrally woven sleeves per WMID assembly not acceptable.
c. Includes color coded pull tape in each sleeve.
d. Pre-Lubricated for cable pulling
e. Non-Hydroscopic
f. 2500 Pound Tensile Strength
g. 480 degree melting point.
h. At least 5 years prior field use including at least 25 million feet of product in use.
i. Provide plenum rated assembly at plenum locations as defined by the National Electric Code.
3. Manufacturers:
a. Maxcell/TVC 3” 3-cell in three unique colors per duct.
b. or equal (No known equal with identical 3 sleeves woven into a single assembly nor equal industry usage).

2.2 PATCH PANEL CABLE MANAGEMENT

A. Patch Panel Wire Management, Rack Mounted, Snap Cover.
1. Drawing References:
1) 2 RU Version: WIRE MANAGER
2. Construction
a. EIA 19 " Rack Mount, as required
b. Continuous flexible system of T shaped fingers and slots along top and panel, deburred to avoid snagging patch cord jacket.
c. Contoured front door with snap-hinges swings up or down and stays in the open position while cabling.
d. Three edge-protected, oval-shaped pass-through ports allow patch cords to pass front-to-rear.
e. Select depth to match installed depth of vertical wire managers
3. Capacity
a. 1 RU - accommodates at least 35 patch cords.
b. 2 RU - accommodates at least 70 patch cords.
4. Manufacturers – 2 RU, including for use with R15 rack:
1) Commscope
2) or equal.

2.3 CONDUIT CABLE MANAGEMENT

A. Conduit End Waterfall Spillway
1. Drawing Reference: CEW

2. Features/Functions
   a. Spillway fastens to end of EMT conduit, provides radius sweep, open on top, solid from below
   b. Maintains proper bend radii for fiber/cable
   c. Provides tie points for fire pillow retention
   d. Supports up to 100 lbs. of hanging fiber/cable
   e. Clamp for securing to EMT
   f. Self-fastening tie down system for supporting cabling
3. Construction:
   a. Fire Retardant ABS
4. Manufacturers:
   a. Bejed BJ-2049 Spillway.

2.4 BACKBOARD CABLE MANAGEMENT

A. Fiber Management Ring, Preformed Loop
   1. Drawing Reference: FMR
   2. Construction:
      a. 24 inch diameter steel ring stores fiber slack using Velco fasteners at regular intervals around ring.
      b. Screw fastens to backboard at BDF or IDF.
   3. Manufacturer
      a. Leviton 48900-IFR for inside plant riser fiber and Leviton 48900-OFR for outside plant fiber.
      b. or equal (no known equal)

B. Wire Management Rings, Wall/Ceiling Mounted:
   1. Drawing References/Functions Features:
      a. WMRB - Bridle Ring Type, Threaded Lag Screw
      b. WMRC - Closed Ring, U shaped assembly with two screw holes at ends,
      c. WMRO - Open, Re-enterable Split Ring permitting cables to be inserted midspan, two screw holes at ends
      d. WMP** - Steel back board with 4 inch deep min, 8 inch wide vertical wire management rings, front enterable. Provide trough at bottom of each column of WMP.
      e. WMP**T - Narrow, steel back board with 4 inch deep min, 3 inch wide vertical wire management rings, front enterable.
   2. Provide as required to support indicated cable bundle and location.
   3. Provide type WMRB at wood frame construction for cable hung from underside of ceiling, unless otherwise noted.
   4. Manufacturers:
      a. WMRB:
         1) B-Line Fasteners, BR Series
         2) Senior Industries
         3) T&B
         4) or equal.
      b. WMRC
         1) Chatworth Products Wall Mount Closed D Ring.
         2) Senior Industries
         3) or equal.
      c. WMRO
         1) Chatworth Products Wall Mount Open Ring.
         2) AllenTel
         3) Systimax, Inc.
         4) Siemon
         5) or equal.
      d. WMP

1) Siemon S188-*** to match adjacent terminal blocks with S188-WD
2) Ortronics OR-806003194 or OR-806003196 to match terminal blocks.
3) By any manufacturer listed for 110TB under Section 27 11 19 – Communications Termination Blocks and Patch Panels
4) or equal.

e. WMP**T
f. Siemon S110M-WM-*** to match adjacent terminal blocks
g. By any manufacturer of listed for 110TB under Section 27 11 19 – Communications Termination Blocks and Patch Panels
h. or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to Section 27 13 00 Communications Indoor Backbone Cabling for requirements for cable routing within IDF's, and BDF's.

3.2 INNERDUCT INSTALLATION

A. Schedule of Application
1. Underground
a. Provide WMID at new and existing ducts used by the work of this project. Provide the WMID in sufficient quantity at each segment to place the indicated fiber cabling plus 3 spare cells. Example: Where the plans indicate provision of 3 OSP fiber cables in a ductbank segment, provide at least two 3-cell WMID.
b. Place fiber cabling meeting the maximum diameter requirements of the WMID manufacturer inside WMID.
c. Omit WMID at conduits smaller than 2”
2. At 4” and larger interior conduits, provide riser or plenum rated WMID as applies. Provide the WMID in sufficient quantity at each segment to place the indicated cabling plus 3 spare cells. Example: Where the plans indicate provision of 3 OSP fiber cables in a conduit, provide at least two 3-cell WMID. Provide plenum rated WMID at plenum conditions.

3.3 CONDUIT END WATERFALL

A. Fasten securely to conduit end wherever cabling will exit conduit 18" or more above the cable tray to prevent damage due to cabling due to weight of cable bearing on a conduit end.

B. Secure cabling with integral cable restraint system.

END OF SECTION

SECTION 27 1300

COMMUNICATIONS INDOOR BACKBONE CABLING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Work of this Section includes:
1. Indoor Copper Backbone Cabling between Communications Rooms and communications terminal nodes other than station cabling.
2. Indoor Optical Fiber Backbone Cabling between Communications Rooms and communications terminal nodes other than station cabling.
3. Terminate fiber on patch panels as specified in Section 27 11 19.
4. Terminate copper cabling on terminal blocks as specified in Section 27 11 19. Provide terminal block, high pair count copper connector cabling and rack mounted patch panels to permit Owner's telephone contractor to cross-connect the entrance and riser cabling to individual station ports using patch cords.
5. For all cabling:
   a. Test cabling to demonstrate performance to specified standards or better using test equipment and methods as specified in Section 27 10 00.
   b. Label cables, jacks, plates and patch panels as specified in Section 27 05 53.
   c. Document on Record Documents as described in Section 27 05 00.

B. Related work in other Sections
1. Section 27 05 26 – Grounding and Bonding for Communications Systems
2. Section 27 05 29 – Hangers and Supports for Communications Systems
3. Section 27 05 33 – Conduits and Backboxes for Communications Systems
4. Section 27 05 36 – Cable Trays for Communications Systems
5. Section 27 05 48 – Noise and Vibration Controls for Communications Systems
6. Section 27 05 53 – Identification for Communications Systems
7. Section 27 10 00 – Structured Cabling, Basic Materials and Methods
8. Section 27 11 13 – Communications Entrance Protection
9. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
10. Section 27 11 19 – Communications Termination Blocks and Patch Panels
11. Section 27 11 23 – Communications Cable Management
12. Section 27 11 26 – Communications Rack Mounted Power Protection & Power Strips
13. Section 27 15 00 – Communications Horizontal Cabling

1.2 REFERENCES

A. Refer to Section 27 10 00 – Structured Cabling, Basic Materials and Methods

1.3 SUBMITTALS

A. Conform with the requirements of Section 01 30 00 – Administrative Requirements and Section 27 05 00 - Common Work Results for Communications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 01 60 00 – Product Requirements and Section 27 10 00 – Structured Cabling, Basic Materials and Methods.

1.5 SEQUENCING

A. Not Used.

PART 2 - PRODUCTS

2.1 COPPER BACKBONE CABLING

A. General
1. Each conductor shall be a minimum of 22 or 24 AWG.
2. Complies with
a. ICEA S-90-661
b. EIA TIA/EIA-568-B.1
c. EIA TIA/EIA-568-B.2
d. NEMA WC 63.1
e. UL 444
3. Solid conductor 100 ohm multi-pair UTP (Unshielded twisted pair), formed into 25 pair binder groups covered with a gray thermoplastic jacket.
4. Imprinted with
a. manufacturers name or identifier,
b. flammability rating,
c. gauge of conductor,
d. transmission performance rating (category designation)
e. at regular intervals not to exceed 2 feet.
5. The word "FEET" or the abbreviation "FT" shall appear after each length marking.
6. Provide communications general purpose (CM or CMG), communications plenum (CMP) or communications riser (CMR) rated cabling in accordance with NFPA 70.
7. Type CMP and CMR may be substituted for type CM or CMG and type CMP may be substituted for type CMR in accordance with NFPA 70.
8. Color coding shall comply with industry standards for 25 pair cables.

B. Cables: Cables which interconnect interior distribution centers shall conform to ICEA S-80-576. Where required, cable shall be UL classified low smoke and low flame for use in air plenums in accordance with NFPA 70. Cables which terminate at each station jack shall conform to ICEA S-80-576. Each cable shall be a minimum of 22 or 24 AWG.

C. Telephone, Inside Distribution Wire, Plenum Rated
1. Drawing Reference ** PR T-IDWP, where ** refers to required pair count.
2. Construction:
a. 4 to 100 pair count voice pair cabling in overall jacket.
b. NEC Type CMP.
c. USOC color code.
d. Nominal Outside Diameter, not to exceed the following:

Pair Count	Outside Diameter (inches)
4 pr.	0.19
25 pr.	0.47
50 pr.	0.63
100 pr.	0.84

3. Manufacturer:
a. Systimax 2010 (District Standard).

2.2 FIBER OPTIC COMMUNICATIONS CABLING AND RELATED:

A. Fiber count per cable to comply with minimum counts indicated on the plans. Comply with applicable Code for insulation, jacket, marking and listing for applicable use.

B. FIBER, SINGLEMODE - GENERAL
1. Meeting EIA/TIA 568
2. Construction:
a. Standards Compliance ITU-T G.652.D | ITU-T G.657.A1 | TIA-492CAAB (OS2)
b. Attenuation, maximum 0.22 dB/km @ 1,550 nm | 0.23 dB/km @ 1,575 nm | 0.25 dB/km @ 1,490 nm | 0.25 dB/km @ 1,625 nm | 0.31 dB/km @ 1,385 nm | 0.34 dB/km @ 1,310 nm | 0.35 dB/km @ 1,650 nm
c. Dispersion, maximum 18 ps(nm-km) at 1550 nm | 3.5 ps(nm-km) from 1285 nm to 1330 nm at 1310 nm
d. Mode Field Diameter 10.4 µm @ 1,550 nm | 9.2 µm @ 1,310 nm | 9.6 µm @ 1,385 nm
e. Mode Field Diameter Tolerance ±0.3 µm @ 1310 nm | ±0.5 µm @ 1550 nm | ±0.6 µm @ 1385 nm
f. Index of Refraction 1.467 @ 1,310 nm | 1.468 @ 1,385 nm | 1.468 @ 1,550 nm
g. Polarization Mode Dispersion Link Design Value, maximum 0.04 ps/sqrt(km)
h. Cladding Diameter 125.0 µm
i. Cladding Diameter Tolerance ±0.7 µm
j. Cladding Non-Circularity, maximum 0.7 %
k. Coating Diameter (Colored) 253 µm
l. Coating Diameter (Uncolored) 240 µm
m. Coating Diameter Tolerance (Colored) ±7 µm
n. Coating Diameter Tolerance (Uncolored) ±5 µm
o. Coating/Cladding Concentricity Error, maximum 12 µm
p. Core/Clad Offset, maximum 0.5 µm
q. Cabled Cutoff Wavelength, maximum 1260 nm
r. Point Defects, maximum 0.10 dB
s. Zero Dispersion Slope, maximum 0.090 ps/[km-nm-nm]
t. Zero Dispersion Wavelength, maximum 1322 nm
u. Zero Dispersion Wavelength, minimum 1302 nm
3. Manufacturer:
a. Corning OS2 Singlemode Fiber
b. Or equal

C. FIBER OPTIC CABLE CONSTRUCTION, GENERAL
1. All Dielectric, unless otherwise noted.
2. Color Code:
a. Per EIA/TIA-598A.
b. Colors shall be across specified storage/installation temperature range.
c. Means of providing conforming colors shall not degrade performance of cable.
3. Jacket:
a. Free of splits, holes or blisters.
b. Marked in conformance with NEC 350G
4. Heavy duty construction, Fiberglass Epoxy Rod/Kevlar strength member(s).
5. Each fiber to be 100% attenuation tested by the Manufacturer prior to shipping to indicate conformance of shipped cable to requirements herein. Manufacturer's test to be affixed to shipping reel.
6. Performance:
a. Temperature Sensitivity:
1) Storage: -40C° to +70C°.
2) Installation: -30C° to +70C°.
3) Variance:
a) Single Mode: Average change, not more than 0.05 dB/km at 1550 -40C° to +70C°. Maximum change not more than 0.15 dB/km at 1550 nm.

D. Fiber Optic Cable, Plenum Rated:
1. Drawing References:
a. XX FOS Singlemode, Plenum where XX indicates fiber count.
2. Fiber: Refer to
a. FIBER, SINGLE MODE, GENERAL, as shown in this section.
3. Application: Intra-building distribution in building plenum and duct space
4. Listing: Meeting NEC OFNP, Listing by nationally recognized testing agency.
5. Construction:
a. Refer additionally to Fiber Cable Construction, General, elsewhere herein.
b. Jacket: Subject to listing and rating for plenum cable.
c. Tight Buffer construction only, “Core Lock” not required.
d. Dimensions, not to exceed the following:
1) 1 to 4 Fibers: 0.20"
2) 5 to 12 Fibers: 0.28"
3) 12 to 24 Fibers: 0.50"
4) 25 to 60 Fibers: 0.80"
5) 61 to 108 Fibers: 0.90"
6) 109 to 144 Fibers: 1.10"
6. Mechanical Specifications
a. Min. Bend Radius Installation 75 mm (2.95 in)
b. Min. Bend Radius Operation 50 mm (1.97 in)
c. Max. Tensile Strength, Long-Term, ≤12F 132 N
d. Max. Tensile Strength, Long-Term, >12F 200 N
e. Max. Tensile Strength, Short-Term, ≤12F 440 N
f. Max. Tensile Strength, Short-Term, >12F 660 N
7. Cable Design
a. Central Element Yarn
b. Outer Jacket Color Yellow
c. Outer Jacket Material Flame-retardant
8. General Specifications
a. Environment Indoor
b. Cable Type Tight-Buffered
c. Fiber Category Single-mode (OS2)
d. Flame Rating Plenum (OFNP)
9. Manufacturer:
a. Corning MIC Tight-Buffered Plenum, Single Mode (OS2)
b. Or equal

2.3 TELEPHONE CABLING CLOSURE

A. In Building Telephone Closure:
1. Drawing Reference: IBTC
2. Features and Functions:
a. Provides transition point from unlisted, gel-filled Outside Plant Cabling to Interior (T-IDW) cabling
b. Can house a straight, butt, and branch splice in a protective housing.
c. Not pressurized or encapsulated.
d. Fire-retardant Plastic construction, meeting PUB55006 for interior (in-building) installation.
e. RUS (formerly REA) listed for application.
f. Provide a suitable means for mounting to backboard.
3. Manufacturer:
a. 3M K&B Series
b. or equal.

PART 3 - EXECUTION

3.1 FIBER OPTIC CABLING PRACTICE

A. Service Loop
1. At IDF's and BDF's, at both ends of cables, provide at least 15 feet of fiber in excess of that required to reach the patch panel by a dressed route. Form into a storage loop and fix in place as directed by the Owner's Representative.
2. At the Telecomm Building, provide at least 20 feet of fiber in excess of that required to reach the patch panel by a dressed route. Form into a storage loop and fix in place in the cable vault (outside of the machine room) as directed by the Owner's Representative.

B. Splicing:
1. Interior: Provide mechanical splices,.
2. Exterior: Do not splice at exterior unless splicing is indicated on Plans. In such circumstances, provide fusion splices.

C. Termination Methods
1. Review proposed breakout procedure with the Owner's Representative before beginning this work.
2. Use full cable breakout method. Display both connectorized and non-connectorized fibers entering a patch panel.
3. Remove sheath so that no more than 4 inches of unstripped cable enters the panel.
4. Strip back a sufficient amount of cable so that fiber strands wrap at least one full wrap, circle or figure eight, inside the panel with the connectorized ends attached to the most distant bulkhead connectors.
5. Group together the fibers from each binder group with 0.125 inch nylon spiral wrap. (Systimax, Panduit, Corning Cable Systems SAN-DT25-06, or equal.)

D. Outside Plant
1. Obtain allowable pulling tension for underground fiber cable from the manufacturer. Use pulling equipment with tension gauges to verify that cable pulls do not exceed allowable pulling tension.
2. Loose Tube, Gel Filled Cabling - No flow of filling when tested in accordance with FOTP-81.

E. Loose Tube Breakout
1. Install breakout tubing over the full exposed length of the fiber strands.
2. Install buffer tubing on all strands, including those not being connectorized as part of this Contract.
3. Reinforce and protect the junction of the cable sheath and buffer tubing using a method approved by the Owner's Representative before beginning this work.

3.2 COPPER BACKBONE TIE CABLE INSTALLATION AND TERMINATION

A. General:
1. Backbone cable(s) shall be installed in conduit system unless otherwise noted.

B. Sequencing:
1. If the installation of a tie cable requires the disconnection and removal of any existing cable(s) carrying active service prior to installation
a. Notify the Owner's Representative no less than 5 working days in advance of when this work is to be performed.
2. When this work is performed, the newly installed cables must be installed, tested and passed in one 24 hour period beginning when the active service on the existing cable is interrupted.

C. Installation of Tie Cable:
   1. All tie cable between terminal blocks at IDF rooms shall be continuous, unspliced runs.
   2. Termination of Voice or Shared Use Tie Cable:
      a. Cable shall be terminated on patch panels.

3.3 DATA/TELEPHONE IDF ROOM LAYOUT

A. General:
   1. Final backboard design layout within an IDF room shall be approved by the Owner's Representative prior to work beginning on the backboard.
   2. Reference the design basis layout in the plans and bring to the Owner's Representative's attention any field conditions that would prevent installation as shown on the plans. Submit for resolution in a timely manner.
   3. Layout of cable around backboard:
   4. All backbone cable shall be formed around the backboard before either rising or dropping vertically to the punch blocks on which they are to be terminated.
   5. All backbone cable shall be organized in Wire Management Rings, Split D, Type WMRO. No tywraps or similar bindings are permitted.
   6. Termination:
      a. Terminate voice pairs and BDF tie cable on 110 blocks.

3.4 DATA/TELEPHONE NODE AND BDF ROOM LAYOUT

A. General:
   1. Final backboard and cable runway design layout within the Telecomm Building or within a BDF room shall be approved by the Owner's Representative prior to work beginning.
   2. Reference the design basis layout in the plans and bring to the Owner's Representative's attention any field conditions that would prevent installation as shown on the plans. Submit for resolution in a timely manner.

B. Layout of cable around backboard:
   1. All cables shall be formed around the backboard before either rising or dropping vertically to the punch blocks on which they are to be terminated.
   2. All cables shall be organized in Wire Management Rings, Split D, Type WMRO.. No tywraps or similar bindings are permitted.

C. For outside plant, flooded cables entering the Telecomm Building, a BDF or an IDF functioning as a building entrance facility,
   1. Transition in a splice case to non-flooded cable prior to termination on protector blocks for voice pairs, or on an unprotected 110 block for systems pairs, where such are indicated. Where systems pairs are not indicated, assume all pairs are for voice use.
   2. Position the splice case on the backboard where accessible for future service. Orient parallel to floor to prevent continuous gel flow from OSP cabling. Place on cable tray only where such placement is indicated on the plans.

END OF SECTION

SECTION 27 1400

COMMUNICATIONS OUTSIDE PLANT BACKBONE CABLING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Work of this Section includes:
   1. Outdoor (Outside Plant) Communications Cabling placed underground in new and existing communications ducts between the MDF and IDF's of this Project selected pedestal locations, including:
      a. High pair count copper cabling
      b. Fiber Optic Cabling
   2. Terminate fiber on patch panels as specified in Section 27 11 19.
   3. Terminate copper cabling on lightning protectors as specified in Section 27 11 13.
   4. For all cabling:
      a. Test cabling to demonstrate performance to specified standards or better using test equipment and methods as specified in Section 27 10 00.
      b. Label cables, jacks, plates and patch panels as specified in Section 27 05 53.
      c. Document on Record Documents as described in Section 27 05 00.

B. Related work in other Sections
   1. Section 27 05 26 – Grounding and Bonding for Communications Systems
   2. Section 27 05 29 – Hangers and Supports for Communications Systems
   3. Section 27 05 33 – Conduits and Backboxes for Communications Systems
   4. Section 27 05 36 – Cable Trays for Communications Systems
   5. Section 27 05 43 – Underground Ducts and Raceways for Communications Systems
   6. Section 27 05 48 – Noise and Vibration Controls for Communications Systems
   7. Section 27 05 53 – Identification for Communications Systems
   8. Section 27 10 00 – Structured Cabling, Basic Materials and Methods
   9. Section 27 11 13 – Communications Entrance Protection
   10. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
   11. Section 27 11 19 – Communications Termination Blocks and Patch Panels
   12. Section 27 11 23 – Communications Cable Management
   13. Section 27 13 00 – Communications Interior Backbone Cabling
   14. Section 27 15 00 – Communications Horizontal Cabling

1.2 REFERENCES

A. Usage: In accordance with Division 1.

B. In addition to the requirements of Section 27 05 00 - Common Work Results for Communications Systems and 27 10 00 - Structured Cabling, conform to the applicable portions of the following standards agencies:
   1. BICSI
      a. Customer Owned Outside Plant Design Manual, 6th Edition
   2. Insulated Cable Engineers Association (ICEA)
      a. ICEA S-56-434 (1983, 5th Ed.) Polyolefin Insulated Communication Cables for Outdoor Use.
   3. Underwriters Laboratories, Inc. (UL)
      a. UL 497 (1995, R 2001) Safety(Dec. 15, 1978, 4th Ed.; Rev. thru Oct. 9, 1990) Protectors for Communications Circuits
   4. U.S. Department of Agriculture, Rural Utilities Service (RUS), formerly Rural Electrification Administration (REA):

a. RUS/REA Bulletin(Jan. 1993; Supp 1 thru 7) 1755I-100 List of Materials Acceptable for Use on Telephone System of REA Borrowers.
b. RUS (REA) PC-2(Jan. 1978) Splicing Standard.
c. RUS (REA) PC-4(July 1976) Acceptance Tests and Measurements of Telephone Plant.
d. RUS (REA) PE-22(No. 1982) Aerial and Underground Telephone Cable.
e. RUS (REA) PE-33(Mar. 1985) Shield Bonding Connectors.
f. RUS (REA) PE-39(June 1993) Filled Telephone Cables.
g. RUS (REA) PE-60(Sep. 1979) Trunk Carrier Systems.
h. RUS (REA) PE-74(Oct. 1985) Filled Splice Closures.
i. RUS (REA) PE-87(Dec. 1983) Terminating (TIP) Cable.
j. RUS (REA) PE-89(June 1993) Filled Telephone Cable with Expanded Insulation.
k. RUS (REA)TECM 644(Apr. 1983; Issue No.3) Design and Construction of Underground Cable (Physical Plant).
l. RUS (REA)TECM 823(Aug. 1980; Issue No. 3) Electrical Protection by Use of Gas Tube Arrestors.
m. SUBMITTALS

C. Conform with the requirements of Division 1 and Section 27 05 00 - Common Work Results for Communications Systems.

1.3 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Division 1 and Section 27 10 00 – Structured Cabling, Basic Materials and Methods.

PART 2 - PRODUCTS

2.1 FIBER OPTIC CABLING

A. Fiber Optic Cable, Indoor Plenum/Outdoor Rated:
1. Drawing References:
a. XX FOS-OPP Singlemode, Indoor Plenum/Outdoor, where XX indicates fiber count.
2. Fiber: Refer to:
a. FIBER, SINGLE MODE, GENERAL, as specified under section 27 13 00.
3. Application: Inter-building site distribution in manholes and site conduit. Conform to NEC and CEC limits on placement within building envelope.
4. Listing: NEC OFNP, Listing by nationally recognized testing agency.
5. Construction:
a. Refer additionally to Fiber Cable Construction, General, elsewhere herein.
b. Suitable and Code approved for wet location installed inside duct.
c. Provide Loose Tube Gel Free Construction Water Blocking Construction.
d. Mechanical Specifications
1) Max. Tensile Strength, Long-Term 810 N
2) Max. Tensile Strength, Short-Term 2700 N
3) Min. Bend Radius Installation 171 mm (6.73 in)
4) Min. Bend Radius Operation 114 mm (4.49 in)
e. Cable Design
1) Central Element Dielectric
2) Buffer Tube Color Coding Yellow
3) Number of Ripcords 2
4) Outer Jacket Color Black
5) Outer Jacket Material Flame-Retardant, UV-Resistant

6) Tensile Strength Elements and/or Armoring Layer 1 - Dielectric strength members
7) Fiber Coloring Blue, Orange, Green, Brown, Slate, White, Red, Black, Yellow, Violet, Rose,Aqua
8) Fibers per Tube 12

f. General Specifications
1) Environment Indoor/Outdoor
2) Cable Type Loose Tube
3) Product Type Dielectric
4) Fiber Category Single-mode (OS2)
5) Flame Rating Plenum (OFNP)
6) Application Aerial , Direct Buried , Duct , General Purpose Horizontal

6. Manufacturer
a. Corning FREEDM Loose Tube, Gel Free, Plenum Single Mode (OS2)
b. Or equal

2.2 FIBER OPTIC SPLICE CLOSURE, OUTSIDE PLANT RATED

A. Drawing Reference: FOSC-OP
1. Functions/Features:
a. Supports stranded loose tube or ribbon fiber cables in either armored or dielectric configurations.
b. Fully sealed to protect fiber and splices
c. Re-enterable underground up to 5 meters.
d. Fusion splice protection chamber
e. Designed and tested to Telcordia GR-771 requirements
f. Rural Utilities Service (RUS) Listed
2. Manufacturers
a. AFL LightGuard 250. Provide splice trays, cable grounding kits and hanger brackets.
b. Commscope FOSC450. Provide splice trays, cable grounding kits and hanger brackets.

2.3 COPPER OSP CABLING

A. Telephone, Outside Plant, Underground in Ductbank
1. Drawing Reference: T-OPD, with pair counts as indicated.
2. Features/Functions:
a. Solid round copper wire.
b. Solid aluminum tape overall shield.
c. Gel filled.
d. Polyethylene Overall Jacket.
e. Suitable for direct burial.
3. Manufacturer:
a. Alcatel
b. Superior/Essex
c. General Cable
d. NORDX/CDT
e. Any meeting REA PE-39 for cable smaller than 400 pair,
f. Any meeting REA PE-39 or REA PE-89 for cable 400 pair or larger.
g. or equal.

B. Shield Connectors:
1. Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire.
2. The connector shall be made of tin-plated tempered brass.
3. Shield bond connectors shall comply with REA PE-33.

C. Grounding Braid:
1. Grounding braid shall provide low electrical impedance connections for dependable shield bonding.
2. The braid shall be made from flat tin-plated copper.

2.4 BOLLARD/PEDESTAL WIFI ENCLOSURE

A. Drawing References: PW1

B. Features/Functions:
1. Design: Cylindrical polyethylene plastic Wi-Fi bollard. Designed to protect APs and antennas in outdoor public spaces. Fiberglass interior equipment stand for mounting APs and antennas minimizes impact on wireless signals.
2. Performance: Designed to protect equipment from tampering, spilling liquids and weather. NEMA 3R performance for indoor/ outdoor environments.
3. Anchors to pre-installed concrete pedestal.
4. Available in 14 standard colors
5. Includes anchor base, equipment stand, hardware to fasten APs and antennas. Tamper resistant hardware
6. Construction:
   a. Nominally 0.25 in. thick, UV and cleaning chemical resistant UL-94HB Polyethylene plastic.
   b. Zinc coated, 0.25 in. thick steel anchor base.
   c. Fiberglass equipment mounting stand.
   d. Size:
      1) Up to 60 in. (1,524 mm)
      2) 11.5 in. (292 mm) inner diameter
      3) Anchor base is 10.9 in. (305mm) diameter
7. Manufacturers:
   a. Oberon Model 3032-LH-xx-48 (Lighthouse). Selection of finish by Architect. Submit for approval.
   b. No known equal.

2.5 MISCELLANEOUS UNDERGROUND PRODUCTS

A. Pull Rope
1. 1/4 inch diameter polyethylene.
2. 200 pound strength.
3. Manufacturers:
   a. Carlon Telecom Systems.
   b. Vikimatic
   c. or equal.

B. Length Marked Tape
1. Provide 1/2 inch flat tape with sequential markings in whole feet.
2. Manufacturers:
   a. Carlon Telecom Systems.
   b. Greenlee
   c. Vikimatic
   d. or equal.

C. Conduit Plugs
1. Provide universal blank duct plug type, with eye for tying rope and tape.
2. Manufacturers:
   a. Carlon Telecom Systems.
   b. Condux International, Inc.
   c. or equal.

D. Bonding Ribbon:
   1. Annealed solid copper 3/8 inch wide x 1/16 inch thick, tin plated.
   2. Manufacturer:
      a. Inwesco 12A55
      b. Corning Cable Systems
      c. Preformed Line Products.
      d. or equal.

E. Bonding Ribbon Clamp:
   1. Soft lead
   2. 1/16 inch thick
   3. Bolt hole for attachment
   4. Manufacturer:
      a. Inwesco 12A56
      b. Corning Cable Systems
      c. Preformed Line Products.
      d. or equal.

F. Fargo Clamp:
   1. Cast copper, silver plated, furnished with copper bolt.
   2. RUS Listed
   3. Manufacturer:
      a. Allied Bolt
      b. Inwesco 12A57
      c. Corning Cable Systems
      d. or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide safety barriers and flag persons for all open manholes and pullboxes that are located in areas accessible to the public.

B. Provide traffic control in accordance with the requirements of Division 1.

C. Conform to OSHA guidelines when accessing manholes and handholes, inclusive of the requirement for air sampling. Provide continuous measurements. Provide the Owner’s Representative with contractor maintained logs of air samples taken at most two hours apart.

D. Provide sufficient personnel to permit one individual to remain above the surface at all times, in visual contact with persons in manholes and similar. Provide the observer with a appropriate means of obtaining assistance.

E. Provide ladders for access to manholes. Do not permit workers to use cables or splice cases as ladders.

F. Install a 3/8" nylon pullrope with all underground cables.

3.2 CABLE PULLING.

A. Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables.

B. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation.

C. Use flexible cable feeds to convey cables through manhole opening and into duct runs.

D. Accumulate cable slack at each manhole or junction box where space permits by training cable around the interior to form one complete loop.

E. Maintain minimum allowable bending radii in forming such loops.

F. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into outdoor pedestals or other enclosures.

G. Cable with tape shield shall have a bending radius not less than 12 times the overall diameter of the completed cable.

H. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.3 CABLES IN MANHOLES, PULL BOXES AND HANDHOLES.

A. Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths.

B. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators.

C. In existing manholes and handholes where new ducts are to be terminated or where new cables are to be installed, locate the existing installation of cables, cable supports and grounding as required for a uniform installation with cables carefully arranged and supported.

D. Support cable splices in underground structures by racks on each side of the splice.

E. Located splices to prevent cyclic bending in the spliced sheath.

F. Install cables at middle and bottom of cable racks, leaving top space opening or future cables, except as otherwise indicated for existing installations.

3.4 SERVICE LOOP AND TRANSITION SPLICE AT BUILDING ENTRY

A. For outside plant, flooded cables of 100 pair or greater entering a BD or EF, provide a transition in a splice case, Type IBTC, to non-flooded cable prior to termination on the protector blocks. Unless otherwise indicated on the plans, position the splice case high on the backboard, parallel to the floor at location suitable for service and where gel will not be drawn from the serving outside plant cabling into the IBTC.

B. At IDF’s and BDF’s, at both ends of cables, provide at least 20 feet of cable in excess of that required to reach the protectors or terminal block by a dressed route. Form into a storage loop, typically around the perimeter of the backboard and fix in place as directed by the Owner’s Representative.

C. Refer to Section 27 13 00 Communications Indoor Backbone Cabling for additional requirements for termination within IDF's, BDF's and Telecommunication Building.

END OF SECTION

SECTION 27 1500

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not necessarily limited to provision of:
   1. Horizontal Station Cabling
      a. Horizontal copper station cabling, meeting EIA/TIA Category 6A standards, homerun from receptacles to indicated IDF or BDF. Terminated on rack mounted patch panels, as indicated.
   2. For all cabling:
      a. Terminate on patch panels as specified in Section 27 11 19 – Communications Termination Blocks and Patch Panels.
      b. Test cabling to demonstrate performance to specified standards or better using test equipment and methods as specified in Section 27 10 00 - Structured Cabling – Basic Materials & Methods.
      c. Label cables, jacks, plates and patch panels as specified in Section 27 05 53 – Identification for Communications Systems.
      d. Document on Record Documents as described in Section 27 05 00 – Common Work Results for Communications.

B. Related Documents:
   1. Specification Section 27 05 00 – Common Work Results for Communications applies to this Section.

C. Related Work in Other Sections:
   1. Section 27 05 29 – Hangers and Supports for Communications Systems
      a. J-hooks and hangers for the work of this Section
   2. Section 27 05 33 – Conduits and Backboxes for Communications Systems
      a. Empty raceway for the work of this Section.
   3. Section 27 05 36 – Cable Trays for Communications Systems
      a. Empty tray for the work of this Section.
   4. Section 27 05 53 – Identification for Communications Systems
      a. Labeling systems and execution for the work of this Section.
   5. Section 27 11 19 – Communications Termination Blocks and Patch Panels
      a. Specification for patch panels and blocks used by work of this Section
   6. Section 27 11 23 – Communications Cable Management
      a. Specification for innerduct, backboard and patch cord management used by the work of this Section.

1.2 REFERENCES

A. As listed in Section 27 10 00 – Structured Cabling – Basic Materials & Methods.

1.3 SUBMITTALS

A. Conform with the requirements of Section 27 05 00 - Common Work Results for Communications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Procedures: In accordance with Section 27 10 00 – Structured Cabling, Basic Materials and Methods.

PART 2 - PRODUCTS

2.1 COPPER CABLING, CATEGORY RATED DATA/VOICE:

A. High Speed, Category 6A Cabling, Plenum Rated
1. Drawing Reference: ** UTP6A-4P, where ** denotes cable count
2. Construction Materials
a. Conductor Material Bare copper
b. Insulation Material Polyolefin
c. Jacket Material Low Smoke PVC
d. Separator Material FEP
e. Separator 2 Material FEP
f. Diameter Over Jacket 0.265 in
g. Jacket Thickness 0.016 in
3. Electrical Specifications
a. ANSI/TIA Category 6A
b. dc Resistance Unbalance, maximum 4 %
c. dc Resistance, maximum 8.00 ohms/100 m
d. Mutual Capacitance 6.0 nF/100 m @ 1 kHz
e. Nominal Velocity of Propagation (NVP) 70 %
f. Operating Frequency, maximum 500 MHz
g. Operating Voltage, maximum 80 V
h. Transmission Standards ANSI/TIA-568-C.2 ISO/IEC 11801 Class EA
i. Dielectric Strength, minimum 1500 Vac, 2500 Vdc
4. Environmental Specifications
a. Environmental Space Plenum
b. Flame Test Method CMP
c. Installation Temperature 0 °C to +60 °C (+32 °F to +140 °F)
d. Operating Temperature -20 °C to +75 °C (-4 °F to +167 °F)
e. Cable Type U/UTP (unshielded)
f. Pairs, quantity 4
g. Jacket Color: Blue
h. Conductor Gauge, singles 23 AWG
i. Conductor Type, singles Solid
j. Conductors, quantity 8
k. Separator Type Isolator
l. Packaging Type Reel
m. Pulling Tension, maximum 11 kg | 25 lb
5. Agency Classification
a. RoHS 2002/95/EC Compliant
b. ISO 9001:2008 Designed, manufactured and/or distributed under this quality management system
6. Manufacturer:
a. Commscope Systimax GigaSPEED X10D 2091SD Plenum
b. Or equal.

B. Indoor/Outdoor Category 6A Plenum, Outdoor Rated Cable
1. Drawing Reference: ** UTP6A-4OP, where ** denotes cable count
2. Construction Materials
a. Jacket Material PVDF
b. Conductor Material Bare copper

c. Insulation Material FEP
d. Separator Material FEP

3. Electrical Specifications
   a. dc Resistance Unbalance, maximum 4 %
   b. dc Resistance, maximum 8.00 ohms/100 m
   c. Delay Skew, maximum 45 ns
   d. Mutual Capacitance 5.6 nF/100 m @ 1 kHz
   e. Nominal Velocity of Propagation (NVP) 70 %
   f. Operating Frequency, maximum 500 MHz
   g. Transmission Standards ANSI/TIA-568-C.2
   h. Safety Voltage Rating 300 V
   i. Dielectric Strength, minimum 1500 Vac | 2500 Vdc
4. Environmental Specifications
   a. Environmental Space Outdoor | Plenum | Sunlight resistant
   b. Smoke Test Method CMP
   c. Flame Test Method CMP | NEC Article 800 | NFPA 262 | UL 444 | UL 910
   d. Installation Temperature -25 °C to +75 °C (-13 °F to +167 °F)
   e. Operating Temperature -40 °C to +75 °C (-40 °F to +167 °F)
5. General Specifications
   a. Cable Type U/UTP (unshielded)
   b. Pairs, quantity 4
   c. Jacket Color Black
   d. Conductor Gauge, singles 23 AWG
   e. Conductor Type, singles Solid
   f. Conductors, quantity 8
   g. Separator Type Isolator
   h. Packaging Type Reel
6. Mechanical Specifications
   a. Pulling Tension, maximum 25 lb
7. Manufacturer:
   a. Commscope Systimax CS44P-IO Indoor/Outdoor Category 6A, plenum, outdoor rated.
   b. Or equal.

2.2 DATA & VOICE STATION JACKS & RECEPTACLES

A. Category 6A Data Jacks Performance Requirements, General
1. Dimensions:
   a. Depth 1.20 in
   b. Height 0.80 in
   c. Width 0.80 in
   d. Electrical Specifications
   e. ANSI/TIA Category 6A
   f. Contact Resistance Variation, maximum 20 mOhm
   g. Contact Resistance, maximum 100 mOhm
   h. Current Rating 1.5 A @ 20 °C
   i. 1.5 A @ 68 °F
   j. Dielectric Withstand Voltage, RMS, conductive surface 1500 Vac @ 60 Hz
   k. Dielectric Withstand Voltage, RMS, contact-to-contact 1000 Vac @ 60 Hz
   l. Insulation Resistance, minimum 500 MOhm
2. Environmental Specifications
   a. Flammability Rating UL 94 V-0
   b. Operating Temperature -10 °C to +60 °C (+14 °F to +140 °F)
   c. Relative Humidity Up to 95%, non-condensing
   d. Safety Standard cUL | UL

e. Storage Temperature -40 °C to +70 °C (-40 °F to +158 °F)

3. General Specifications
   a. Cable Type U/UTP (unshielded)
   b. Color:
      1) Data: Blue
      2) Voice: White
      3) Wireless Access Point (WAP): Yellow
      4) Security Camera: Green
4. Mechanical Specifications
   a. Conductor Gauge, solid 22 AWG, 24 AWG, 26 AWG
   b. Conductor Gauge, stranded 22 AWG, 24 AWG
   c. Conductor Type Solid, Stranded (7 strands)
   d. Material Type Copper alloy, High-impact, flame retardant, thermoplastic
   e. Outlet/Module Contact Plating Gold over nickel
   f. Plug Insertion Life Test Plug IEC 60603-7 compliant plug
   g. Plug Insertion Life, minimum 750 times
   h. Plug Retention Force, minimum 30 lbf, 133 N
   i. Rear Termination Contact Plating Gold over nickel
   j. Rear Termination Type IDC
   k. Wiring Scheme T568B
5. Regulatory Compliance/Certifications
   a. RoHS 2002/95/EC Compliant
   b. ISO 9001: 2008. Designed, manufactured and/or distributed under this quality management system
6. Manufacturers - Category 6A jacks
   a. Commscope Systimax 360 GigaSPEED X10D MGS600
   b. Or equal
7. Manufacturers - Blank Module.
   a. Commscope Systimax M20AP Covers
   b. Or equal

B. Telecommunications Outlets, New, Copper Jacks, Wall Mount,Flush
1. Drawing Reference: MMP4
2. Assembly. Provide complete telecommunications outlet assembly, including but not limited to:
   a. Faceplate with District standard openings
   b. Blank connector modules at faceplate openings not filled with connector modules.
   c. Labels and label holders.
3. Construction
   a. Plastic - Color to match surrounding electrical plates in room.
4. Faceplate.
   a. Features.
      1) Single gang.
      2) Openings for up to 4 jack connector modules MMP4.
      3) Label holders with space to label the plate number and the number of each jack.
5. Manufacturer:
   a. Commscope Systimax L
   b. Or equal

C. Voice Telephone, Station Plates & Jack/receptacles:
1. Drawing References:
   a. Wall Mounted Telephone, Flush: 630A
2. Station jacks shall be modular four wire type and conform to FCC Part 68.
3. Construction, where not otherwise specified, scheduled or indicated:

a. Single Gang Wall Plate with two integral wall telephone mounting studs.
b. Modular jack as specified above. Provides 4 pairs to end device.
c. Mechanically fastened to Building. Adhesive fastening not acceptable
d. Stainless Steel Plate.
e. Mounts to Single Gang Ring, Single Gang Box or Surface Mounted to Wall or to opening in Surface Raceway - Refer to Schedule on Plans.
f. Jack is flush in plate and does not protrude.

4. Manufacturers, Flush Wall Mounted Wall Telephone.
   a. Commscope Systimax M10LW4SP
   b. Or equal

D. Modular Furniture Receptacle Plates, 1 to 4 Receptacles, Universal Fit
1. Drawing Reference: OMP4
2. Construction:
   a. Modular, with snap-in receptacle options as scheduled.
   b. Universal fit adjustable latches plate bezel mount fits at least Haworth - Premise, Knoll Ref and Steelcase systems.
   c. Colors of plates, mounting screws and inserts as scheduled, black if not otherwise indicated.
   d. Options for 1 to 4 receptacles per plate. Where 6 jacks are called for, install two OMP4 plates in two knockouts.
   e. Otherwise as for MMP6 above.
3. Manufacturers:
   a. Systimax M14CE-E
   a. Or equal

E. Patch Cords
1. Small Diameter Category 6A Patch Cords – One patch cord per patch panel port. Verify length of patch cords required after patch panels and switches have been installed. One patch cord per station jack including WAPs and CCTV cameras. Verify length of patch cords required in the field and to be confirmed after furniture or device installation. Exact counts to be coordinated with District ITS before ordering. Provide 10% of the total count for spare.
   a. Color
      1) Data: Blue
      2) Voice: White
      3) Wireless Access Point: Yellow
      4) Security Camera: Green
2. Manufacturers:
   a. Commscope MiNo6A Cat 6A Reduced-Diameter Patch Cord.
   b. Or equal
3. Singlemode Fiber Patch Cords - One patch cord per patch panel port. Verify length of patch cords required after patch panels and switches have been installed. Provide 20% of the total count for spare.
   a. Manufacturers:
      1) Commscope Systimax InstaPatch 360 LC-LC duplex patch cords.
      2) Or equal

PART 3 - EXECUTION

3.1 SIGNAL POLARITY AND COLOR CODE CONVENTION

A. Prepare with Category 6A Station Wire, RJ45 - Per EIA/TIA-568, designation T568B.

3.2 STATION CABLE INSTALLATION AND TERMINATION PROCEDURES

A. General:
1. All station cable, between the station outlets and the IDF terminal blocks, shall be continuous unspliced runs.
2. Station cable shall run loose throughout all pathways. At no time shall any station cable be secured by a tywrap, electrical tape or similar bindings. If bundling for directional change, plenum rated Velcro shall be used.

B. Run Lengths:
1. Station, Horizontal and IDF Links:
a. Horizontal Distribution runs (including vertical portions) shall not exceed 295 feet from station outlet to the associated communications closet.
b. IDF room distribution wiring not to exceed 19.5 feet
c. Alternately, total length not to exceed 328 feet.
d. Report to the Owner's Representative conditions exceeding these requirements.
2. Limit cable bends to a minimum radius of 8 times cable diameter except where otherwise noted herein.
3. Service loop at Station
a. Copper. Provide ten feet (10') service loop at each station and fifteen feet (15') for Wireless Access Point (WAP), suspended on a J-hook directly above the outlet. This is to allow the Modular Communications Unit to be removed from the outlet box and visually inspected without leaving so much wire in the box that it might become accidentally damaged during installation. Contractor to field verify the performance of the proposed installation in a mockup using the proposed cabling, jacks, raceway and listed test equipment prior to proceeding.
b. Fiber Station Cabling. Provide 10 feet of slack fiber storage at the station, neatly coiled on the fiber management provided within the FMP enclosure, at least 12 inches at OMP.
4. Termination of wiring at the station outlet:
a. All data and voice station cable shall be terminated at the individual receptacle modules in accordance with EIA/TIA-568-B, assignment T568B.
b. Termination of wiring at existing station outlets:
1) Install in data and voice inserts in place of existing blank insert in existing faceplate.
2) Install new labels and label holders.
5. Termination of station wiring at the IDF
a. For the installation/layout of station cable within the IDF rooms, see detail on drawings.
b. All Category 6A station cables entering the IDF room will be terminated on a Category 6A RJ45 jack mounted in a Patch Panel as specified in Section 27 11 19 – Communications Termination Blocks and Patch Panels.
c. Termination shall begin at the upper left corner of the path panel and proceed to the right continuing down, left to right until all cables are terminated.

END OF SECTION

SECTION 27 4116

INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Provide all labor, materials, transportation and equipment to complete the furnishing, installation, assembly, set up, and testing of the Sound and Audiovisual System work indicated on the drawings and specified herein. Notwithstanding any detailed information in this Section, provide complete, working systems.

B. Design, engineer and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of the Work of this Section. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction.

1.02 SYSTEM FUNCTIONS

A. Loudspeaker Processing, typical

1. Program audio content to output through front of room loudspeakers/surround sound loudspeakers.

2. Speech reinforcement audio content to output through overhead ceiling loudspeakers.

3. At rear of spaces, blend slight amount of program audio to ceiling loudspeakers.

4. For spaces over 25’ deep with overhead speech reinforcement loudspeakers, provide audio delay as required so that direct acoustical source energy arrives to the listener at the same time as the reinforced overheard audio.

B. Equipment Racks, typical

1. Provide blank plates at all unused openings.

2. Provide fans as required to keep the interior of each equipment rack at a temperature of no more than 5-10 degrees cooler than equipment manufacturer's recommended operating temperature.
   a. Fans to not emit more noise than 30 dB.

3. Mount equipment using T-25 Security rack screws.

C. Controls Systems, general

1. Review all push button and touchpanel button nomenclature with City's Representative prior to system programming.

2. Provide graphic indication of program volume level on control touchpanel when volume control is selected.

3. Provide Main menu selection button on all touchpanel screens to route user back to main touchpanel menu.
   a. Confirm all control functions and layouts with City's Representative prior to system programming.

4. Training Mode - General: Functions to operate by scene/mode, not by device.
   a. Control Push Button Selections
      1) Audio Mute
      2) Video Mute
      3) Program Volume
      4) Power Off
   b. Touchpanel Menus
      1) Startup Page: “Press here to begin”
      2) Home Page:
      3) “Select Source”: Provides sub-menus of source selections:
      4) O.F.C.I. PC, where occurs
      5) User-connected device at media plate (HDMI, Laptop VGA + mini stereo audio)
      6) Wireless Connection Gateway, where occurs
      7) External source (routed to room via AV matrix switch)
      8) “Controls”: Provide sub-menu of:
      9) Screen up/down control (where projection occurs)
      10) Individual projector/display on/off control
      11) “Power Off”: Provides sub-menu selection of “Do you want to power off the system?” with “Yes” and “No” selections. Upon selection of “Yes”, menu reads “Please wait, shutting down system”
   c. All menus, except Home Page, to include “Home” button to revert back to the Home Page.

1.03 REFERENCE STANDARDS

A. Conform to the applicable portions of the current standards published by these organizations:

1. SMPTE Society of Motion Picture and Television Engineers.

2. NAB National Association of Broadcasters.

3. EIA Electrical Industries Association of America.

4. UL Underwriters Laboratories.

5. AES Audio Engineering Society.

6. NEC National Electrical Code.

7. NFPA National Fire Protection Association.

8. EIAJ Electrical Industries Association of Japan.

9. IEC International Electrotechnical Commission.

10. FCC Federal Communications Commission.

11. NTC Network Transmission Committee of the Video Transmission Engineering Advisory Committee.

12. NCTA National Cable Television Association.

13. BTSC Broadcast Television Stereo Committee.

14. TASO Television Allocation Study Organization.

B. Conform additionally to the following specific standards:

1. American National Standards Institute (ANSI)
   a. ANSI S1.4-1983 (R2001) American National Standard Specification for Sound Level Meters
   b. ANSI S1.11-1986 (R2001) American National Standard Specification for Octave-Band and Fractional Octave-Band Analog and Digital Filters
   c. ANSI S1.42-1986 (R2001) American National Standard Design Response of Weighting Networks for Acoustical Measurements
   d. ANSI IT 7.214-89 Audio-visual Systems - Front Projection Screens (Tripod/Free-Standing) - Methods for Testing and Reporting Performance Characteristics.

2. Audio Engineering Society Incorporated (AES)
   a. AES2-1984 (r1997) AES Recommended Practice Specification of Loudspeaker Components Used in Professional Audio and Sound Reinforcement
   b. AES5-1998 (Revision of AES5-1984) AER recommended practice for professional digital audio – Preferred sampling frequencies for applications employing pulse-code modulation
   c. AES14-1992 (r1998) AES standard for professional audio equipment – Application of connectors, part 1, XLR-type polarity and gender
   d. AES20-1996 AES recommended practice for professional audio – Subjective evaluation of loudspeakers
   e. AES26-2001 Revision of AES26-1995 AES recommended practice for professional audio interconnections – Conservation of the polarity of audio signals
   f. AES-R2-1998 AES project report for articles on professional audio and for equipment specifications – Notations for expressing levels

3. Electronic Industries Association of America (EIA)
   a. EIA-160 Sound Systems
   b. EIA-310-E Racks, Panels and Associated Equipment
   c. EIA-101-A Amplifiers for Sound Equipment
   d. SE-103 Speakers for Sound Equipment
   e. SE-104 Engineering Specifications for Amplifiers for Sound Equipment

4. International Electrotechnical Commission (IEC)
   a. IEC 268-3 (1988) Sound system equipment – Part 3: Amplifiers
   b. IEC 268-5 (1989) Sound system equipment – Part 5: Loudspeakers
   c. IEC 268-12 (1987) Sound system equipment – Part 12: Application of Connectors for Broadcast and Similar Use
   d. IEC 651 (1979) Sound level meters

5. International Organization for Standardization (ISO)
   a. ISO 1996-1 Acoustics – Description and measurement of environmental noise – Part 1: Basic quantities and – Composite Analog Video Signal – NTSC for Studio Applications

6. Federal Specifications (FS)
   a. GG-S-00172D Screen, Projection. Federal Supply Classification (FSC) 670.

7. Federal Standards (Fed-Std)
   a. 191A Textile Test Methods.
      1) 5760 Mildew Resistance of Textile Materials; Mixed Culture Method.
      2) 5903.1 Flame Resistance of Cloth; Vertical.

8. NFPA
   a. 255 Method of Testing Surface Burning Characteristics of Building Materials.
   b. 701 Methods of Fire Tests for Flame-Resistant Textiles and Films.

9. Society of Motion Picture Engineers (SMPTE).
   a. SMPT 196M-86 Motion Picture - Screen Luminance and Viewing Conditions - Indoor Theater Projection Guide.
   b. SMPTE 202M-1998 Motion Pictures – B Chain Electroacoustic Response – Dubbing Theaters, Review Rooms and Indoor Theaters
   c. SMPTE RP167-1995 Alignment of NTSC Color Picture Monitors
   d. SMPTE EG1-1990 Alignment Color Bar Test Signal for Television Picture Monitors
   e. SMPTE EG27-1994 Supplemental Information for ANSI/SMPTE 170M and Background on the Development of NTSC Color Standards (R1999)
   f. RP 94 Recommended Practice for Gain Determination of Front Projection Screens.
   g. SMPTE RP 95 Recommended Practice for Installation of Gain Screens.
   h. SMPTE RP 98 Recommended Practice for Measurement of Screen Luminance in Theatres.

10. Underwriters Laboratories Incorporated (UL)
    a. UL 813 Commercial Audio Equipment 1996
    b. UL 1419 Professional Video and Audio Equipment 1997
    c. UL 1492 Audio-Video products and Accessories 1996
    d. UL 6500 Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General Use 1999

1.04 RELATED WORK BY OTHERS

A. By Base Building Construction Contract.

1. Division 26 - Power for all equipment.

2. Section 27 0500 – Common Work Results for Communications Systems

3. Section 27 0533 – Conduits and Backboxes for Communications Systems
   a. Empty raceway system for work of this Project, including floorboxes.

4. Section 27 1000 – Structured Cabling, Basic Materials and Methods

5. Section 27 1500 – Communications Horizontal Cabling.

1.05 RELATED WORK IN OTHER SECTIONS

A. Section 27 0500 – Common Work Results for Communications Systems

B. Section 27 0526 – Grounding and Bonding for Communications Systems

C. Section 27 0529 – Hangers and Supports for Communications Systems

D. Section 27 0533 – Conduits and Backboxes for Communications Systems

E. Section 27 1116 – Communications Cabinets, Racks, Frames and Enclosures

F. Section 27 1126 – Communications Rack Mounted Power Protection and Power Strips

G. Section 27 1300 – Communications Indoor Backbone Cabling

H. Section 27 1500 – Communications Horizontal Cabling

1.06 QUALITY ASSURANCE

A. Test Equipment: Provide in conformance with the applicable requirements of Section 27 0500 – Common Work Results for Audiovisual Systems. Test systems using at least one (1) each of the following test measurement devices or their functional equivalents:

1. Sound Systems:
   a. Wide band oscilloscope, 50 MHz, analog. (Example: Tektronix TAS-250 or 2212).
   b. True RMS audio digital volt-ohm-millimeter (Example: Fluke 8060A).
   c. Integrated audio test set (Example: Audio Precision or Neutrik A1 or A2 System).
   d. Acoustic polarity tester (Example: BSS Audio Ltd. Phasecheck System AR 130).
   e. Pink Noise generator (Example: Ivie IE-20B).
   f. Calibrated microphone and pre-amplifier assembly (Example: Ivie IE-2P preamplifier/power supply with Ivie/ACCO, Bruel & Kjaer, or Larson-Davis microphone capsule).
   g. Real time audio spectrum analyzer, one-third octave (Example: Ivie IE-30A or JBL Smaart system).
   h. Frequency/time audio analyzer (Example: Crown TEF system or JBL Smaart system).

B. Baseband Video Systems:

1. Wide band oscilloscope, 50 MHz, analog. (Example: Tektronix TAS-250 or 2212).

2. Analog composite test generator (Example: Tektronix TSG 170A or TSG 100 Opt. 01).

3. Analog composite waveform/vector monitor (Example: Tektronix 1740A or WFM 90.)

C. RGBHV Wideband Component Analog Video Systems:

1. Wide band oscilloscope, 200 MHz, analog. (Example: Tektronix TAS-485).

2. RGBHV test generator (Example: Extron VTG 300).

D. Projection Systems:

1. Luminance meter. (Example: Tektronix J17/J18 with J1803 8 degree luminance head).

2. Grey scale chart.

3. Precision optical comparator. (Example: Phillips or Tektronix J17/J18 with J1810/J1820 chromaticity head).

E. High-bandwidth Digital Content Protection (HDCP) check

1. Quantum Data 882E HDMI-HDCP Compliance Test Tool

F. Structured Cabling used for Audiovisual Systems

1. Level III field testers as defined in ANSI/TIA-1152 - Fluke, Agilent Or approved equal.

2. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 4 of ANSI/TIA-1152

3. The RJ45 test plug shall fall within the values specified in ANSI/TIA-568-C Annex C for NEXT, FEXT and Return Loss.

4. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The Contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

5. Tone Test Sets.

G. Any other items of equipment or materials required to demonstrate conformance with the Contract Documents.

1.07 SUBMITTALS

A. Conform with Section 27 0500 – Common Work Results for Communications Systems.

1.08 CONFLICTS

A. Present any conflicts between codes, regulations, specifications and/or requirements at least thirty (30) days prior to the commencement of the scheduled work.

1.09 SYSTEM PERFORMANCE REQUIREMENTS, AUDIO-VISUAL SYSTEM

A. Using the listed test equipment, document that the installed systems meet or exceed the performance standards below.

B. Audio Playback and Sound Reinforcement Systems:

1. Electrical Performance; Source Input to Power Amplifier Output:
   a. Frequency Response (Equalizer flat): +0.5 dB 30 Hz to 15 kHz.
   b. Total Harmonic Distortion (THD): Less than 0.5%, 30 Hz to 15 kHz, +4 dBm line level.
   c. Signal to Noise: At least 70 dB, 30 Hz to 15 kHz, referenced to input of +4 dBm.
   d. Crosstalk: At least -60 dB, 30 Hz to 15 kHz.

2. Electro/Acoustic Performance:
   a. At PE Class Labs:
      1) Program audio to be capable of 96 dBA output level
      2) Ceiling speech reinforcement audio to be capable of 86dBA output level
   b. All other spaces:
      1) Program audio to be capable of 86 dBA output level

2) Ceiling speech reinforcement audio to be capable of 86dBA output level

c. Uniformity of Coverage: ±6 dBA.

3. Equipment: Specified individually.

4. Audio Signal Path:
   a. Shall not degrade performance of connected equipment.
   b. Test all cabling from signal input to signal output to confirm signal loss not less than cable manufacturer's specification.

C. Video Systems:

1. Video Signal System: NTSC to EIA RS-170A, except as noted.

2. Video Signal Path: To EIA RS-250B short haul where equalized, otherwise to the performance limit of the specified video cable.

3. Test all cabling from signal input to signal output to confirm signal loss not less than cable manufacturer's specification.

D. RGBHV Video Systems:

1. Video Signal: Pass 300 Hz to 120 MHz sine wave from any input to any output with losses of less than 1 dB over cable loss at cable manufacturer specified performance points without amplification.

E. Projection Systems:

1. Luminance testing consistent with performance of specified projectors and screens.

2. Brightness, convergence per ANSI standard procedures for device.

3. Measure (9) points of illuminance per screen and calculcate average value in lumens.

F. High-bandwidth Digital Content Protection (HDCP) check

1. At spaces with HDMI transmission:
   a. Run HDCP check to ensure all devices are HDCP compliant.
   b. Test with sample source device with quantity of HDCP keys as required to operate by the system.

1.10 TRAINING

A. Conduct training on completed system at reasonable convenience of the City during normal City business hours.

B. Operator Training: Sixteen Hours (16) hours.

C. Initial Use Support: Provide standby trainer/system engineer during two (2) system uses, each not to exceed four (4) hours of training.

1.11 DEFINITIONS

A. Definitions of Terms: The following definitions and conditions apply to each of the respective parameters and the measurements of those parameters, unless specifically stated otherwise:

1. Frequency Response: The minimum acceptable frequency band over which the amplitude response is within 3 dB (or any specified range), or the specified limits of the response relative to the reference frequency (1 kHz for audio, 1.0 MHz for video) under design load conditions, at any operating level up to and including the specified maximum output while fully in compliance with all other performance specifications.

2. Maximum Output Level: The minimum acceptable maximum signal output level (voltage, current or power) attained under design load conditions attained while fully in compliance with all other performance specifications.

3. Harmonic Distortion: The maximum acceptable harmonic distortion measured at any operating level, up to and including the specified maximum output, with an applied sine wave signal of any frequency in the range of the specified frequency response.

4. Audio Intermodulation Distortion: The maximum acceptable intermodulation distortion resulting from the introduction of 60 Hz and 7 kHz signals in a ratio of 4:1 under design load conditions at any operating level up to and including the specified maximum output level.

5. Signal to Noise Ratio: The minimum acceptable ratio of signal to noise levels derived from broadband measurements under design load at maximum output over the entire range of the specified frequency response.

6. Clipping Level: The minimum acceptable maximum level of signal applied to the device under design load conditions while fully in compliance with all other performance specifications.

7. Sensitivity: The maximum acceptable level of input signal applied to the device that is necessary to provide the maximum output under design load conditions.

8. Design Load: The load (in ohms) specified by usage of the particular device input or output.

9. Composite Triple Beat Ratio: The ratio of visual carrier level to composite third order distortion products.

10. Cross Modulation Ratio: The ratio of visual carrier level to coherent spurious signal level (i.e. intermodulation products).

11. Carrier to Noise Ratio: The ratio of visual carrier to noise levels derived from broadband measurements under design load at maximum output over the entire range of the specified frequency response.

B. Signal Levels: The following voltage levels shall be considered the standard operating levels for the particular circuitry, unless specifically noted otherwise (0.775 Volt = 0 dBu = 0 dbm for a 600 ohms terminated circuit):

1. Microphone Circuits: -30 dBu or less.

2. Audio Line Level Circuits: -30 dBu to +24 dBu; equivalent to -30 dBm to +24 dBm for a 600 ohms terminated circuit.

3. Loudspeaker Level Circuits: More than +24 dBu.

4. Video Line Level Circuits: 1.0 Volt, peak to peak composite signal.

5. Radio Frequency (RF), Television (MATV) Circuits: +6 to +72 dBmV (0 dBmV = 1,000 microvolts).

C. Characteristic Impedances: The following operating impedances shall be considered to be the standard operating impedances for the particular circuitry, unless specifically noted otherwise:

1. Microphone Circuits: 50-250 ohms source, 150-1500 ohms terminating, electrostatically and electromagnetically balanced to ground.

2. Audio Line Level Circuits: 600 ohms maximum source, 600 ohms minimum terminating, line to line, electrostatically and electromagnetically balanced to ground.

3. Video Line Level Circuits: 75 ohms maximum source, 75 ohms minimum terminating to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.

4. Radio Frequency (RF) Television Circuits: 75 ohms nominal to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.

D. Definitions

E. Definitions of Terms: The following definitions and conditions apply to each of the respective parameters and the measurements of those parameters, unless specifically stated otherwise:

1. Frequency Response: The minimum acceptable frequency band over which the amplitude response is within 3 dB (or any specified range), or the specified limits of the response relative to the reference frequency (1 kHz for audio, 1.0 MHz for video) under design load conditions, at any operating level up to and including the specified maximum output while fully in compliance with all other performance specifications.

2. Maximum Output Level: The minimum acceptable maximum signal output level (voltage, current or power) attained under design load conditions attained while fully in compliance with all other performance specifications.

3. Harmonic Distortion: The maximum acceptable harmonic distortion measured at any operating level, up to and including the specified maximum output, with an applied sine wave signal of any frequency in the range of the specified frequency response.

4. Audio Intermodulation Distortion: The maximum acceptable intermodulation distortion resulting from the introduction of 60 Hz and 7 kHz signals in a ratio of 4:1 under design load conditions at any operating level up to and including the specified maximum output level.

5. Signal to Noise Ratio: The minimum acceptable ratio of signal to noise levels derived from broadband measurements under design load at maximum output over the entire range of the specified frequency response.

6. Clipping Level: The minimum acceptable maximum level of signal applied to the device under design load conditions while fully in compliance with all other performance specifications.

7. Sensitivity: The maximum acceptable level of input signal applied to the device that is necessary to provide the maximum output under design load conditions.

8. Design Load: The load (in ohms) specified by usage of the particular device input or output.

9. Composite Triple Beat Ratio: The ratio of visual carrier level to composite third order distortion products.

10. Cross Modulation Ratio: The ratio of visual carrier level to coherent spurious signal level (i.e. intermodulation products).

11. Carrier to Noise Ratio: The ratio of visual carrier to noise levels derived from broadband measurements under design load at maximum output over the entire range of the specified frequency response.

F. Signal Levels: The following voltage levels shall be considered the standard operating levels for the particular circuitry, unless specifically noted otherwise (0.775 Volt = 0 dBu = 0 dbm for a 600 ohms terminated circuit):

1. Microphone Circuits: -30 dBu or less.

2. Audio Line Level Circuits: -30 dBu to +24 dBu; equivalent to -30 dBm to +24 dBm for a 600 ohms terminated circuit.

3. Loudspeaker Level Circuits: More than +24 dBu.

4. Video Line Level Circuits: 1.0 Volt, peak to peak composite signal.

5. Radio Frequency (RF), Television (MATV) Circuits: +6 to +72 dBmV (0 dBmV = 1,000 microvolts).

G. Characteristic Impedances: The following operating impedances shall be considered to be the standard operating impedances for the particular circuitry, unless specifically noted otherwise:

1. Microphone Circuits: 50-250 ohms source, 150-1500 ohms terminating, electrostatically and electromagnetically balanced to ground.

2. Audio Line Level Circuits: 600 ohms maximum source, 600 ohms minimum terminating, line to line, electrostatically and electromagnetically balanced to ground.

3. Video Line Level Circuits: 75 ohms maximum source, 75 ohms minimum terminating to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.

4. Radio Frequency (RF) Television Circuits: 75 ohms nominal to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.

H. SOFTWARE LICENSING

1. Provide licensing for project specific software programming at programmable devices.

2. Provide licensing and original software copies for each device provided under Work of this Section that uses software for operation, configuration or control.
   a. Provide licensing for required workstation operating systems, and required third party software.
   b. For the Control System, provide a complete copy of the source code, including the device interface driver code modules.

3. Upgrade each software package to the release in effect at the end of the Warranty Period.

PART 2 PRODUCTS

2.01 GENERAL

A. Loudspeaker Substitutions

1. In addition to the procedures of Division 1 Product Substitution Procedures, for loudspeakers, the Owner's Representative may require a subjective evaluation test generally conforming to AES20-1996.

2. Perform the subjective evaluation test at the convenience of the Owner's Representative, at a location reasonably proximate to the Project site as agreed by the Owner's Representative.

3. Loudspeaker substitutions shall provide sound pressure level equal to the specified product at the target ear plane, seated or standing as applies. If the substitute loudspeaker is less sensitive than the specified loudspeaker, pursuant to Section 01 60 00 Product Substitution Procedures, the Contractor is responsible to provide greater amplifier power in the ratio of the inverse of the sensitivity difference.

2.02 PACKAGED LOUDSPEAKER ASSEMBLIES AND RELATED

A. Sound Bar Speaker

1. Drawing Reference: SBS

2. Construction:
   a. System Configuration 2-channel 2-way full-range for music / speech
   b. Components & Loading (2) 3.5 " long-throw woofers and (1) 0.75" tweeter per channel
   c. Recommended High-Pass Filter On-board 1st order @ 120 Hz; no outboard HP needed
   d. Enclosure Type Low profile sealed enclosure
   e. Enclosure Material Extruded ABS plastic with steel baffle insert
   f. Finish: Black
   g. Connectors Dual binding-head screws
   h. Suspension Hardware Universal mounting kit for direct attachment to display
   i. Grille Integral fabric wrap

3. Minimum Features/Function/Performance:
   a. Frequency Response: 120 – 20,000 Hz, +/- 3 dB
   b. Sensitivity 90 dB @ 2.83 volts / 1M
   c. Impedance 8 ohm

d. Power Handling 90 W long term (AES-2) (per channel)
e. Maximum Output 103 dB long term; 109 dB peak
f. Nominal Coverage Angles 100□ H x 120□ V
g. Nominal Dimensions
h. height: 4.13 “
i. width: match display wall
j. depth: 2.06 ”
k. Net Weight 15 lbs

4. Manufacturers:
   a. Innovox
   b. Cambridge Sound
   c. JBL
   d. Or equal

B. Compact Two-Way Loudspeaker:

1. Drawing Reference: SP

2. Minimum Features/Function/Performance:
   a. System
      1) Frequency Range: (-10 dB)160 Hz – 20 kHz
      2) Frequency Response (+/-3 dB): 85 Hz – 17 kHz
      3) Power Rating: 2200 W Continuous Program (2 hrs) 100 W (400W peak) Continuous Pink Noise (2 hrs) 75 W (300W peak) Continuous Pink Noise (100 hrs)
      4) Maximum Input Voltage: 25.3 V RMS (2 hrs), 50.6 V peak
      5) Maximum SPL: 3110 dB average Continuous Pink Noise (116 dB peak)
      6) Sensitivity: 490 dB, 1W/1m (averaged 100 Hz – 10 kHz)
      7) Coverage Angle: 5100° x 100°
      8) Directivity Factor (Q): 6.04 (averaged 1 kHz – 16 kHz)
      9) Directivity Index (DI): 7.6 dB (averaged 1 kHz – 16 kHz)
      10) Nominal Impedance: 8 ohms (THRU setting)
      11) Crossover Type: 2nd order low-pass, 3rd order high-pass
   b. Circuitry
      1) Transformer Taps: 70V: 30W, 15W, 7.5W, 3.7W 100V: 30W, 15W, 7.5W Insertion Loss <0.94 dB at any tap settingThru Setting: 8Ω nominal
      2) Recommended Protective High-Pass: 660 Hz high-pass (24 dB/oct) (for 8Ω operation and for all 70V/100V tap settings)
   c. Transducers
      1) Low Frequency: 135 mm (5.25 in), woven-fiberglass cone with pure butyl rubber surround with Weather-Edge frame protection, high-temp fiberglass voice coil former, high-temp voice coil wire, optimized cone geometry, linear suspension spider, and FEA optimized motor structure.
      2) High Frequency: 19 mm (0.75 in) PEI diaphragm, low-viscosity ferro-magnetic fluid, and lightweight Kapton™ voice coil former.
   d. Physical
      1) Enclosure Material: High Impact Polystyrene (HIPS), painted with highly-UV resistant paint on white (-WH) version for maximum UV fade resistance.
      2) Grille: Highly zinc-plated, finished in durable TGIC polyester powder coating. MTC-25WMG-1 (&-WH) available with Weather-Max™ multi-layer foam and tight-weave mesh vapor barrier backing.
      3) Installation: InvisiBall wall-mounting system included. Two 6 mm attachment points (on top and bottom) for optional MTC-25UB-1 (&-WH) U-bracket. Secondary safety attachment loop point on back panel.

4) Environmental: IP-44 per IEC529 (IP-55 when installed with the optional MTC-25WMG-1 WeatherMax™ grille and either MTC-PC2 or MTC-PC3 panel cover.) Exceeds MilSpec 810 for humidity, salt-spray, temperature & UV. Passes MilStd-202F for salt spray and ASTM G85 for acid-air plus salt spray. Optional MTC-25WMG-1 WeatherMax™ grille for breaking up driving rain and for especially difficult environments.
5) Termination: Screw-down terminal strip, zinc-plated copper based, nickel-plated metal screws and washers. Accepts up to 9 mm outside 4 mm inside open lugs (#6, #8, or #10 lug), plus bare wire (up to 12 AWG / 2.5 mm2). Optional MTC-PC2 and MTC-PC3 protective panel covers available to provide sealed entrance for additional weather protection.
6) Agency Rating: ROHS-compliant; Transformer UL Recognized per UL1876
7) Colors: Black (RAL9004) or white (-WH, RAL9016)
8) Dimensions (H x W x D): 7243 x 188 x 145 mm (9.6 x 7.4 x 5.7 in); 203 mm (8.0 in) deep total when mounted on InvisiBall wall-mount bracket.Net
9) Weight (each): 3.4 kg (7.5 lb)
10) Shipping Weight (pair): 8.16 kg (18 lb)

3. Manufacturers, Speakers:
   a. JBL Control 25-1 w/ Invisiball mount (confirm color w/ City Rep.)
   b. Tannoy
   c. Or equal.

2.03 DISTRIBUTED LOUDSPEAKERS AND RELATED

A. Provide tamper resistant fasteners at all assemblies mounted within 10 feet of finished floor in public occupancy spaces.

B. 6.5” 2-way Loudspeaker Assembly - 70V Coupled, Ceiling Mounted in T-Bar Ceiling or Concealed Spline or Fabric Wrapped Ceiling

1. Drawing Reference: SA

2. Minimum Features/Function:
   a. Performance
      1) Woofer: 6.5 inch (165 mm) treated paper w/ring mode decoupled cloth surround & steel basket
      2) Tweeter: 0.98 inch (25 mm) treated cloth dome, horn loaded
      3) Crossover Frequency: 2.5 kHz
      4) Impedance: 8 Ohms nominal with transformer set to “8Ω”
      5) Transformer Taps: 3.75W/7.5W/15W/30W at 70V;7.5W/15W/30W at 100V
      6) Frequency Response: 75 Hz to 20 kHz (±3 dB)
      7) Frequency Range: 60 Hz to 20 kHz (-10 dB)
      8) Power Handling: 60 Watts program (8 Ohms)
      9) Sensitivity: 89 dB @ 1W/1m
      10) Coverage: 95° conical (nominal)
   b. Connections
      1) Input: (1) 4-pin 5mm detachable terminal block with screw-down flanges;Speaker input with parallel pass-thru;Maximum Wire Size: 12 AWG
   c. Controls
      1) Transformer Tap: (1) Recessed screwdriver-adjustable rotary switch on baffle; used to select 70/100V tap or 8 Ohms (bypass)
   d. Environmental
      1) Temperature: -2° to 120°F (-19° to 49°C)
      2) Humidity: 5% to 95% RH (non-condensing)

e. Construction
   1) Enclosure: Zinc-plated steel, plenum-rated, 1/2” or 3/4” conduit knockout top and side, (1) cable clamp included
   2) Baffle: ABS UL® 94V-0 plastic
   3) Grille: Steel with white textured finish, paintable, magnetically-held “zero-bezel” frameless design, safety tether included
   4) Mounting: Flush ceiling mount using 4 integral 2-step toggle clamps;2.4 in (61 mm) maximum surface thickness;8.1 in (206 mm) minimum mounting depth;9-7/8 in (250 mm) diameter recommended cutout;Tile bridge included;(2) rigging points for safety tether (SPKA-ST-15 sold separately)
f. Dimensions
   1) Diameter: 10.57 in (269 mm) not including toggles
   2) Depth: 8.31 in (211 mm)
   3) Weight: 10.0 lb (4.5 kg)
g. Compliance
   1) UL Listed for US & Canada, CE, FCC Part 15 Class B, UL 1480, UL 1480A, UL 2043 [2

3. Manufacturer
   a. Crestron Saros ICE6T-W-T
   b. JBL Control
   c. Or equal

2.04 POWER AMPLIFIERS AND RELATED

A. Power Amplifiers, General

1. Drawing Symbol: PA [number].

2. Provide the following functions and/or features
   a. Employ solid state devices (integrated circuits and/or transistors) throughout and employ positive protection of circuit components.
   b. With amplifier input driven 10 dB beyond input level required to produce full rated output, amplifier shall withstand for at least 15 seconds any of the following load conditions without instability or operation of main over current protection (i.e. no blown fuses or circuit breakers).
      1) "Short" circuit of 0.1 ohm.
      2) Open circuit (no load).
      3) Standard Reactive Load: 5.4 ohms in series with the parallel combination of 12.5 microhenrys; 800 microfarads and 18.3 ohms resistive.
   c. Peak voltage of turn-on and/or turn-off transients not greater than 20 dB below maximum rated amplifier output.
      1) Time duration of transients not to exceed 3 seconds.
   d. Input level controls for each output channel to be calibrated, stepped attenuators with at least 50 dB range.
      1) For 0 to 34 dB of attenuation, steps not to be greater than 2.0 dB.
      2) Attenuators to track calibration within 0.5 dB.
      3) Stepped attenuators are not required at Power Amplifiers where the connected driving source device includes a precision attenuator under digital control with precision not less than that specified herein.
   e. Input Connectors: XLR connector or tip sleeve (standard) phone jack or barrier strip.
   f. Output Connectors: Standard 0.75 inch spacing "5-way" binding posts, or barrier strip.

g. Where integral cooling fans are provided, such fans shall have a minimum life rating of 50,000 hours at 25 degree Centigrade ambient temperature.
h. Where indicated, provide balanced input, differential or transformer. Provide matching accessory to implement if not a standard feature of the product provided.
i. Listed by a Nationally Recognized Testing Laboratory.

3. Minimum performance requirements with all channels driven
   a. Power Output Per Channel: As scheduled on Drawings as Minimum Amplifier (Min Amp) and specified below; continuous average sine wave power into 70 Volt line over a bandwidth of 40 Hz to 20 kHz.
      1) Frequency Response: plus 0 dB, minus 0.5 dB, 40 Hz to 20 kHz at rated output.
      2) Total Harmonic Distortion: Less than 0.25 percent at rated output, 40 Hz to 20 kHz.
      3) Intermodulation Distortion: Less than 0.04 percent at rated output using frequencies of 60 Hz and 7 kHz, mixed in a ratio of 4:1.
      4) Input Impedance: 15,000 ohms minimum; unbalanced, or balanced as shown on drawings.
      5) Hum & Noise: At least 94 dB signal-to-noise ratio.
      6) Channel Separation: At least 75 dB at 1 kHz.
      7) Phase Shift: Less than plus20 degrees from 20 Hz to 20 kHz.
      8) D.C. Offset: Less than 10 millivolts.

B. Power Amplifiers, 2 Channel, 70 Volt

1. Drawing Symbol
   a. PA70-100
   b. PA70-200
   c. PA70-300
   d. PA70-600
   e. PA70-30
   f. PA70-40

2. Comply with Power Amplifiers, General, in this Section.

3. Power Output per Channel, continuous average sine wave power into 70 Volt line impedance, not less than.
   a. PA70-100, 100 Watts
   b. PA70-200, 200 Watts
   c. PA70-300, 300 Watts
   d. PA70-600, 600 Watts
   e. PA70-30, 30 Watts
   f. PA70-40, 40 Watts

4. Dimensions: Not to exceed 3 rack units for 2 channels.
   a. Manufacturer, PA70-100
      1) Crown CDi
      2) QSC
      3) Peavey
      4) Or equal
   b. Manufacturer PA70-200
      1) Crown CDi
      2) QSC
      3) Peavey
      4) Or equal

c. Manufacturer, PA70-300
   1) Crown CDi
   2) QSC
   3) Peavey
   4) Or equal
d. Manufacturer, PA70-600
   1) Crown CDi
   2) QSC
   3) Peavey
   4) Or equal
e. Manufacturer, PA70-30
   1) Crown CDi
   2) QSC
   3) Peavey
   4) Or equal.
f. Manufacturer, PA70-40
   1) Crown CDi
   2) QSC
   3) Peavey
   4) Or equal.

2.05 ASSISTIVE LISTENING SYSTEM

A. General

1. Provide Radio Frequency Type, Frequency Modulated

2. 72 MHz Assistive Listening band.

3. Quantity of Devices:
   a. Transmitter with Mic: Twelve (2).
   b. Receiver with Headphone: Fourteen (4).
   c. Case: Two (2).

B. ALS Transmitter

1. Drawing Symbol: ALS TX

2. Features
   a. Balanced bridging line input.
   b. Rack mounted.
   c. Connector for remote-mounted antenna.
   d. Selectable transmitting frequency.

3. Manufacturer
   a. Listen Technologies LT-800-072 Stationary Transmitter with LA-326 Rack Mounting Kit
   b. Phonic Ear
   c. Williams Sound Corp
   d. Or equal.

C. ALS Remote Transmitting Antenna

1. Drawing Symbol: A

2. Features
   a. Antenna system with mounting hardware, matching specified ALS TX.

3. Manufacturer
   a. Listen Technologies LA-123
   b. Phonic Ear
   c. Williams Sound Corp
   d. Or equal.

D. Receivers and Accessories

1. Receiver
   a. Battery powered, rechargeable.
   b. Volume control.
   c. Receptacle for earphone/accessory.
   d. Rechargeable battery.
   e. Tuneable to channel in use by the user.
   f. Quantity: As Scheduled on the plans

2. Earphone
   a. Ear hung, not inserted in the ear canal.
   b. Hearing-Aid Compatible - For hearing-aid compatible receivers:
   c. Wireless neck loop compatible with “T” coil hearing aids.
   d. Built-in antenna
   e. Operates with provided receivers

3. Manufacturer
   a. Listen Technologies LR-500-072-0-M-C, LA-164 earphones, and LA-166 neck loops
   b. Phonic Ear
   c. Williams Sound Corp
   d. Or equal.

E. Battery Charger/Storage/Carry Case

1. Features
   a. Store and charge up to 16 Receivers and related accessories.
   b. Cover, latches and carrying handles.
   c. Removable lid.
   d. Quantity: To simultaneously recharge each received as scheduled on the plans

2. Manufacturer
   a. Listen Technologies LA-325
   b. Phonic Ear
   c. Williams Sound Corp
   d. Or equal.

2.06 CONTROL SYSTEM, SWITCHING AND RELATED

A. General

1. Products provide under this Section shall be made by manufacturers regularly engaged in the production of programmable commercial audio-visual control systems. Such manufacturers shall have at least 5 years prior production experience in the manufacture of such goods.

2. Provide control system to perform functions scheduled on drawings and herein.

3. System to be field programmable.

4. Provide programming allowance to implement system as required to provide the functionality indicated herein and as defined by the City during design and construction phase meetings, including closely matching the user interface of the existing control panels used elsewhere at the City in style, color and organization to the extent directed by the City's Representative.

5. In addition to providing programming to meet the requirements outlined in part one of this specification section and as outlined by the City during the reconstruction programming meetings, contractor to provide an allowance of up to $6000 to implement new functions in the audiovisual systems programming identified by the City after the substantial completion of this project. Allowance may not be expended by the Contractor in completing the base bid scope of work including warranty defect items.

B. Control Processor

1. Drawing References: CONTROL

2. Features/Functions/Performance:
   a. Control System shall utilize a processor at no less that of sufficient capacity to provide the indicated control functions without degradation due to system overload.
   b. I/O Ports:
      1) At least 3 RS-232/422/485 Ports.
      2) At least 8 IR/Serial Ports.
      3) At least 8 Isolated Relay Ports
      4) At least 8 I/O Ports.
      5) At least 1 Port for the control system manufacturer's proprietary A/V network.
      6) At least 1 TCP/IP Ethernet Network connection via an RJ-45 connector.
   c. Control System shall be fully compatible with the control system manufacturer's projector and A/V equipment status monitoring and
   d. management software.
   e. Control System shall include a 10/100 BaseT Ethernet Port that supports
   f. all of the following features:
      1) TCP/IP Communications
      2) DHCP and DNS Support
      3) IEEE 802.11b and Bluetooth Compatibility
      4) Native Email Client
      5) Remote Diagnostics
      6) Remote Program Loading and Administration
      7) Built-In Web Server
      8) FAT32 File System for easy data management
      9) SSL security plug-in
      10) PDA Integration and Control, XPanel PDA - Pocket PC 2002
      11) WebTablet Integration and Control – Microsoft Tablet PC
      12) Self Generating Executable GUI, XPanel EXE – Microsoft Family of Operating Systems
      13) Self Generating ActiveX powered Microsoft Internet Explorer Integration and Control, XPanel Microsoft Internet Explorer.
      14) Self Generating Java powered Web Integration and Control
   g. Control System Processor shall utilize a real time, event driven, multitasking, multi-threaded operating system with a dual bus architecture.
   h. High speed processor shall communicate directly with Ethernet, control

i. ports and proprietary control network utilizing high-speed, parallel bus
j. infrastructure. Control processors that communicate via a serial bus shall
k. not be accepted.
l. Control processor shall contain sufficient memory for the applications indicated.
m. Control System processor shall utilize a FAT32 file structure.
n. Control System shall support internal communications speed via two, independent communications busses. First control bus speed shall be at least 40 mb/s, second control bus speed shall be at least 300 mb/s.
o. Full API (Applications Interface) directly to control system via TCP/IP for integration with Visual Basic, C++, Java, etc. applications. API support through included control system manufacturer's ActiveX modules and/or their Dynamic Link Library (.DLL) file.
p. Control system manufacturer's to continuously monitor the integrity of the A/V control network for wiring faults, marginal communication
q. performance, network errors – all information is viewable.
r. System Support RS-485 token passing network with data communication for a minimum distance of 5000 feet.
s. Allow proprietary A/V Network network expansion via Ethernet or RS-232 ports, which can allow for high-speed network acceleration.
t. Support a minimum of 253 proprietary network devices simultaneously.
u. Control system shall support object-oriented logic based programming
v. language and a C-like language programming language. Both programming types are supported to run simultaneously and integral to
w. each other.
x. System shall supply Windows-based graphical
y. programming software for drag and drop object oriented programming for the control system operation.
z. System shall provide Windows-based graphical programming software, which is self-documenting in that it generates a symbolic flow diagram printout from the system program.
aa. The control system shall support a variety of wireless communication modes, including one-way and two-way radio frequency and infrared transmission.

3. Provide supplemental AV Network power supplies and network segmentation (C Block) as necessary to conform with the manufacturer’s recommendations for the total number of connected devices.

4. Manufacturers:
   a. Crestron Series 3 or CP2E with I/O expanders as required to match indicated functionality, CNTBLOCK and CNPWS-75 power supplies as required. Provide options and software kit as necessary to enable manufacturers XPanel IE functionality at clinicians desktops, and at desktop of of designated clinical lab administrative support personnel.
   b. AMX
   c. Extron
   d. or equal.

C. Conference Table/Lectern AV Media Input and Fliptop Touchscreen Control Panel

1. Drawing Reference: AVCFT

2. Features/Functions
   a. 3.5" color touchscreen with 320x240 resolution and 18-bit color depth
   b. Ten customizable backlit buttons
   c. Mounts flush in tabletop surface

d. Compatible with specified control processor
e. Light sensor adjusts touchscreen brightness as room lighting changes
f. Cable cubby, flip-top design offers easy access to AV, data, and power connections
g. AC power modules available
h. Accommodates manufacturer's adaptor plates
i. Integrated lid switch automatically wakes the touchpanel when opened and can trigger any other system function
j. Top surface available in black anodized or brushed aluminum finishes
k. Template-based touchscreen layout design
l. Easy control system setup
m. UL/c-UL listed and CE compliant

3. Manufacturers
   a. Crestron FT-TSC600
   b. Extron
   c. AMX
   d. Or equal

D. A/V Net distribution block

1. Drawing Reference: CBLOCK

2. Function/Features/Performance:
   a. Parallel distribution block for termination of multiple 4-wire A/V net cables
   b. NET 1 – 8: (8) 4-pin 3.5mm detachable terminal blocks
   c. Enclosure: Steel, black matte powder coat finish, surface mount box with (2) integral mounting flanges

3. Manufacturers
   a. Crestron CNTBLOCK
   b. Extron
   c. AMX
   d. Or equal.

E. Control Panel with integral processor and serial port, Hardwired, Module Style

1. Drawing References: CBP

2. Features:
   a. Wall mount pushbutton control panel
   b. Programmable buttons to accommodate control of a device's:
      1) Power On and Off
      2) Volume Up and Down
      3) Source Select Toggle
         a) Multiple pushes of a single button switches between controlled device's input sources
   c. Communication: RS232
   d. 1-gang, Decora wall-mountable

3. Manufacturer:
   a. SP Controls PixiePlus PXE-DCM+
   b. Crestron BPC-8
   c. RTI
   d. or equal

F. Multimedia Receiver w/Scaler (Fiber)

1. Drawing Reference: DMRX

2. Features/Functions:
   a. Video
      1) Scaler: HD video scaler, motion-adaptive deinterlacer, interlacer, intelligent frame rate conversion, Deep Color support, 3D to 2D conversion, content-adaptive noise reduction, widescreen format selection (zoom, stretch, maintain aspect-ratio, or 1:1), video wall processing (2x2, 3x2, 3x3, 4x3, or 4x4)
      2) Input Signal Type: DM 8G® SM Fiber (DigitalMedia™ over one single-mode fiber optic strand)
      3) Output Signal Types: HDMI®, DVI
      4) Formats: DM 8G SM Fiber & HDMI w/Deep Color & 3D, DVI, HDCP content protection support
      5) Input Resolutions, Progressive: 640x480@60Hz, 720x480@60Hz (480p), 720x576@50Hz (576p), 800x600@60Hz, 848x480@60Hz, 852x480@60Hz, 854x480@60Hz, 1024x768@60Hz, 1024x852@60Hz, 1024x1024@60Hz, 1280x720@50Hz (720p50), 1280x720@60Hz (720p60), 1280x768@60Hz, 1280x800@60Hz, 1280x960@60Hz, 1280x1024@60Hz, 1360x768@60Hz, 1365x1024@60Hz, 1366x768@60Hz, 1400x1050@60Hz, 1440x900@60Hz, 1600x900@60Hz, 1600x1200@60Hz, 1680x1050@60Hz, 1920x1080@24Hz (1080p24), 1920x1080@25Hz (1080p25), 1920x1080@50Hz (1080p50), 1920x1080@60Hz (1080p60), 1920x1200@60Hz, plus any other resolution allowed by HDMI up to 165MHz pixel clock
      6) Input Resolutions, Interlaced: 720x480@30Hz (480i), 720x576@25Hz (576i), 1920x1080@25Hz (1080i25), 1920x1080@30Hz (1080i30), plus any other resolution allowed by HDMI up to 165MHz pixel clock
      7) Scaler Output Resolutions, Progressive: 640x480@60Hz, 720x480@60Hz (480p), 720x576@50Hz (576p), 800x600@60Hz, 848x480@60Hz, 1024x768@60Hz, 1280x720@50Hz (720p50), 1280x720@60Hz (720p60), 1280x768@60Hz, 1280x800@60Hz, 1280x960@60Hz, 1280x1024@60Hz, 1360x768@60Hz, 1366x768@60Hz, 1400x1050@60Hz, 1440x900@60Hz, 1600x900@60Hz, 1600x1200@60Hz, 1680x1050@60Hz, 1920x1080@50Hz (1080p50), 1920x1080@60Hz (1080p60), 1920x1200@60Hz, 2048x1152@60Hz
      8) Scaler Output Resolutions, Interlaced: 720x480@30Hz (480i), 720x576@25Hz (576i), 1920x1080@25Hz (1080i25), 1920x1080@30Hz (1080i30)
      9) Pass-Thru Output Resolutions: Matched to input
   b. Audio
      1) Input Signal Type: DM 8G SM Fiber
      2) Output Signal Type: HDMI
      3) Formats: Dolby Digital®, Dolby Digital EX, Dolby Digital Plus, Dolby® TrueHD, DTS®, DTS-ES, DTS 96/24, DTS-HD High Res, DTS-HD Master Audio™, up to 8ch PCM
   c. Communications
      1) Ethernet: 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP
      2) USB: Supports signal extension of USB HID class devices, expandable to support virtually any USB 1.1 or 2.0 device using Crestron USB-EXT-DM USB over Ethernet Extenders
      3) RS-232: 2-way device control and monitoring up to 115.2k baud with hardware and software handshaking
      4) IR/Serial: 1-way device control via infrared up to 1.1 MHz or serial TTL/RS-232 (0-5 Volts) up to 19.2k baud

5) DigitalMedia: DM 8G SM Fiber, HDCP, EDID, CEC, Ethernet
6) HDMI: HDCP, EDID, CEC
7) NOTE: Supports management of HDCP and EDID; supports management of CEC between the connected HDMI device and a control system

d. Connectors – Bottom
1) HDMI OUT: (1) 19-pin Type A HDMI female;HDMI digital video/audio output; also supports DVI
2) USB HID: (1) USB Type A female; USB 2.0 host port for connection of a mouse/keyboard or other USB HID-compliant device
3) COM: (1) 5-pin 3.5mm detachable terminal block; Bidirectional RS-232 port;Up to 115.2k baud, hardware and software handshaking support
4) IR 1 – 2: (1) 4-pin 3.5mm detachable terminal block comprising (2) IR/Serial ports;IR output up to 1.1 MHz; 1-way serial TTL/RS-232 (0-5 Volts) up to 19200 baud

e. Connectors – Top
1) DM IN SMF/LC: (1) LC female optical fiber connector;DM 8G Single-Mode Fiber input;Connects to DM 8G SM Fiber output of a DM switcher, transmitter, or other DM device via CRESFIBER8G-SM single-mode fiber optic cable
2) LAN: (1) 8-wire RJ45 female, shielded;10Base-T/100Base-TX Ethernet port 24VDC 0.75A MAX:(1) 2.1 x 5.5 mm DC power connector;24 Volt DC power input;PW-2407WU power pack included

f. Connectors – Rear
1) G: (1) 6-32 screw, chassis ground lug

g. Controls & Indicators
1) PWR: (1) green LED, indicates operating power supplied via local power pack
2) DM LINK: (1) green LED, indicates DM link status
3) VIDEO: (1) green LED, indicates video signal presence and lock status
4) USB HID: (1) green LED, indicates a valid device connection and activity on the USB HID port
5) SETUP: (1) red LED and (1) miniature recessed pushbutton, for Ethernet setup
6) RESET:(1) miniature recessed pushbutton, for hardware reset
7) DM IN (Top): (1) green LED, indicates DM link status
8) LAN (Top): (2) LEDs, green LED indicates Ethernet link status, amber LED indicates Ethernet activity

h. Power Requirements
1) Power Pack: 0.75 Amps @ 24 Volts DC;100-240 Volts AC, 50/60 Hz power pack, model PW-2407WU included

i. Environmental
1) Temperature: 32° to 104°F (0° to 40°C)
2) Humidity: 10% to 90% RH (non-condensing)
3) Heat Dissipation: 45 BTU/Hr

j. Enclosure
1) Chassis: Metal, black finish, vented sides and front
2) Mounting: Mounts to a 2-gang electrical box, 2-Gang UK (BS 4662) electrical box, or 2-Gang European (DIN 49073) electrical box

k. Dimensions
1) Height: 7.69 in (196 mm)
2) Width: 7.60 in (193 mm)
3) Depth: 1.44 in (37 mm) with mounting bracket
4) Weight: 2.09 lb (949 g)

3. Manufacturer
a. Crestron DM-RMC-SCALER-S2
b. Extron
c. Or equal

G. Multimedia Receiver w/ Scaler (Copper)

1. Drawing Reference: DMRC

2. Features/Functions
   a. 4K60 4:4:4 HDR HDMI, HDR and HDCP2.2 compliant
   b. Deep Color
   c. 3D
   d. DVI
   e. Serial RS232 Communications
   f. Infrared Control
   g. VESA stream compression
   h. HDCP 2.2
   i. CEC
   j. EDID format management
   k. Enclosure
      1) Metal, black finish, vented sides and front
      2) 8” x 8” x 2”
   l. Built-in video scaler: HD video scaler, motion-adaptive deinterlacer, interlacer, intelligent frame rate conversion, Deep Color support, 3D to 2D conversion, content-adaptive noise reduction

3. Manufacturers
   a. Crestron DM-RMC-4KZ-100-C
   b. Extron
   c. Or equal

H. 24-Port PoE Network Switch

1. Drawing References: NSW, CAMCTL NSW

2. Port Count:
   a. 24

3. Construction.
   a. 1 Rack Unit maximum
   b. Provide accessories as required to rack mount.

4. Manufacturers:
   a. Cisco Catalyst WS-C2960S-24PS-L.
   b. DLink
   c. Hewlett Packard
   d. Or equal

I. Control Panel/Touch, Topset (CTP) w/ Tabletop Kit; Wallmount (CTW) w/ Wallmount Kit.

1. Drawing Reference: CTP (Topset); CTW (Wallmount)

2. Features/Functions:
   a. Touchscreen Display
      1) Display Type TFT Active matrix color LCD
      2) Size 7 inch (178 mm) diagonal
      3) Aspect Ratio 15:9 WVGA
      4) Resolution 1024 x 600 pixels
      5) Brightness 350 nits (cd/m²)

6) Contrast 1100:1
7) Color Depth 24-bit, 16.7M color
8) Illumination Edgelit LED
9) Viewing Angle ±80° horizontal, ±80° vertical
10) Touchscreen: Protected Capacitive, 5-point multi-touch capable

b. Graphics Engine: Crestron Smart Graphics, multi-language web browser, multi-language on-screen keyboard, screensaver, single scalable streaming video window.

c. Communications
1) 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, TCP/IP, UDP/IP, CIP, DHCP, SSL, TLS, SSH, SFTP (SSH File Transfer Protocol), IEEE 802.1X, SNMP, IPv4 or IPv6, IEEE 802.3af and 802.3at Type 1 compliant.
2) USB 2.0 Type A (for future use)
3) 8-pin RJ45 with 2 LED indicators; 10Base-T/100Base-TX Ethernet port, Power over Ethernet compliant; Green and yellow LEDs indicate Ethernet port status
4) IEEE 802.3at Type 1 (802.3af compatible) Class 3 (12.95 W) PoE Powered Device

d. Enclosure
1) Plastic, smooth black or white finish, edge-to-edge glass with black or white surround 8”H x 11”W x 7”D
2) Submit color choice for selection by City representative.

3. Manufacturer:
a. Crestron TSW-760-B-S w/ wallmount or Tabletop kit
b. Extron
c. Or equal

2.07 VIDEO PROCESSING

A. Digital Media Presentation System

1. Drawing Reference: AVSW

2. Functions/Features:
a. High-Definition multimedia system switcher, mic mixer, audio DSP, amplifier, and control system
b. Provides connectivity as shown on drawings.
c. Matrix signal routing for up to 7 simultaneous sources and 4 outputs
d. Compatible with HDMI, DVI, DisplayPort Multimode, and SPDIF digital sources
e. Compatible with RGB, composite, S-Video, component, and stereo audio analog sources
f. Features auto-detecting, auto-switching inputs for all types of video and audio sources
g. Includes built-in 6-channel gated microphone mixing w/DSP
h. Audio signal mixing and routing to 7 separate outputs
i. Audio-follow-video or breakaway switching for all inputs
j. Enables HDMI audio signal extraction and embedding
k. Provides 3 stereo analog outputs with independent DSP per output
l. Features built-in 40 Watt amplifier, selectable for 8 Ohm stereo or 70/100 Volt mono operation
m. Multi-channel audio signals can be routed to the HDMI and specified receiver outputs
n. Transmits audio, video and control signaling to specified receiver over a single UTP6-4P cable.

o. Provides remote power to specified control and transmit devices
p. Manages HDCP keys for reliable, low-latency switching
q. Performs automatic AV signal format management via EDID
r. Scaler options provide discrete image optimization for each display device
s. Integrated Ethernet switch provides a single-point LAN connection
t. Control system provides fully-programmable device control
u. Compatible with specified control devices.
v. Ability to provide remote control operations via Apple iPad
w. Internal universal power supply
x. 3-space, 19-inch rack-mountable

3. Manufacturer
   a. Crestron DMPS3-4K-350-C
   b. Extron
   c. Or equal.

B. High Definition A/V Transmitter (Fiber)

1. Drawing Reference: DMTX

2. Functions/Features:
   a. Video
      1) Switcher: 4x1 auto-switching, auto-detecting multi-format digital/analog inputs; Crestron QuickSwitch HD® technology
      2) Input Signal Types: DisplayPort, HDMI® w/Deep Color & 3D (DVI & Dual-Mode DisplayPort compatible [4]), RGB/VGA (RGBHV, RGBS, RGsB), component (YPbPr), S-Video (Y/C), composite (NTSC, PAL) [5]
      3) Output Signal Types: DM 8G® Fiber w/Deep Color & 3D [2]
      4) Resolutions, DisplayPort, Progressive: 640x480@60Hz, 720x480@60Hz (480p), 720x576@50Hz (576p), 800x600@60Hz, 848x480@60Hz, 852x480@60Hz, 854x480@60Hz, 1024x768@60Hz, 1024x852@60Hz, 1024x1024@60Hz, 1280x720@50Hz (720p50), 1280x720@60Hz (720p60), 1280x768@60Hz, 1280x800@60Hz, 1280x960@60Hz, 1280x1024@60Hz, 1360x768@60Hz, 1365x1024@60Hz, 1366x768@60Hz, 1400x1050@60Hz, 1440x900@60Hz, 1600x900@60Hz, 1600x1200@60Hz, 1680x1050@60Hz, 1920x1080@50Hz (1080p50), 1920x1080@60Hz (1080p60), 1920x1200@60Hz, 2048x1152@60Hz, plus any other resolution allowed by DisplayPort up to 165MHz pixel clock
      5) Resolutions, DisplayPort, Interlaced: 1920x1080@25Hz (1080i25), 1920x1080@30Hz (1080i30), plus any other resolution allowed by DisplayPort up to 165MHz pixel clock
      6) Resolutions, HDMI, Progressive: 640x480@60Hz, 720x480@60Hz (480p), 720x576@50Hz (576p), 800x600@60Hz, 848x480@60Hz, 852x480@60Hz, 854x480@60Hz, 1024x768@60Hz, 1024x852@60Hz, 1024x1024@60Hz, 1280x720@50Hz (720p50), 1280x720@60Hz (720p60), 1280x768@60Hz, 1280x800@60Hz, 1280x960@60Hz, 1280x1024@60Hz, 1360x768@60Hz, 1365x1024@60Hz, 1366x768@60Hz, 1400x1050@60Hz, 1440x900@60Hz, 1600x900@60Hz, 1600x1200@60Hz, 1680x1050@60Hz, 1920x1080@24Hz (1080p24), 1920x1080@25Hz (1080p25), 1920x1080@50Hz (1080p50), 1920x1080@60Hz (1080p60), 1920x1200@60Hz, 2048x1080@24Hz, 2048x1152@60Hz, plus any other resolution allowed by HDMI up to 165MHz pixel clock
      7) Resolutions, HDMI, Interlaced: 720x480@30Hz (480i), 720x576@25Hz (576i), 1920x1080@25Hz (1080i25), 1920x1080@30Hz (1080i30), plus any other resolution allowed by HDMI up to 165MHz pixel clock

8) Resolutions, RGB: 640x480@60Hz, 720x480@60Hz (480p), 720x576@50Hz (576p), 800x600@60Hz, 848x480@60Hz, 1024x768@60Hz, 1280x720@50Hz (720p50), 1280x720@60Hz (720p60), 1280x768@60Hz, 1280x800@60Hz, 1280x960@60Hz, 1280x1024@60Hz, 1360x768@60Hz, 1366x768@60Hz, 1400x1050@60Hz, 1440x900@60Hz, 1600x1200@60Hz, 1680x1050@60Hz, 1920x1080@50Hz (1080p50), 1920x1080@60Hz (1080p60), 1920x1200@60Hz, 2048x1152@60Hz
9) Resolutions, Component [5]: 480i, 576i, 480p, 576p, 720p50, 720p60, 1080p24, 1080i25 (1125 lines), 1080i30, 1080p30, 1080p50 (1125 lines), 1080p60
10) Resolutions, Composite & S-Video [5]: 480i, 576i
11) Analog-To-Digital Conversion: 12-bit 170 MHz per each of 3 channels

b. Audio
1) Switcher: 4x1 with auto-detecting digital/analog inputs and analog audio breakaway
2) Input Signal Types: DisplayPort, HDMI (Dual-Mode DisplayPort compatible), analog stereo
3) Output Signal Type: DM 8G Fiber
4) Digital Formats, DisplayPort: Dolby Digital®, Dolby Digital EX, DTS®, DTS-ES, DTS 96/24, LPCM up to 8 channels
5) Digital Formats, HDMI: Dolby Digital, Dolby Digital EX, Dolby Digital Plus, Dolby® TrueHD, DTS, DTS-ES, DTS 96/24, DTS-HD High Res, DTS-HD Master Audio™, LPCM up to 8 channels
6) Analog Formats: Stereo 2-channel
7) Analog-To-Digital Conversion: 24-bit 48 kHz
8) Analog Input Level Compensation: ±10 dB
9) Analog Performance: Frequency Response: 20 Hz to 20 kHz ±0.75 dB;S/N Ratio: >90 dB, 20 Hz to 20 kHz A-weighted;THD+N: <0.05% @ 1 kHz;Stereo Separation: >90 dB

c. Communications
1) Ethernet: 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP
2) USB: Supports signal extension of USB HID class devices, expandable to support virtually any USB 1.1 or 2.0 device using Crestron USB-EXT-DM USB over Ethernet Extenders[6]
3) DigitalMedia: DM 8G Fiber, HDCP, EDID, CEC, Ethernet
4) HDMI: HDCP, EDID, CEC
5) NOTE: Supports management of HDCP and EDID; supports management of CEC between the connected HDMI device and a control system

d. Connectors
1) VID: (1) RCA female, composite video input;Input Level: 1 Vp-p nominal;Input Impedance: 75 Ohms nominal
2) PC: (1) HD15 female, analog VGA/RGB/video input;Signal Types: VGA, RGB, component, S-Video, or composite [5];Formats: RGBHV, RGBS, RGsB, YPbPr, Y/C, NTSC, PAL;Input Levels: 0.5 to 1.5 Vp-p with built-in DC restoration;Input Impedance: 75 Ohms;Sync Input Type: Autodetect RGBHV, RGBS, RGsB, YPbPr;Sync Input Level: 3 to 5 Vp-p;Sync Input Impedance: 510 Ohms
3) AUDIO IN: (1) 3.5mm TRS mini phone jack;Unbalanced stereo line-level audio input;Input Level: 2 Vrms maximum;Input Impedance: 10k Ohms
4) AUDIO IN L, R: (2) RCA female;Unbalanced stereo line-level audio input;Input Level: 2 Vrms maximum;Input Impedance: 10k Ohms
5) HDMI: (1) 19-pin Type A HDMI female;HDMI digital video/audio input (DVI & Dual-Mode DisplayPort compatible [4])
6) DISPLAY PORT: (1) 20-pin DisplayPort female;DisplayPort digital video/audio input [3]

7) COM: (1) 5-pin 3.5mm detachable terminal block, bidirectional RS-232 port;Up to 115.2k baud, hardware and software handshaking support
8) IR: (1) 2-pin 3.5mm detachable terminal block, IR/Serial port;IR output up to 1.1 MHz;1-way serial TTL/RS-232 (0-5 Volts) up to 19200 baud
9) DM OUT MMF/SC: (1) SC female optical fiber connector;DM 8G Fiber output;Connects to DM 8G Fiber input of a DM switcher, receiver/room controller, or other DM device via CresFiber® 8G fiber optic cable[2]
10) 24VDC 0.75A: (1) 2.1 x 5.5 mm DC power connector;24 Volt DC power input;PW-2407WU power pack included
11) LAN: (1) 8-wire RJ45 female;10Base-T/100Base-TX Ethernet port
12) G: (1) 6-32 screw, chassis ground lug
13) USB HID (front): (1) USB Type A female;USB 2.0 host port for connection of a mouse/keyboard or other USB HID-compliant device

e. Controls & Indicators
1) PWR: (1) green LED, indicates operating power supplied via local power pack
2) RESET: (1) miniature recessed pushbutton for hardware reset
3) DM LINK: (1) green LED, indicates DM link status
4) SETUP: (1) red LED and (1) miniature recessed pushbutton for Ethernet setup
5) INPUT AUTO, VIDEO, PC, HDMI, DISPLAY PORT: (5) green LEDs, indicate which input is selected or if auto-switch mode is active
6) INPUT SELECT: (1) pushbutton for selecting inputs or activating auto-switch mode
7) LINK (rear): (1) green LED, indicates DM link status
8) LAN (rear): (2) LEDs, green LED indicates Ethernet link status, amber LED indicates Ethernet activity

f. Power Requirements
1) Power Pack: 0.75 Amps @ 24 Volts DC;100-240 Volts AC, 50/60 Hz power pack, model PW-2407WU included

g. Environmental
1) Temperature: 32° to 104° F (0° to 40° C)
2) Humidity: 10% to 90% RH (non-condensing)
3) Heat Dissipation: 43 BTU/hr

h. Enclosure
1) Chassis: Metal, black finish, vented top and sides
2) Front Panel: Metal, black finish with polycarbonate label overlay
3) Mounting: Freestanding, under-table mountable, or 1RU half-width 19-inch rack-mountable (adhesive feet attached, under-table and rack mounting kits sold separately)

i. Dimensions
1) Height:1.76 in (45 mm)
2) Width:7.07 in (180 mm)
3) Depth:8.75 in (223 mm)
4) Weight2.0 lb (0.9 kg)

3. Manufacturer
a. Crestron DM-TX-401-S
b. Extron
c. Or equal

C. High Definition A/V Transmitter (Copper)

1. Drawing Reference: DMTC

2. Functions/Features:
a. Provides HDMI, RGBHV and mini stereo audio inputs

b. Provides USB extension
c. Provides LAN connectivity
d. Transmits audio, video and control signaling to specified receiver over a single UTP6-4P cable.
e. HDCP compatible.
f. Can be remotely powered by specified control system.
g. Mounts to underside of table.
h. Nominal dimensions: 6.5” x 7” x 1.5”

3. Manufacturer
   a. Crestron DM-TX-4KZ-202-C
   b. Extron
   c. Or equal.

D. HDMI Distribution Amplifier

1. Drawing Reference: HDDA-4, HDDA-6

2. Features/Functions:
   a. Up to 4096x2160 at 60Hz 4:2:0, 8-bit
   b. HDMI 2.2, HDCP 1.4 compliant
   c. 10.2 Gbps
   d. RS-232 Serial Control
   e. 1 HDMI Input, 6 HDMI Output

3. Manufacturer:
   a. Extron DA6 HD 4k
   b. Kramer
   c. Or equal

E. Combination RJ45/F-Connector 2-gang Plate for Camera Video/Control

F. Drawing Reference: MP3

G. Features/Functions:
   a. 1 gang: (2) F-type Connectors for HD-SDI (RG6 coax)
   b. 1 gang: (1) RJ45 for Cat6
   c. Manufacturer:
   d. Cable Matters
   e. Leviton
   f. Or equal

H. HDMI Output Plate

I. Drawing Reference: MP2

J. Features/Functions:
   a. HDMI Output
   b. HDMI over Category Cable Input
   c. Single-gang decora
   d. Manufacturer:
   e. Crestron DM-RMC-4K-100-C-1G-W-T

K. HDMI and RGBHV w/ Stereo Audio Input Plate

1. Drawing Reference: MP1

2. Features/Functions

3. Inputs
    1) HDMI
    2) RGBHV
    3) Stereo Audio
    4) USB
    5) 2x1 combination digital/analog switch
    6) Supports resolutions up to 2048x1080 @ 24Hz
    7) Analog-To-Digital Conversion 10-bit 165 MHz per each of 3 channels
    8) Communications
    9) Audio, video and control 330 feet over a single UTP Cat 6 cable.
    10) HDCP management, EDID format management, CEC
    b. USB Supports USB HID class devices
    c. Compatible with specified switcher.
    d. Remotely powered from switcher/headend equipment location.
    e. 2 gang.

4. Manufacturers
    a. Crestron DM-TX-200-C-2G w/ required remote power accessories.
    b. Extron
    c. Or equal.

L. USB Extender Balun

1. Drawing Reference: USB-X

2. Features:
    a. USB extension up to 100 m (330 ft) over solid-core CAT5e (or better) unshielded twisted pair (UTP) cable [1]
    b. USB Device Support USB 1.1 and 2.0 compatible including mass storage and isochronous devices [2]
    c. USB Hub Support Any signal chain may include up to 4 USB hubs plus one USB-EXT-2 system [2]
    d. Maximum USB Devices 30 USB devices, or 4 USB hubs with 26 USB devices
    e. Host Computer OS Support Windows, macOS, Linux
    f. USB Throughput USB 2.0 up to 480 Mbps;
    g. USB 1.1 up to 12 Mbps

3. Connectors – Local Extender
    a. 24V 1A (1) 2.1 x 5.5 mm DC power connector;
    b. 24 Volt DC power input (power pack included)
    c. Link (1) 8-pin RJ45 connector, female; Connects to Link port on the Remote Extender
    d. USB (1) USB Type B connector, female (USB B to A cable included);
    e. USB 2.0 device port for connection to the USB host computer, media server, game console, annotator, codec, etc.
    f. Config (front) (For factory use only)

4. Connectors – Remote Extender
    a. 24V 1A (1) 2.1 x 5.5 mm DC power connector;
    b. 24 Volt DC power input (power pack included) [3]

c. Link (1) 8-pin RJ45 connector, female; Connects to Link port on the Local Extender
d. Config (front) (For factory use only)
e. USB (front) (2) USB Type A connectors, female; USB 2.0 host ports for connection of USB mice, keyboards, whiteboards, game controllers, cameras, audio devices, mobile devices, printers, flash drives, hard drives, hubs, and other USB devices. Available USB Power: 1 Amp maximum per port, 1.5 Amps maximum total.

5. Indicators – Local Extender
   a. Mode (1) Recessed pushbutton (for factory use only).
   b. Power (1) Blue LED, indicates operating power is supplied via the local power pack or via the Link connection.
   c. Link (1) Green LED, indicates a valid Link connection to the Remote Extender.
   d. Host (1) Green LED, indicates a valid connection to the USB host.
   e. Activity (1) Amber LED, indicates data activity on the Link interface.

6. Indicators – Remote Extender
   a. Power (1) Blue LED, indicates operating power is supplied via the local power pack or via the Link connection.
   b. Link (1) Green LED, indicates a valid Link connection to the Local Extender.
   c. Host (1) Green LED, indicates a valid connection to the USB host at the Local Extender.
   d. Activity (1) Amber LED, indicates data activity on the Link interface.
   e. Mode (rear) (1) Recessed pushbutton (for factory use only).

7. Power
   a. Power Pack (included)
   b. Input: 100-240 Volts AC, 50/60 Hz; Output: 1 Amp @ 24 Volts DC.
   c. Available USB Power Supplies 1 Amp maximum per each of two USB Type A ports, 1.5 Amps maximum total.

8. Environmental
   a. Temperature 32° to 122° F (0° to 50° C)
   b. Humidity 20% to 80% RH (non-condensing)

9. Construction (Typical per Unit)
   a. Housing Metal, black finish, adhesive rubber feet
   b. Mounting Includes four slots for wire ties or other third-party mounting hardware

10. Dimensions (Typical per Unit)
    a. Height 1.03 in (26 mm) without feet
    b. Width 2.96 in (75 mm)
    c. Depth 3.43 in (87 mm)

11. Compliance
    a. CE, IC, FCC Part 15 Class B digital device.

12. Manufacturer:
    a. Crestron USB EXT
    b. Extron
    c. Or equal

2.08 AUDIO MIXING, CONTROL, SWITCHING, PROCESSING AND RELATED

A. Audio De-embedder

1. Drawing Reference: ADE

2. Functions
   a. De-embed stereo audio from HDMI
   b. HDMI input
   c. HDMI output (pass-through)
   d. Stereo Analog Audio output

3. Manufacturer:
   a. Extron HAE 100 4k
   b. Kramer
   c. Or equal

B. Conferencing Camera

1. Drawing Reference: CCAM

2. Features/Functions:
   a. 1/3” CMOS Sensor
   b. 1080p 30fps
   c. f/1.8 lens
   d. USB

3. Manufacturer:
   a. HuddleCamHD
   b. Logitech
   c. Or equal

2.09 VIDEO TERMINAL EQUIPMENT

A. LCD Panel, 55”

1. Drawing Reference: LCD55

2. Minimum Features/Functions:
   a. Viewable Area 55" diagonal, normally black TFT LCD
   b. Native Display Resolution Full 1920 x 1080 (1080i) HD Resolution
   c. Full 1920 x 1080 (native) High Definition resolution from Digital RGB, Analog RGB and HD Video Sources.
   d. Brightness 450 nit (cd/m2)
   e. Number of Colors 16.7 million (Full Color)
   f. Contrast Ratio 1700:1
   g. Aspect Ratio 16:9
   h. Viewing Angle 176º H / 176º V
   i. Response Time 4ms
   j. Backlight Type Fluorescent
   k. Runtime: 16/7, professional
   l. Audio: 7 Watts x 2 (@ 6 ohms) speaker terminals
   m. Inputs:
      1) DVI-D (24-pin) - HDCP Compatible (DVI 1.0),

2) RGB Analog (15-pin Mini D-sub),
3) HDMI – HDCP Compatible
4) Composite (BNC),
5) Stereo Audio for PC (3.5mm stereo mini-jack),
6) Stereo Audio for A/V (RCA pin L/R),
7) RS-232C Serial Port (9-pin D-sub)

n. Outputs:
1) DVI-D loop-through (15-pin Mini D-sub),
2) Stereo audio line-out (RCA pin L/R),
3) Stereo audio (7W/channel) speaker terminals

o. Rugged design incorporating commercial components,
1) Black metal rear enclosure,
2) Integrated protective acrylic overlay,

p. Compatible for use in both portrait and landscape mode applications.

q. Weight / Dimensions
1) Not more than 100 lbs.
2) Not larger than 55 (w) x 40" (h) x 2" (d)

r. Maximum Power Consumption
1) In accordance with California State Law.

3. Minimum Environmentals
a. Operating Temperature 32 ~ 104º F (0 ~ 40º C)
b. Storage Temperature -4 ~ 140º F (-20 ~ 60º C)

4. Regulatory Approvals UL 60950, FCC Class A

5. Remote Control included

6. Manufacturers:
a. Samsung
b. NEC
c. Or equal.

B. LCD, 43” Diagonal

1. Drawing Reference: LCD43

2. Features/Functions:

3. Manufacturer:
a. Sharp
b. NEC
c. Samsung
d. Or equal

C. LCD, 65” Diagonal

1. Drawing Reference: LCD65

2. Features/Functions:

3. Manufacturer:
a. Sharp
b. NEC

c. Samsung
d. Or equal

D. LCD Panel, 80”

1. Drawing Reference: LCD80

2. Minimum Features/Functions:
   a. Viewable Area 80" diagonal, normally black TFT LCD
   b. Native Display Resolution Full 1920 x 1080 (1080i) HD Resolution
   c. Full 1920 x 1080 (native) High Definition resolution from Digital RGB, Analog RGB and HD Video Sources.
   d. Brightness 450 nit (cd/m2)
   e. Number of Colors 16.7 million (Full Color)
   f. Contrast Ratio 1700:1
   g. Aspect Ratio 16:9
   h. Viewing Angle 176º H / 176º V
   i. Response Time 4ms
   j. Backlight Type Fluorescent
   k. Runtime: 16/7, professional
   l. Audio: 7 Watts x 2 (@ 6 ohms) speaker terminals
   m. Inputs:
      1) DVI-D (24-pin) - HDCP Compatible (DVI 1.0),
      2) RGB Analog (15-pin Mini D-sub),
      3) HDMI – HDCP Compatible
      4) Composite (BNC),
      5) Stereo Audio for PC (3.5mm stereo mini-jack),
      6) Stereo Audio for A/V (RCA pin L/R),
      7) RS-232C Serial Port (9-pin D-sub)
   n. Outputs:
      1) DVI-D loop-through (15-pin Mini D-sub),
      2) Stereo audio line-out (RCA pin L/R),
      3) Stereo audio (7W/channel) speaker terminals
   o. Rugged design incorporating commercial components,
      1) Black metal rear enclosure,
      2) Integrated protective acrylic overlay,
   p. Compatible for use in both portrait and landscape mode applications.
   q. Weight / Dimensions
      1) Not more than 175 lbs.
   r. Maximum Power Consumption
      1) In accordance with California State Law.

3. Minimum Environmentals
   a. Operating Temperature 32 ~ 104º F (0 ~ 40º C)
   b. Storage Temperature -4 ~ 140º F (-20 ~ 60º C)

4. Regulatory Approvals UL 60950, FCC Class A

5. Remote Control included

6. Manufacturers:
   a. Samsung
   b. NEC
   c. Or equal

E. LCD/Plasma Wall Mount, Fixed

1. Drawing Reference: None - provide at locations where wall mount of LCD65 devices is indicated.

2. Functions:
   a. Can support an LCD or Plasma panel up to 65" diagonal and weighing up to 160 pounds from wall, in a portrait mode or landscape mode as required by the application.
   b. Designed to mount to 16", 20", 24" center stud systems
   c. Panel can be securely fastened to mount using to prevent theft by adding an Owner furnished padlock.
   d. Designed to accommodate panels from at least Pioneer, Panasonic, Sharp, Samsung, & LG Electronics
   e. Heavy duty construction with steel components
   f. Adjustable.
   g. Depth: Nominally 2”.
   h. UL listed

3. Manufacturers:
   a. Chief Manufacturing, Inc. LSMU Fusion required to match LCD and Plasma Panels panel supplied by the work of this Project.
   b. Premiere Mounts
   c. Display Devices
   d. Or equal.

F. LCD 32” Video Workstation Display Monitor

1. Drawing Reference: LCD32

2. Features/Functions:
   a. HDMI Input

3. Manufacturer:
   a. NEC V321-2
   b. Samsung HG32NE477SF
   c. Or equal

2.10 SOUND CABLES AND RELATED

A. General

1. Provide cable with electrical conductors of soft drawn annealed copper, bare or tinned, solid or concentric stranded as applies, conductivity not less than 98 percent of pure copper.

2. Comply with applicable Code for insulation, jacket, marking and listing for applicable use.
   a. Refer to California Electrical Code, Table 725-61. Cable Uses and Permitted Substitutions.

3. Manufacturer part number specified is for a Listed Type CM construction to indicate intended cable construction and quality.
   a. Code requirements take precedence.
   b. Provide type required by Code at no additional cost to the City.

B. Cable, Microphone and Line Level, General Purpose

1. Drawing Symbol(s): SP.

2. Description: Shielded, single twisted pair, with #20 AWG color coded stranded conductors and foil shield with drain wire.

3. Performance/Construction
   a. Conductors AWG #20.
   b. Conductors Stranding: 7 by 28.
   c. D.C. Resistance Per 1000 feet 15 ohms maximum.
   d. Shield: Aluminum polyester foil with #20 AWG stranded tinned copper drain wire.
   e. Diameter 0.24 inch maximum.
   f. Where 2A indicated, provide 2 each SP

4. Manufacturer
   a. Belden 8762
   b. West Penn.
   c. Or equal.

C. Cable, Microphone and Line Level, Miniature

1. Drawing Symbol: SP

2. Restriction: For use within fixed equipment racks only.

3. Description: Shielded, single twisted pair, with #22 AWG color coded stranded conductors and foil shield with drain wire.

4. Performance/Construction:
   a. Conductors AWG #22.
   b. Conductors Stranding: 7 by 30.
   c. D.C. Resistance Per 1000 feet: 20 ohms maximum.
   d. Shield: Aluminum polyester foil with #24 stranded tinned copper drain wire.
   e. Diameter 0.15 inch maximum.
   f. Where 2A indicated, provide 2 each SP

5. Manufacturer
   a. Belden 8451, 9451, 1266A.
   b. Alpha.
   c. West Penn.
   d. Or equal.

D. Cable, Loudspeaker and D.C. Power

1. Drawing Symbol(s)
   a. #18TP
   b. #16TP
   c. #14TP
   d. #12TP

2. Description
   a. Twisted pair, jacketed, unshielded cables, #12, #14, #16, or #18, as shown on Drawings.

b. Plenum rated where installed in open plenum return voids.

3. Performance/Construction
   a. Conductor, AWG: #12, #14, #16, and #18, as noted.
   b. Maximum diameter
      1) 0.384 inch (#12)
      2) 0.332 inch (#14)
      3) 0.256 inch (#16)
      4) 0.224 inch (#18).

4. Manufacturer
   a. Belden.
      1) #12TP, Belden 8477
      2) #14TP, Belden 8473
      3) #16TP, Belden 8471
      4) #18TP, Belden 9740
      5) West Penn.
      6) Or equal.

2.11 VIDEO CABLES, COPPER COAX AND RELATED

A. General

1. Provide cable with electrical conductors of soft drawn annealed copper, bare or tinned, solid or concentric stranded as applies, conductivity not less than 98 percent of pure copper.

2. Comply with applicable Code for insulation, jacket, marking and listing for applicable use.
   a. Refer to California Electrical Code, Table 725-61. Cable Uses and Permitted Substitutions.
   b. Manufacturer part number specified is for a Listed Type CM construction to indicate intended cable construction and quality.

3. Code requirements take precedence.

4. Provide type required by Code at no additional cost to the City.

B. Cable, Precision Video

1. Drawing Symbol(s): P-VIDEO.

2. Description: 100 percent sweep tested from 0.01 to 100 MHz, double braided shield solid center conductor 75 ohms coaxial precision video cable.

3. Performance
   a. Cable Type: Coaxial precision video.
   b. Center Conductor AWG: Twenty (20) bare copper.
   c. Insulation: Polyethylene.
   d. Shield: Tinned copper double braid, minimum 98 percent coverage.
   e. Nominal Impedance: 75 ohms.
   f. Velocity of Propagation: 66 percent.
   g. Attenuation Per 100 feet:

1) 1.0 MHz: 0.25 dB
2) 4.5 MHz: 0.45 dB
3) 10.0 MHz: 0.78 dB.

h. Jacket: Polyethylene.

i. Diameter: 0.305 inch maximum.

4. Manufacturer
   a. Belden 9209A.
   b. Canare
   c. Gepco
   d. Or equal.

C. Cable, Miniature Precision Video

1. Drawing Symbol: Miniature Precision Video.

2. Description: 100 percent sweep tested from 0.01 to 100 MHz, braided shield plus foil shield, stranded center conductor 75 ohms coaxial miniature precision video cable.

3. Performance
   a. Cable Type: Coaxial precision video.
   b. Center Conductor AWG: 22 or 23 bare copper.
   c. Center Conductor Stranding: 7 by 30 or 7 by 32.
   d. D.C. Resistance Per 1000 feet: 15 ohms maximum.
   e. Insulation: Cellular Polyethylene.
   f. Shield: 100 percent foil plus trimmed copper braid, 95 percent coverage.
   g. Nominal Impedance: 75 ohms.
   h. Velocity of Propagation: 66 percent.
   i. Attenuation Per 100 feet:
      1) 1.0 MHz: 0.15 dB
      2) 10.0 MHz: 1.3 dB
      3) 100 MHz: 5.0 dB.
   j. Jacket: Polyethylene.
   k. Diameter: 0.240 inch maximum.

4. Manufacturer
   a. Belden 9209A.
   b. Canare LV-61S.
   c. Or equal.

D. Cable Set, Audio Video, Manufactured

1. Provide signal type as indicated on Drawings.

2. Manufacturer
   a. Liberty Wire & Cable Interflex Z-200 and Z-300 Series
   b. Markertek
   c. Or equal.

E. Cable, SVideo

1. Plan Reference(s): SV, SVideo

2. Construction
   a. 2 miniature precision coax cables in an overall shielded overall jacket to transmit NTSC analog component video based on the separation of chrominance and luminance transmission method.
   b. Jacket: Code approved equal for application.
   c. Overall two sub cable assembly diameter: 0.33" maximum in raceway applications.

3. Performance:
   a. Conductor DC Resistance: 41 Ohms / 1000ft. max
   b. Capacitance: 16.7 pf/ft.
   c. Impedance: 75 Ohm -5 +2 Ohms
   d. Time Delay: 1.22ns/ft.
   e. Velocity of Propagation: 83%
   f. Attenuation
      1) 1.22 dB/100 ft.: 5 MHz
      2) 3 dB/100 ft.: 30 MHz
      3) 5.34 dB/100 ft.: 90 MHz.
   g. Construction: Two precision video cables in one overall jacket.

4. Manufacturer:
   a. Altinex CB5620PL in plenum spaces, riser rated elsewhere.
   b. Belden
   c. West Penn
   d. Extron
   e. Or equal.

F. Cable, Data Monitor Precision Video

1. Plan Reference(s):
   a. D5 Video

2. Construction
   a. 5 miniature high resolution coax cables in an overall shielded overall jacket to transmit analog component video based on the Red-Green-Blue-Horizontal Sync-Vertical Sync (RGBHV) transmission method.
   b. Sub cables are color coded Red, Green, Blue, Black, Grey; or approved alternate color coding scheme.
   c. Jacket: Code approved equal for application.
   d. Overall five sub cable assembly diameter: 0.56" maximum in raceway applications.
   e. Center Conductor AWG: Twenty two (22) ga Silver Plated Copper.
   f. Insulation: Foamed Teflon.
   g. Shield:
      1) Each subcable is double shielded
      2) Overall cable has 100% tape shield.

3. Approval/Rating:
   a. UL: Recognized Type CL2P (Article 725 of NEC) for plenum application, riser rated elsewhere.

4. Performance - each sub-cable:
   a. Resistance: 0.0162 ohms/ft. nominal @ 20C

b. Impedance: 75 ohm nominal
c. Capacitance: 17.5 pf/ft. nominal
d. Velocity of Propagation: 80% nominal
e. Time Delay: 1.19ns/ft. nominal
f. Maximum Attenuation Per 100':
    1) 10 MHz: 0.8 dB/100 ft.
    2) 50 MHz: 2.5 dB/100 ft.
    3) 100 MHz: 3.5 dB/100 ft.
    4) 200 MHz: 4.6 dB/100 ft.
    5) 300 MHz: 5.0 dB/100 ft.
    6) 400 MHz: 7.2 dB/100 ft.
    7) 1000 MHz: 14.6 dB/100 ft.
g. Manufacturers:
    1) Altinex CB5100PL in plenum spaces, riser rated elsewhere.
    2) Extron
    3) Belden
    4) Gepco.
    5) Or equal.

G. Multimedia Cable:

1. Drawing Reference: Multimedia Cable

2. Description: 100% sweep tested (0.01 to 1000 MHz) double braided shield solid center conductor 75 ohms coaxial precision video cable and shielded, single twisted pair, with #26 AWG color coded stranded conductors and foil shield with drain wire.

3. Construction:
    a. Seven (7) miniature high resolution video coax cables (for RGBHV and S-Video use) and (6) twisted pairs (for audio) in an overall jacket
    b. Color coded.
    c. Diameter: 0.57" maximum.
    d. Jacket: Flamarest or Code approved equal for application.
    e. CL Listed.
    f. Center Conductor AWG: Twenty (26) ga bare copper.
    g. Shield: Aluminum/Polyester Tape.

4. Performance - Each miniature high resolution video coax cable:
    a. Capacitance: 16 pF/ft. Max
    b. Nominal Impedance: 75 ohms.
    c. Velocity of Propagation: 82%.
    d. Attenuation Per 100':
        1) 10 MHz: 1.6 dB
        2) 100 MHz: 6.1 dB
        3) 1000 MHz: 30.4 dB.

5. Acceptable, subject to above:
    a. Altinex CB4600MR.
    b. No Known Equal.

H. DVI Cabling

1. Drawing Reference: DVI/HDMI

2. Features/Functions
   a. The plans indicate the required distances for HDMI format transmission. Contractor to provide a transmission system appropriate to the indicated lengths. Contractor engineered solutions may consist of:
      1) Passive HDMI cabling, where the indicated length is within the service distance of such systems.
      2) Copper HDMI cabling and active HMDI repeaters
      3) Fiber Optic Cabling and HDMI transceivers.
   b. Contractor to select and provide the method of transmission appropriate to the length and operating parameters of the selected transmission system as defined by the manufacturers of the cabling systems, the repeaters and/or transceivers and the HDMI transmission standard as defined at www.hdmi.com.

3. Manufacturers, copper cabling and extenders:
   a. Extron
   b. Broadata
   c. Altinex
   d. Liberty Cable
   e. Or equal.

2.12 CONTROL CABLING

A. Category Media Cabling

1. Drawing Reference(s): AV Net

2. Features/Functions:
   a. 1 cable equivalent to a 2 pair, 18 gauge cable suitable for RS-485 (A/V Net) signaling and remote device powering.

3. Manufacturers:
   a. Crestron Crestnet-P
   b. Liberty Wire & Cabling
   c. AMX
   d. Extron
   e. Or equal.

B. High Speed, TIA/TIA Category Cabling

1. Drawing Reference:** UTP6-4, where ** denotes cable count

2. Construction:
   a. Provide horizontal copper cable in accordance with:
      1) EIA ANSI/TIA/EIA-568-B.2,
      2) UL 444,
      3) NEMA WC 66 (Performance Standard for Category 6 and Category 7 100 Ohm Shielded and Unshielded Twisted Pair)
      4) ICEA S-90-661
   b. UTP (unshielded twisted pair),
   c. 100 ohm impedance
   d. Four each individually twisted pair, 22 or 24 AWG conductors,
      1) Color code
      2) Pair 1 White/Blue Blue
      3) Pair 2 White/Orange Orange
      4) Pair 3 White/Green Green

5) Pair 4 White/Brown Brown
e. No shield in the sheath.
f. Jacket
1) Thermoplastic jacket
2) Color: Blue unless otherwise indicated.
3) Cable imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular intervals not to exceed 2 feet.
4) The word "FEET" or the abbreviation "FT" shall appear after each length marking.
5) Provide communications general purpose (CM or CMG), communications plenum (CMP) or communications riser (CMR) rated cabling in accordance with NFPA 70.
6) Type CMP and CMR may be substituted for type CM or CMG and type CMP may be substituted for type CMR in accordance with NFPA 70.

3. Certification
a. Warrantied by the manufacturer to provide Category 6 performance when installed in accordance with applicable EIA/TIA standards and when terminated with the jacks supplied by the Contractor for this Project.

4. Performance
a. Assembly electrically meets or exceeds EIA ANSI/TIA/EIA-568-B.2 Category 6 performance standards

5. Manufacturers:
a. Berk-Tek LANmark-1000
b. Amp
c. Belden/CDT
d. Berk-Tek
e. Commscope/Systimax
f. Commscope/Uniprise
g. General Cable
h. Hitachi
i. Mohawk/CDT
j. NORDX/CDT
k. Superior/Essex
l. Or equal

C. High Speed, Category 6 Cabling, Plenum Rated

1. Drawing Reference:** UTP6-4P, where ** denotes cable count

2. Construction:
a. As for non-plenum, with fire retardant overall jacket construction.
b. UL listed, NEC compliant for plenum installation.
c. CSA Certified type PCC FT4 FT6.

3. Manufacturers
a. As for non-plenum Cat. 6, plenum construction.
b.

2.13 MISCELLANEOUS PRODUCTS

A. Cable Termination Devices and Related:

1. Screw-type or Tubular Clamp Barrier Blocks:
   a. Buchanan 125, 0625 Series.
   b. Electrovert equivalent.
   c. TRW-Cinch 140, 141, 142 Series.
   d. Weidmuller equivalent.
   e. Pass & Seymour/Legrand equivalent.
   f. Phoenix equivalent.

2. Tubular Clamp Barrier Blocks, High Density, Switch Block Section
   a. Drawing Reference: TB15.
   b. Features/Functions
      1) Paired screw terminals on opposite sides of insulating base.
      2) TB15 Base mounts to DIN rail, providing space beneath TB15 to dress field and source cabling.
      3) Terminates range of wire gages used by project – at least 30 gage to 10 gage.
      4) High density:
         a) At least 33 pairs of connections per foot for 12 and smaller gage terminations,
         b) At least 16 pairs of connections per foot for 10 gage terminations.
      5) Switch Block Section permits load, such as field devices, to be separated from monitoring panel for testing independent of source then restored without disturbing field wiring terminations.
      6) Rated at least fifteen (15) amperes at 300V AC/DC

   c. Approvals
      1) UL
   d. Manufacturers:
      1) Allen Bradley Isolation Switch Blocks,
         a) 1492-H7 for 30 to 12 gage
         b) 1492-CE9 for 10 gage.
      2) Tyco Buchanan 0135 Series.
      3) WECO Electrical Connectors
      4) Altech
      5) Curtis Industries
      6) Electrovert
      7) Weidmuller
      8) Pass & Seymour/Legrand
      9) Phoenix
      10) Or equal.

3. Low Level Audio Cable Termination, Insulation Displacement Products
   a. Coordinate with wire size, type and insulation
   b. Manufacturer
      1) ADC "Dense Patch".
      2) Siemon Model S66M450 with D10 Designation Strip.
      3) Or equal.

B. Audio and Control Connectors and Related:

1. Circular Audio Connector, Cord, 3 through 5 contacts, gold plated contacts, captive cable clamp strain relief, matte black chrome finish over nickel metal shell
   a. Neutrik C-Series, X-Series.
   b. Switchcraft.
   c. Or equal.

2. Circular Audio Connector, Panel mount, male and female devices to fit same panel cutout including fasteners, 3 through 5 contacts, gold plated contacts, matte black chrome finish over nickel metal shell, female receptacles locking type:
   a. Neutrik D Series Version L.
   b. Switchcraft
   c. Or equal.

3. Loudspeaker Connector, Panel mount, female devices to fit same panel cutout including fasteners as other panel mount receptacles, 4 contacts, matte black finish Polyamid/graphite shell, female receptacles locking type. UL Component Recognized:
   a. Neutrik NL4MP.
   b. Switchcraft
   c. Or equal.

C. Video Connectors and Related

1. Video Connector, BNC type, 75 ohms, Panel, recessed, flush with panel face, insulated from panel, double female
   a. Manufacturer
      1) Canare BCJ-JRU.
      2) Tec Nec
      3) Liberty Wire & Cable/Panelcraft
      4) Or equal.

2. Video Connector, BNC type, 75 ohms, Panel, recessed, flush with panel face, insulated from panel, single female to solder pin
   a. Manufacturer
      1) Canare BCJ-RU.
      2) Tec Nec
      3) Liberty Wire & Cable/Panelcraft
      4) Or equal.

3. Video connector, BNC type, 75 ohms, cord, crimp applied. Coordinate with cable.
   a. Manufacturer
      1) Amp.
      2) McDonaldAmphenol.
      3) Augat/LRC Products
      4) Canare.
      5) Kings.
      6) Liberty Wire & Cable/Panelcraft
      7) RFI/Celltronics.
      8) Trompeter.
      9) Or equal.

4. Video Precision 75 ohms Terminator, BNC:
   a. Manufacturer
      1) Canare BCP-TA

2) Trompeter TNAI-1-75.
3) Or equal.

5. XGA Connectors, DB15
   a. Drawing Reference HD15
   b. Manufacturer
      1) Amp.
      2) Amphenol.
      3) Canare.
      4) Kings.
      5) Liberty Wire & Cable/Panelcraft
      6) RFI/Celltronics.
      7) Or equal.

D. Custom Facility Panels and Rackmount Auxiliary Panels

1. Provide connector types and plate finish as shown. If none shown, provide:
   a. Rack mount panels: Steel Panel, black finish.
   b. Wall Panels: Steel, finish to match surrounding electrical and other low voltage panels.

2. Manufacturer
   a. PanelCrafters Division of Liberty Wire & Cable, Classic Series
   b. Whirlwind
   c. RCI Systems
   d. Or equal.

E. Power Supplies and Related:

1. Drawing Reference: PS24.

2. Relay and Lamp Power Supply:

3. 24 VDC, regulated within 5%. Ripple not greater than 1.5%. Output current rating at least 150% of maximum possible load. Circuit breaker or intrinsic over current protection. UL Recognized or UL Listed.

F. Power Panel:

1. Drawing Reference: POWER.

2. Functions/Features:
   a. Front face of panel shall provide two electrical power outlets and a switch. An indicator lamp shall show the presence of AC power when on. The front face of panel shall have a black finish. The rear face shall provide a minimum of at least four receptacles. The panel shall be racked mounted in a maximum of two rack units. The panel shall be Code approved and UL rated for this application.

3. Manufacturers:
   a. Hubbell
   b. Geist
   c. Or equal

PART 3 EXECUTION

3.01 GENERAL

A. Perform the Work of this Section in accordance with acknowledged industry and professional standards and practices, and the procedures specified herein.

B. Furnish and install (herein, "provide") all materials, devices, components, and equipment required for complete, operational systems.

3.02 WIRING CLASSIFICATION AND RELATED

A. Audio Signal Wiring Classification:

1. Type A-l: Microphone level wiring less than -30 dBμ, 20 Hz to 20 kHz.

2. Type A-2: Line level wiring -30 dBμ to +24 dBμ, 20 Hz to 20 kHz.

3. Type A-3: Loudspeaker level or circuit wiring greater than +24 dBμ, from 20 Hz to 20 kHz.

B. Video and Related Signal Wiring Classification:

1. Type V-1: Baseband and composite video wiring 1 volt peak-to-peak into 75 ohms, 0 to 10.0 MHz.

2. Type V-2: Synchronization and switching pulse wiring 4 volts peak-to-peak into 75 ohms, 15.62 to 15.75 kHz.

3. Type V-3: Color subcarrier wiring 0 to 4 volts peak-to-peak into 75 ohms, 3.57 to 4.43 MHz.

4. Type V-4: MATV system wiring 0.1 to 1000 uV peak-to-peak into 50 or 75 ohms, 47 to 890 MHz.

C. Control Signal Wiring Classifications:

1. Type C-1: DC control wiring 0 to 50 volts.

2. Type C-2: Synchronous control or data wiring 0 to 40 volts, peak-to-peak.

3. Type C-3: AC control wiring 0 to 48 volts, 60 Hz.

D. Additional Wiring Classifications:

1. Type M-1: DC power wiring 0 to 48 volts.

2. Type M-2: AC power wiring greater than 50 volts, 60 Hz.

E. Wiring Combinations:

1. Except as indicated herein, conduit, wireways and cable bundles shall contain only wiring of a single classification. The following combinations are acceptable in conduit, or cable

harnesses. Additional acceptable combinations may be indicated on the Contract Drawings.

a. Types A-1, C-1, and M-1.
b. Types A-2, C-l, C-2, and M-l, runs less than twenty (20) feet.
c. Types A-2, C-1, and M-1.
d. Types A-3, C-1, C-2, and M-1.
e. Types A-2, V-1, and V-3.
f. Types V-1, V-2, V-3, and C-1.
g. Types M-2 and C-3.

3.03 WIRE AND CABLE INSTALLATION

A. Provide permanent identification of run destination at all raceway terminations.

B. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.

C. All shielded cables shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels or equipment enclosures.

D. Within buildings, make splices only in designated terminal cabinets and/or on designated equipment backboards. Outside buildings, make splices only in designated manholes and/or handholes. Protect splices outside of buildings with splicing kits equivalent to Scotchcast Re-enterable. Make splices only with connectors or terminal devices specified herein. Document all splices on Record Drawings.

E. Verify that all raceway has been de-burred and properly joined, coupled, and terminated prior to installation of cables. Verify that all raceway is clear of foreign matter and substances prior to installation of wire or cable.

F. Inspect all conduit bends to verify proper radius. Comply with Code for minimum permissible radius and maximum permissible deformation.

G. Apply a chemically inert lubricant to all wire and cable prior to pulling in conduit. Do not subject wire and cable to tension greater than that recommended by the manufacturer. Use multi-spool rollers where cable is pulled in place around bends. Do not pull reverse bends.

H. Provide a box loop for all wire and cable routed through junction boxes or distribution panels. Provide tool formed thermal expansion loops at cable at manholes, handholes and at both sides of all fixed mounted equipment. Cable loops and bends shall not be bent at a radius greater than that recommended by the manufacturer.

I. Secure all wire and cable run vertically for continuous distances greater than thirty (30) feet. Secure robust non-coaxial cables with screw-flange nylon cable ties or similar devices appropriate to weight of cable. For all other cables, provide symmetrical conforming nonmetallic bushings or woven cable grips appropriate to weight of cable.

3.04 SIGNAL POLARITY CONVENTION

A. Maintain consistent absolute signal polarity at all connectors, patch points and connection points accessible in the system. Comply with AES26-2001.Where applicable, a positive polarity electrical signal shall yield positive acoustic pressure from the loudspeakers.

B. Audio signal connector convention: Comply with AES 14-1992 (r1998)

Signal	Connector	Wire
Signal Phase	Pin 2	Red or White
Signal Anti-Phase	Pin 3	Black
Signal Ground	Pin 1	Drain Wire

C. Video and RF/MATV Connector Convention:

Signal	Connector	Wire
Signal Phase	Center Pin	Center conductor
Signal Anti-Phase	Shell	Shield
Signal Ground	Shell	Shield

3.05 WIRING PRACTICE

A. Land all non-coaxial field wiring entering each equipment rack at specified terminal devices prior to connection to any equipment or devices within racks. At Contractor's option, such terminals may be located in the equipment racks or in the terminal cabinets provided. Coordinate such selection with Project construction sequence and test procedures specified herein.

B. Identify all wire and cable clearly with permanent labels wrapped about the full circumference within one (1) inch of each connection. Indicate the number designated on the associated field or shop drawing or run sheet, as applies. Assign wire or cable designations consistently throughout a given system. Each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Conform to the requirements of Section 27 05 00.

C. Apply all crimp connectors only with manufacturer's recommended ratchet type tooling and correct crimp dies for connector and wire size. Plier type crimp tooling shall not be acceptable.

D. Coordinate insulation displacement (quick connect) terminal devices with wire size and type. Comply with manufacturer's recommendations. Make connections with automatic impact type tooling set to recommended force.

E. Make all connections to screw-type barrier blocks with insulated crimp-type spade lugs. Lugs are not required at captive compression terminal type blocks. Provide permanent designation strips designed for use with the terminal blocks provided. Make neat, intelligible markings with indelible markers equivalent to "Sharpie".

F. Tin terminated shield drain wires and insulate with heat shrinkable tubing.

G. Use only rosin core 60/40 tin/lead solder for all solder connections.

H. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections. No wire or cable shall be supported by a connection point. Provide service

loops where harnesses of different classes cross, or where hinged panels are to be interconnected.

I. Termination and buildout resistors and related circuit correction components shall be visible. Do not install in connector shells or internally modify equipment. Show locations on Record Drawings.

J. Correct any and all of the following unacceptable wiring conditions:

1. Deformed, brittle or cracked insulation.

2. Insulation shrunken or stripped further than 1/8" away from the actual point of connection within a connector, or on a punch block.

3. Cold solder joints.

4. Flux joints.

5. Solder splatter.

6. Ungrommeted, unbushed, or uninsulated wire or cable entries.

7. Deformation or improper radius of wire or cable.

8.

3.06 SIGNAL GROUNDING PROCEDURES

A. Comply with National Electrical Code.

B. Unless otherwise noted maintain a unipoint ground scheme.

C. Signal and electrical system grounds shall be isolated except at the Project ground field connection.

D. Equipment enclosures shall not be permitted to touch each other unless bolted together and electrically bonded.

E. Ground and bond equipment racks and similar equipment enclosures containing powered equipment exclusively via the Isolated Ground conductors provided under Division 26. INSULATE RACK MOUNTING, ANCHORAGE, AND RACEWAY CONNECTIONS.

F. At each rack, provide an Isolated Ground bus within the rack. At each rack, provide a lug bonded to the rack frame with a #12 TW stranded wire to the rack Isolated Ground bus.

G. At each ensemble of racks, provide a single labeled Isolated Ground tubular-clamp bus bar terminal strip to land the individual rack Isolated Ground bus ground conductors. Connect the main Isolated Ground conductor from the Technical Power panelboard at this point.

H. Equipment signal ground shall be to the Isolated Ground System via the green wire of the equipment power cord. Where equipment uses two (2) wire power cord, provide #12 green bond wire to rack IG bus bar. At equipment, provide crimp lug and suitable hardware for bonding.

I. Shielded cables of this section shall be grounded exclusively to Isolated Ground by a single path. Shield shall be tied to Isolated Ground at one end only, i.e., at the low potential (receiving) end of run, unless otherwise noted.

J. Unless otherwise noted, at audio jackfields, tie source shield at jackbay frame. Float shields at connections to output jacks. Bus each row of jack frames and run individual #12 green ground wire for each row to rack IG bus bar.

K. Signal Ground provisions shall realize less than 0.15 ohms to the primary ground connection.

3.07 FINISHES

A. Finishes and materials for contractor fabricated assemblies such as racks, custom control panels, brackets, and blank panels, equipment mounting in furniture or casework, speaker baffles, speaker grille material and in general any item or component herein which is visible shall adhere to the following:

1. Finish shall be as directed by the City.

2. In the event that the City provides no direction as to finish, finish shall match exactly the surrounding and adjacent surfaces.

3. Wooden speaker back boxes and baffles shall be painted flat black if not otherwise finished or stained.

3.08 EQUIPMENT ENCLOSURE (RACK) AND EQUIPMENT BACKBOARD FABRICATION

A. Combustible material, other than incidental trim of indicated equipment, is prohibited within equipment racks.

B. Within each equipment enclosure, provide a full-height multi-circuit ISOLATED GROUND outlet strip with branch circuit count as shown on drawings; locate on the left side of the equipment enclosure, as viewed from the rear. In each enclosure provide number of receptacles required by present and future equipment indicated on drawings, plus at least two spare receptacles. Provide flexible steel raceway and junction box for connection of power service. Bond internal raceway to rack frame.

C. Provide a permanent label on the front of each equipment rack including the rack designation, and the circuit breaker number and associated electrical distribution panel designation servicing same.

D. Maintain separation of wiring classifications as specified herein. Separately dress, route and land microphone and line level cables and related on the right side of the equipment enclosure, as viewed from the rear; dress, route, and land loudspeaker level and control cables on the left side of the equipment enclosure, as viewed from the rear.

E. Access shall not require demounting or de-energizing of equipment. Install access covers, hinged panels, or pull-out drawers to insure complete access to terminals and interior components.

F. Fasten removable covers containing any wired component with a continuous hinge along one side, with associated wiring secured and dressed to provide an adequate service loop. Provide an appropriate stop locks to hold all hinged panels and drawers in a serviceable position.

G. Provide permanent labels for all equipment and devices. Where possible, fasten such labels to the rack frame or to blank or vent panels which will remain in place when active equipment is removed for possible service.

H. At jackfields, provide service loop to permit removal of jackfields from rack sufficient to conveniently access all jack contacts for routine cleaning and maintenance. Organize the service loop and harness such that reasonable reconnection of jacks and jack normals is possible without cutting apart the harness.

I. Coordinate the design and execution of wire harnessing of multi-bay rack ensembles with conditions of delivery to installation locations at Project Site, and with the requirement herein for test of the completely wired system in the shop prior to delivery to the Project Site. Organize the wiring harnesses such that they will fold within one shippable unit without risk of damage, or provide polarized multipin connectors and related interconnect systems as specified elsewhere herein.

J. At each equipment backboard, provide UL Listed surge suppressing multioutlet assembly with at least six (6) receptacles.

3.09 EQUIPMENT RACK AND EQUIPMENT BACKBOARD TESTING AND ADJUSTING PROCEDURES

A. Conduct procedures in fabrication shop. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable. Submit test report. Request and coordinate verification of submitted test data by the representative of the Architect. Correct all non-conforming conditions prior to shipment to Project Site. Perform at least the following procedures:

B. Preliminary: Verify:

1. Grounding of devices and equipment. Integrity of signal and electrical system ground connections.

2. Proper provision of power to devices and equipment.

3. Integrity of all insulation, shield terminations and connections.

4. Integrity of soldered connections. Absence of solder splatter, solder bridges.

5. Absence of debris of any kind, tools, etc.

6. Routing and dressing of wire and cable.

7. All wiring, including polarity and continuity, including conformance with wire designations on running sheets, field and shop drawings.

8. Mechanical integrity of all support provisions.

C. Rig temporary power and grounding. Comply with all applicable Codes, regulations and ordinances.

D. Determine the proper sequence of energizing systems to minimize the risk of damage. Energize. Burn in for at least 168 hours.

E. Sound Systems:

1. Gain control settings: Establish tentative normal settings for all gain controls. Set all equalizers flat. Set all automatic gain control devices to bypass. Terminate power amplifier outputs with power load resistors with resistance value within 10% the nominal output impedance of the respective amplifier. Adjust all gain controls on equipment for optimum signal-to-noise ratio and signal balance and, unless they are sub-panel mounted, cap them to prevent tampering. Unless specified or directed otherwise, adjust gains such that in a given system the "front end" operates at unity gain and maintains 10 dB of clip margin referenced to the first onset of clipping of the associated power amplifier(s). Measure and document system gains at 1 kHz. Settings may require further adjustment by the Contractor, a result of testing by the representative of the City.

2. Freedom from parasitic oscillation and radio frequency pickup: Maintain previous setup. Set up for each mode of operation specified in the functional requirements; verify that all systems are free from spurious oscillation and radio-frequency pickup using broadband oscilloscope. Correct any such defects.

3. Hum and noise level/signal to noise level/signal to crosstalk level: Maintain previous setup. Terminate microphone and line-level inputs with shielded resistors of 150 and 600 ohms, respectively. Set available variable gain controls such that full power amplifier output would be achieved with -40 dBm input level at a microphone input and +12 dBm at a line-level input. Measure and document the specified parameters of the system overall for each microphone input channel and line-level input channel. Compare with nominal signal level.

4. Total Harmonic Distortion: Maintain previous setup. Measure at reference operating level at least at 63 Hz, 125 Hz, 1 kHz, 10 kHz.

3.10 LABELING

A. Conform to the requirements of Section 27 0553 – Identification for Communications Systems.

B. Provide permanent "wedge" type labels on all controls, as applies, to indicate correct settings after systems performance testing and adjustment procedures have been successfully completed.

END OF SECTION

SECTION 27 4123

COMMUNICATIONS BROADBAND SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes Broadband System (Cable Television) distribution including but not limited to:
   1. Headend active amplification, equalization and pads
   2. Provision to block on-site generated channels from leaving the building through the Community Antenna Television (CATV) service feed.
   3. Broadband distribution including
      a. Broadband passives
      b. Broadband cable and patch cords
      c. Related testing.
   4. Areas to receive broadband television signal are as indicated and scheduled on the plans.

B. Related Work in Other Sections
   1. Division 26 - Power at Comm Room Backboard for Broadband Amplifiers
   2. Section 27 05 00 – Common Work Results for Communications: Applies to Work of this Section.
   3. Section 27 05 26 – Grounding and Bonding for Communications Systems
      a. Provides grounding of Broadband passives provided under Work of this Section.
   4. Section 27 05 29 – Hangers and Supports for Communications Systems
   5. Section 27 05 33 – Conduits and Backboxes for Communications Systems
   6. Section 27 05 53 – Identification for Communications Systems defines labeling requirements for the work of this Section.
   7. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
   8. Section 27 11 19 – Communications Termination Blocks and Patch Panels
   9. Section 27 11 23 – Communications Cable Management

C. Related Work by Others
   1. District
      a. Orders CATV service from franchised service provider. Obtains franchised CATV service provider’s set-top boxes in types and quantities as necessary to decode encrypted digital program streams required for the District’s building operations.

1.2 REFERENCES

A. Usage: In accordance with Section 01 42 00 – References.
   1. Code of Federal Regulations (CFR)
      a. Part 68, Federal Communications Commission. Part 76, Cable Television Rules and Regulations

1.3 DEFINITIONS

A. Composite Triple Beat Ratio: The ratio of visual carrier level to composite third order distortion products.

B. Cross Modulation Ratio: The ratio of visual carrier level to coherent spurious signal level (i.e. intermodulation products).

C. Carrier to Noise Ratio: The ratio of visual carrier to noise levels derived from broadband measurements under design load at maximum output over the entire range of the specified frequency response.

D. DBS: Direct Broadcast Satellite

E. Signal Levels
1. Information Note: 0.775 Volt equals 0 dBu equals 0 dbm for a circuit terminated in 600 ohms direct current resistance.
2. Microphone Circuits: Minus 30 dBu or less.
3. Audio Line Level Circuits: Minus 30 dBu to plus 24 dBu; equivalent to minus 30 dBm to plus 24 dBm for a 600 ohms terminated circuit.
4. Loudspeaker Level Circuits: More than plus 24 dBu.
5. Video Line Level Circuits: 1.0 Volt, peak to peak composite signal.
6. Radio Frequency (RF), Television Circuits: Plus 6 to plus 72 dBmV (0 dBmV equals 1,000 microvolts).

F. Characteristic Impedances
1. Microphone Circuits: 50 to 250 ohms source, 150 to 1500 ohms terminating, electrostatically and electromagnetically balanced to ground.
2. Audio Line Level Circuits: 600 ohms maximum source, 600 ohms minimum terminating, line to line, electrostatically and electromagnetically balanced to ground.
3. Video Line Level Circuits: 75 ohms maximum source, 75 ohms minimum terminating to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.
4. Radio Frequency (RF) Television Circuits: 75 ohms nominal to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.

1.4 SYSTEM DESCRIPTION

A. Summary Description
1. System receives feed from CATV service provider in broadband RF format.
2. System redistributes CATV signal amplified and equalized to indicated drop locations.

B. Performance Requirements, Broadband Cabling
1. The specified cable performance, pro-rated for the total link distance and connector loss.

C. Performance Requirements, Broadband System
1. Radiation shall comply with Title 47, Code of Federal Regulations, Part 76, Cable Television Rules and Regulations.
2. Provide interference-free distribution of any of the scheduled reception channels and allow for future distribution of internally generated forward and reverse channels.
3. The Television Allocation Study Organization (TASO) Grade of the signal of any channel when viewed on a standard commercial television receiver at any Broadband System receptacle tapoff outlet shall not be less than the TASO Grade of the same channel viewed on the same receiver when connected directly to the Broadband Optical Fiber Receiver through a passive attenuator.
4. Provide for Cable Television (CATV) compatible adjacent channel operation with bandwidth to at least 1 GHz.
5. Bandwidth of broadband distribution amplifiers shall be from 54 MHz to 1 GHz in the forward direction, unless otherwise indicated on the Communications Series Drawings.

6. Passive elements shall permit upstream (reverse channel) transmission of 5 MHz to 42 MHz sub-low band Very High Frequency (VHF) television channels from any Faceplate to the building entrance facility.
7. Provide amplification at communications rooms, such that upon adjustment of the distribution facility, each MATV outlet will realize output levels of:
   a. Plus 6 to plus 12 dBmV from 54 to 450 MHz nominal, not greater than plus 15 dBmV at any Faceplate.
   b. Not less than plus 3 dBmV above 450 MHz.
   c. The signal level from any channel to any adjacent channel shall not vary more than 2 dB at the Faceplate.
   d. Long Term Variations in Amplitude: Not to exceed 3 dB.
   e. Amplitude Response within any TV Channel: Not to exceed plus 1.0 dB.
   f. Amplitude Response for Entire Spectrum Sector: Not to exceed plus and minus 3 dB.
   g. Visual Carrier to Noise Ratio: Not less than 50 dB.
   h. Composite Triple Beat Ratio: Not less than 55 dB.
   i. Cross Modulation Ratio: Not less than 57 dB.
   j. Visual Carrier to Hum Modulation Ratio: Not less than 63 dB.
   k. Visual Carrier to Reflections Ratio: Not less than 46 dB.
8. In the event that a specific device not meeting the above performance parameters is shown in the Contract Documents as included in the signal chain, the manufacturer's performance specifications of that device shall prevail, with the exception of Radiation, which will not be waived.

D. Channel Allocation Summary, Broadband System
   1. Per the District's basic service lineup at the time of system commissioning.
   2. Assume the following CATV frequency channels will be used and provided for through the headend electronics and distribution systems provided by the work of this contract.
   3. CATV Channels 2-79 forward direction.

1.5 SUBMITTALS

A. Conform with Section 27 05 00 - Common Work Results for Communications

1.6 QUALITY ASSURANCE

A. Test Equipment
   1. Provide in conformance with the applicable requirements of Section 27 05 00 Common Work Results for Communications.
      a. Broadband Signal Level Meter, 5-750 MHz. Acterna CLI-1750, Sadelco, Blonder Tongue, or equal.
      b. Broadband Signal Generator, 5-750 MHz - Acterna LST-1700, Avcom, Agilent or equal.
      c. Spectrum Analyzer, 5-750 MHz. Tektronix 2715, Avcom, or equal.
      d. True RMS Audio-Frequency Digital Volt-Ohm-Millimeter.
      e. Domestic television receiver with Cable Television frequency plan.
      f. Other items of equipment or materials required to demonstrate conformance with the Contract Documents.

PART 2 - PRODUCTS

2.1 BROADBAND DISTRIBUTION

A. Broadband Indoor Distribution Amplifier, 750 MHz, 30 dB Gain, Uni-Directional
1. Plan Reference: BBIDAU750-30
2. Listing: UL.
3. Manufacturers:
a. Blonder-Tongue BIDA750-30
b. Pico Macom PIDA-750
c. Scientific-Atlanta.
d. Broadband Engineering.
e. Triple Crown.
f. or equal .

B. Broadband Indoor Distribution Amplifier, 1000 MHz, 30 dB Gain, Bi-Directional
a. Plan Reference: BBIDA 1000
b. Listing: UL
c. Performance:
1) Forward Path:
a) Bandwidth: At least 49-1000 MHz.
b) Flat Gain: Not less than 32 dB with at least 10 dB of adjustment.
c) Cross modulation, composite triple beat and hum modulation each at least 3 dB better than minimum system specifications herein.
2) Reverse Path: Bandwidth: 5-36 MHz.
a) Flat Gain: Not less than 20 dB with at least 15 dB of adjustment.
b) Cross modulation, composite triple beat and hum modulation each at least 3 dB better than minimum system specifications herein.
3) Bi-Directional.
d. Manufacturers:
1) Blonder-Tongue BIDA 100A-30
2) Pico Macom
3) Scientific-Atlanta.
4) Broadband Engineering.
5) Triple Crown
6) or equal.

C. Broadband Indoor Distribution Amplifier, 750 MHz, 30 dB Gain, Bi-Directional
1. Plan Reference: BBIDAB750-30
2. Listing: UL
3. Performance:
a. Forward Path:
1) Bandwidth: At least 49-750 MHz.
2) Flat Gain: Not less than 32 dB with at least 10 dB of adjustment.
3) Cross modulation, composite triple beat and hum modulation each at least 3 dB better than minimum system specifications herein.
b. Reverse Path: Bandwidth: 5-36 MHz.
1) Flat Gain: Not less than 20 dB with at least 15 dB of adjustment.
2) Cross modulation, composite triple beat and hum modulation each at least 3 dB better than minimum system specifications herein.
c. Bi-Directional.
4. Manufacturers:
a. Blonder-Tongue BIDA 75A-30
b. Pico Macom PIDA-750
c. Scientific-Atlanta.
d. Broadband Engineering.

e. Triple Crown.
f. or equal.

D. Broadband Indoor Distribution Amplifier, 750 MHz, 10 dB Gain
1. Plan Reference: BBIDA750-10
2. Listing: UL
3. Performance:
a. Forward Path:
b. Bandwidth: 49-750 MHz.
c. Flat Gain: Not less than 10 dB.
d. Cross modulation, composite triple beat and hum modulation each at least 3 dB better than minimum system specifications herein.
e. Unidirectional.
4. Manufacturers:
a. Pico Macom CDA10
b. Blonder-Tongue
c. Scientific-Atlanta.
d. Broadband Engineering.
e. Triple Crown.
f. or equal.

2.2 BROADBAND PASSIVES

A. General
1. Provide 50 to 1000 MHz bandwidth in the forward path, 5 to 45 MHz reverse path.
2. Provide Electromagnetic interference shielding effectiveness greater than minus 120 dB.

B. Directional Couplers and Taps
1. Manufacturers
a. Blonder-Tongue SRT Series.
b. Pico Macom.
c. Regal.
d. or equal.

C. Grounding Block
1. Drawing Symbol: GB, LP.
2. Comply with NEC 820-7.
3. Bandwidth to at least 1000 MHz.
4. Manufacturer
a. Pico Macom GRB Series.
b. Gilbert.
c. Regal.
d. or equal.

D. RF Attenuator
1. Drawing Symbol: PAD
2. Manufacturer:
a. Pico Macom FAM Series.
b. Blonder-Tongue FAF Series.
c. Regal RILA Series.
d. RMS FAP Series.
e. or equal.

E. Splitter/Combiners, 2 to 8 way
1. Drawing Symbol

a. Two Way: SP-2.
b. Three Way: SP-3.
c. Four Way: BBOC4, SP-4.
d. Eight Way: BBOS8, SP-8.
e. Manufacturer, SP-2, SP-4, SP-8
1) Blonder-Tongue DGS Splitters.
2) Blonder-Tongue SRT Series.
3) Pico Macom TSB-1G Series.
4) Regal.
5) or equal.

F. Terminator, 75 ohm, "F" type
1. Manufacturers
a. Blonder-Tongue 4670.
b. Pico Macom F-59T.
c. or equal.

G. In-Line Cable Slope Equalizer
1. Drawing Symbol: TILT
2. Features
a. Passive network element.
b. Pass band 5 to 1,000 MHz.
c. 75 ohm characteristic impedance.
d. Provide insertion loss versus frequency at approximately the inverse of that for coaxial cable.
e. Return loss approximately 20 dB.
f. Available in values of at least 3, 6, 6 and 12 dB of equalization.
g. Provide the equalization value as indicated in Communications Series Drawings.
3. Manufacturers
a. Toner Cable Equipment, Inc. XEQ-900-[equalization value].
b. dB-tronics
c. Soontai Tech Co., Ltd.
d. or equal.

2.3 BROADBAND MISCELLANEOUS PRODUCTS

A. Connectors; Radio Frequency Broadband
1. Features
a. "F" Type, size to match cable
b. 360 degree radial compression.
c. Pull-out strength not less than 40 pounds.
2. Manufacturers
a. Thomas & Betts/LRC Snap-N-Seal F Connectors.
b. Steren/Pico Macom PermaSeal-II F Series Compression Connectors.
c. Liberty Cable
d. or equal.

2.4 CABLE

A. Broadband Cable
1. Drawing Symbols:
a. RG-59M
b. RG-6M, RG6ML
c. RG-11M

2. Marking and fire resistance:
3. Comply with CEC 820-4 and 820-15.
4. Manufacturer part numbers specified in this paragraph are for listed Type CATV. Provide the listed Type cable as indicated or as required by the condition of placement at no additional cost to the District.
5. Approvals
   a. CEC and NEC for application.
   b. SCTE
6. Performance:
   a. RG6ML cabling to be 100% sweep tested by the manufacturer up to 2,200 MHz and shall be listed by the manufacturer as suitable for L-Band Satellite signal distribution. Minimum performance as follows:

Frequency (MHz)	Maximum Nominal Attenuation (dB)
1	0.26
10	0.81
50	1.46
100	2.05
200	2.83
500	4.53
1000	6.59
1450	8.1
1800	8.8
2200	10.1

   b. All other cabling to be 100% sweep tested by the manufacturer up to at least 1000 MHz and shall be listed by the manufacturer as suitable for MATV distribution up to 1 GHz, and meet or exceed maximum loss described for RG6ML type up to 1 GHz.
7. Size: Unless otherwise noted or scheduled, size for loss condition and best reasonable economy.

Use	Cable Size
Trunk Feeder	RG-11 size.
Riser Feeder	RG-11 size.
Drop Feeder	RG-6 size.

8. Shield and jacket by placement:

Placement	Shield	Jacket
Antenna and Headend	Quad	PVC
Metallic Raceway	Double	PVC or PE
Not in Raceway (where permitted)	Triple or Hardline	NEC 820-15

9. Manufacturer, triple shield RG6M
   a. Belden 1189A or 1189U
   b. CommScope F6TSVV, F677TSVV
   c. West Penn/CDT T841
   d. Carol/General Cable
   e. Steren
   f. or equal.
10. Manufacturer flooded jacket, quad shield RG6M
    a. Belden 1190A
    b. CommScope F6SSEF
    c. Carol/General Cable

d. Steren
e. or equal.

11. Manufacturer L Band RG6ML
    a. Belden
    b. CommScope
    c. Carol/General Cable
    d. Steren
    e. or equal.
12. Manufacturer flooded jacket, quad shield RG11M
    a. Belden 1618A
    b. CommScope F11SSEF
    c. Carol/General Cable
    d. Steren
    e. or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Distribution
   1. Install passives and indicated active broadband distribution components on Communications Rooms backboards. Neatly dress and organize work to maximize serviceability and minimize potential for interference with other tradespersons occupying the Communications Room.
   2. Maintain indicated hold clears for work of Others.
   3. Utilize backboard wiring managers as specified in Section 27 11 23.
   4. Label cabling, ports and connectors per Section 27 05 53.
   5. Place termination resistors at all unused system terminal points.

3.2 SIGNAL POLARITY CONVENTION

A. Maintain consistent absolute signal polarity at all connectors, patch points and connection points accessible in the system.

B. Video and Broadband Connector Convention:

Signal	Connector	Wire
Signal Phase	Center Pin	Center conductor
Signal Anti-Phase	Shell	Shield
Signal Ground	Shell	Shield

3.3 SYSTEMS PERFORMANCE TESTING AND ADJUSTING PROCEDURES

A. Passive and Amplification Broadband System
   1. Using the specified broadband signal generator and broadband signal level meter, the test equipment manufacturer's procedure and the performance standards of this Section, perform the following tests and adjustments - test and document signal levels at each faceplate scheduled for MATV service:
      a. Sweep installed cabling systems to detect faults due to damaged cabling and mis-installed connectors. Remedy defective conditions before proceeding.
      b. Verify frequency response of cabling.
      c. Apply pads and tilt equalization to balance performance of individual drops as indicated on the system single line diagram.

B. Gain Adjustment.
   1. Coordination installation of CATV service at system headend with District's franchised CATV provider.
   2. Adjust amplifier gain and equalization to match the performance standards defined in 1.4 of this Section.

C. Subjective.
   1. Verify subjective picture quality at installed MATV faceplates in the presence of the District's Representative of both the Cable Television signal and the Satellite derived channel. For this demonstration, provide a portable cable ready color television and franchised CATV provider Set-top boxes where equivalent systems not already installed at selected locations.

D. Submit Test Report.

END OF SECTION

SECTION 27 5116

PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Provisions and Division 1 Specification sections, apply to this Section.

B. Materials, methods and procedures contained in Specification Sections 27 05 00, 27 10 00 and 27 15 00 apply to this section.

1.2 SUMMARY

A. Provide all labor, materials, transportation and equipment to complete the furnishing, installation, assembly, set up, and testing of the Public Address Systems work indicated on the drawings and specified herein. Notwithstanding any detailed information in this Section, provide complete, working systems.

B. Design, engineer and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of the Work of this Section. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction.

C. Public Address System
1. Building Public Address System provides zoned public address functionality using District furnished telephone system as an input and constant voltage (70V) distributed speakers for speaker output.

1.3 RELATED WORK IN OTHER SECTIONS

A. Division 26: Power.

B. Section 27 05 33: Raceway and backboxes for the work of this Section.

C. Section 27 10 00 and 27 15 00: Wiring and cabling for the work of this Section other than within racks or speaker wiring.

D. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures and
1. Racks for the work of this Section

1.4 COORDINATION

A. In addition to the requirements of Sections 27 05 00, coordinate:
1. (N) PD Tenant Improvement Public Address system elements shall extend coverage of (E) PD Public Address system to areas of renovation and provide expansion of (E) PA head-end as required to accommodate new zones of coverage, ambient noise sensing, user-volume control, programmable source level and programmable mute-override functionality in the Tenant Improvement area.
2. Audiovisual Systems

a. Coordinate integration of the public address signal and all-call signaling into Audiovisual Systems audio and control systems.

1.5 SUBMITTALS

A. Conform with Section 27 05 00 - Common Work Results for Communications

1.6 SYSTEM PERFORMANCE REQUIREMENTS

A. Public Address Systems:
1. Electrical Performance; Source Input to Power Amplifier Output:
a. Frequency Response (Equalizer flat): ±0.5 dB 30 Hz to 15 kHz.
b. Total Harmonic Distortion (THD): Less than 0.5%, 30 Hz to 15 kHz, +4 dBm line level.
c. Signal to Noise: At least 70 dB, 30 Hz to 15 kHz, referenced to input of +4 dBm.
d. Crosstalk: At least -60 dB, 30 Hz to 15 kHz.
2. Electro/Acoustic Performance; Distributed Systems, measured at 5 feet above floor:
a. Minimum Average SPL, prior to tuning and commissioning: 83 dBA.
b. Consistent with devices specified herein. Uniformity of not less than ±6 dBA.
3. Equipment: Specified individually.
4. Audio Signal Path: Shall not degrade performance of connected equipment.

1.7 QUALITY ASSURANCE

A. Test Equipment.
1. Refer additionally to Section 27 05 00
2. Public Address Systems:
a. True RMS audio digital volt-ohm-millimeter (Example: Fluke 87).
b. Pink Noise generator (Example: Ivie IE-20B, Neutrik).
c. 70V Impedance meter (Examples: TOA ZM-104, University, Sennheiser).
d. ANSI Type 2 Sound Level Meter displaying A-weighted Sound Pressure Level (Examples: CEL, RION, Larson-Davis, Bruel & Kjaer).
e. Real-time precision audio spectrum analyzer (Examples: CEL, RION, Larson-Davis, Bruel & Kjaer) with ANSI Type I or Type II calibrated microphone.

1.8 TRAINING

A. Conduct training on completed system at reasonable convenience of the District during normal District business hours.

B. Operator Training: Three (3) hours.

1.9 DEFINITIONS

A. Definitions of Terms: The following definitions and conditions apply to each of the respective parameters and the measurements of those parameters, unless specifically stated otherwise:
1. Frequency Response: The minimum acceptable frequency band over which the amplitude response is within 3 dB (or any specified range), or the specified limits of the response relative to the reference frequency (1 kHz for audio, 1.0 MHz for video) under design load conditions, at any operating level up to and including the specified maximum output while fully in compliance with all other performance specifications.

2. Maximum Output Level: The minimum acceptable maximum signal output level (voltage, current or power) attained under design load conditions attained while fully in compliance with all other performance specifications.
3. Harmonic Distortion: The maximum acceptable harmonic distortion measured at any operating level, up to and including the specified maximum output, with an applied sine wave signal of any frequency in the range of the specified frequency response.
4. Audio Intermodulation Distortion: The maximum acceptable intermodulation distortion resulting from the introduction of 60 Hz and 7 kHz signals in a ratio of 4:1 under design load conditions at any operating level up to and including the specified maximum output level.
5. Signal to Noise Ratio: The minimum acceptable ratio of signal to noise levels derived from broadband measurements under design load at maximum output over the entire range of the specified frequency response.
6. Clipping Level: The minimum acceptable maximum level of signal applied to the device under design load conditions while fully in compliance with all other performance specifications.
7. Sensitivity: The maximum acceptable level of input signal applied to the device that is necessary to provide the maximum output under design load conditions.
8. Design Load: The load (in ohms) specified by usage of the particular device input or output.

B. Signal Levels: The following voltage levels shall be considered the standard operating levels for the particular circuitry, unless specifically noted otherwise (0.775 Volt = O dBu = 0 dbm for a 600 ohms terminated circuit):
1.
2. Microphone Circuits: -30 dBu or less.
3. Audio Line Level Circuits: -30 dBu to +24 dBu; equivalent to -30 dBm to +24 dBm for a 600 ohms terminated circuit.
4. Loudspeaker Level Circuits: More than +24 dBu.

C. Characteristic Impedances: The following operating impedances shall be considered to be the standard operating impedances for the particular circuitry, unless specifically noted otherwise:
1. Microphone Circuits: 50-250 ohms source, 150-1500 ohms terminating, electrostatically and electromagnetically balanced to ground.
2. Audio Line Level Circuits: 600 ohms maximum source, 600 ohms minimum terminating, line to line, electrostatically and electromagnetically balanced to ground.

PART 2 - PRODUCTS

2.1 DISTRIBUTED LOUDSPEAKER ASSEMBLIES AND RELATED

A. Provide tamper resistant fasteners at all assemblies mounted within 10 feet of finished floor in public occupancy spaces. Provide UL 1480 assemblies where required by code.

B. 3” Loudspeaker Driver Assembly
1. Drawing Reference: SA
2. Functions/Features:
a. 3” Full Range Loudspeaker
b. Integral 70v tap transformer
c. Frequency Response 110Hz – 12kHz
d. Dispersion: 135-degrees
e. Power Taps: 2, 4, 8, 16 Watts & 6-ohms
f. Sensitivity: 89.7dB (1W/1m)

g. UL1480 and UL2043 Listed
h. Blind access mount

3. Manufacturer:
a. JBL Control 12C-VA
b. Atlas FAP33T-W
c. Or equal.

C. 3" Loudspeaker Assembly - 70V Coupled, Ceiling Mounted in Gyp or Plaster Ceiling:
1. Drawing Reference: SC
2. Complete Assembly to consist of:
a. Provide 3” Loudspeaker Assembly specified elsewhere herein
b. with blind access mount backbox.
c. Baffle to match that supplied for SA

D. 6" Loudspeaker Assembly, Waterproof - 70V Coupled, Ceiling Mounted in Gyp or Plaster Ceiling:
1. Drawing Reference: SG
2. Complete Assembly to consist of:
a. Six-inch loudspeaker.
b. Seventy volt tap transformer, 4 watt output minimum.
c. Waterproof driver. Suitable for installation in shower room environment, including regular exposure to steam.
d. Ceiling baffles with 1” wide maximum steel trim ring at the baffle perimeter, fine perforated mesh over the remainder of the baffle, blind studs for mounting loudspeaker, and torsion spring for blind attachment of baffle to enclosure. The baffle can mount to the enclosure through ceilings up to 2” thick.
e. Round recessed steel enclosure, with damping compound to prevent metallic resonance.
f. Height: Less than 6”.
3. Manufacturer
a. Misco JC6WP-4T70 w/ Atlas Sound FAMT-6 adapter, 62-8 baffle, BMT95-8 backcan, 81-8R tile bridge
b. Or equal.

E. Paging Horn - 70V Coupled, Wall Mount, Weather Resistant
1. Drawing Reference: SHC4
2. Complete Assembly to consist of:
a. Constant directivity horn consisting of a 1.5” voice coil.
b. Seventy volt tap transformer; 30 W minimum tap.
c. Frequency Range (+/- 5dB): 400 Hz – 6.5 kHz.
d. Sensitivity: 107 dB @ 1W/1m.
e. Coverage: 60 degrees horizontal, 40 degrees vertical
f. Weather resistant enclosure.
g. Nominal Dimensions: 9”H x 12”W x 14”D.
h. Tilting wall mount bracket.
i. Finish: Per Architect.
3. Manufacturer
a. ElectroVoice PA430T
b. Community
c. Atlas Sound
d. Or equal

2.2 POWER AMPLIFIERS, ANALOG LINE LEVEL INPUT

A. Power Amplifiers, General

1. Drawing Symbol: PA[number].
   a. Provide the following functions and/or features
      1) Employ solid state devices (integrated circuits and/or transistors) throughout and employ positive protection of circuit components.
      2) With amplifier input driven 10 dB beyond input level required to produce full rated output, amplifier shall withstand for at least 15 seconds any of the following load conditions without instability or operation of main over current protection (i.e. no blown fuses or circuit breakers).
         a) "Short" circuit of 0.1 ohm.
         b) Open circuit (no load).
         c) Standard Reactive Load: 5.4 ohms in series with the parallel combination of 12.5 microhenrys; 800 microfarads and 18.3 ohms resistive.
      3) Peak voltage of turn on and/or turn off transients not greater than 20 dB below maximum rated amplifier output.
         a) Time duration of transients not to exceed 3 seconds.
      4) Input level controls for each output channel to be calibrated, stepped attenuators with at least 50 dB range.
         a) For 0 to 34 dB of attenuation, steps not to be greater than 2.0 dB.
         b) Attenuators to track calibration within 0.5 dB.
         c) Stepped attenuators are not required at Power Amplifiers where the connected driving source device includes a precision attenuator under digital control with precision not less than that specified herein.
      5) Input Connectors: XLR connector or tip sleeve (standard) phone jack or barrier strip.
      6) Output Connectors: Standard 0.75 inch spacing "5 way" binding posts, or barrier strip.
      7) Where integral cooling fans are provided, such fans shall have a minimum life rating of 50,000 hours at 25 degree Centigrade ambient temperature.
      8) Where indicated, provide balanced input, differential or transformer. Provide matching accessory to implement if not a standard feature of the product provided.
      9) Listed by a Nationally Recognized Testing Laboratory.
   b. Minimum performance requirements with all channels driven
      1) Power Output Per Channel: As scheduled on Drawings as Minimum Amplifier (Min Amp) and specified below; continuous average sine wave power into 70 Volt line over a bandwidth of 40 Hz to 20 kHz.
         a) Frequency Response: plus 0 dB, minus 0.5 dB, 40 Hz to 20 kHz at rated output.
         b) Total Harmonic Distortion: Less than 0.25 percent at rated output, 40 Hz to 20 kHz.
         c) Intermodulation Distortion: Less than 0.04 percent at rated output using frequencies of 60 Hz and 7 kHz, mixed in a ratio of 4:1.
         d) Input Impedance: 15,000 ohms minimum; unbalanced, or balanced as shown on drawings.
         e) Hum & Noise: At least 94 dB signal to noise ratio.
         f) Channel Separation: At least 75 dB at 1 kHz.
         g) Phase Shift: Less than plus20 degrees from 20 Hz to 20 kHz.
         h) D.C. Offset: Less than 10 millivolts.

B. Public Address Analog Audio Interface
   1. Drawing Reference: PA-AUDIO
   2. Manufacturer:

a. BiAmp Vocia VI-6
b. Qsys
c. Or equal.

C. Public Address VoIP Interface
1. Drawing Reference: PA-VOIP
2. Manufacturer:
a. BiAmp Vocia VOIP-1
b. Qsys
c. Or equal.

D. Public Address General Purpose I/O Module
1. Drawing Reference: PA-GPIO
2. Features/Functions
a. Network Connection: Dual RJ45 with shielded Ethernet(CAT5, CAT5e, CAT6, or CAT7)
b. General Purpose Outputs:
1) Quantity: 16
2) Type: FET Switch, open drain (low side driver)
3) Max Continuous Current: 0.35VA
4) Current Limit: 0.8A
5) Maximum External Supply: 30V DC
6) VMon Input Shutdown: 35V DC
c. General Purpose Inputs:
1) Quantity: 16
2) High Range Logic Low: 0-8V DC
3) High Range Logic High: 12-30V DC
4) TTL Logic Low: 0 – 0.8V
5) TTL Logic High: 2-5V
6) Voltage Monitor: 4-30V DC
7) Input Transient Protection: ± 8kV Peak
8) Input Isolation: 500V RMS
d. Overall Dimensions:
1) Height: 1.6 inches (41 mm)
2) Width: 12.5 inches (370 mm)
3) Depth: 5 inches (128 mm)
4) Weight: 2.4 lbs (1.1 kg)
e. Power:
1) PoE: 802.3af Class 3802.3at Type 1 Class 3
2) DC Power: 24V; <100mV Ripple 15W
f. Environment:
1) Ambient Operating Temperature Range: 23-104° F (-5 – 40° C)
2) Humidity: 0 – 95% non-condensing
3) Altitude: 0 – 10,000 Feet (0 - 3,000 Meters) MSL
g. Compliance: EN 54-16 CertifiedFCC Part 15B (USA)CE marked (Europe)UL and C-UL listed (USA and Canada)RoHS Directive (Europe)
3. Manufacturer:
a. BiAmp Vocia GPIO-1
b. Qsys
c. Or equal.

E. Public Address Pre-recorded Message/Announcement Module
1. Drawing Reference: PA-MIR
2. Manufacturer:
a. BiAmp Vocia MS-1e

b. Qsys
c. Or equal.

F. Public Address Analog Line Output Module
1. Drawing Reference: PA-AMP4
2. Manufacturer:
a. BiAmp Vocia VO-4
b. Qsys
c. Or equal.

G. Public Address 8-Channel Distributed Audio Zone Amplifier w/ failover
1. Drawing Reference: PA-AMP8
2. Manufacturer:
a. BiAmp Vocia VA-8600c w/ AM-600c and VFOM-1 modules as required
b. Qsys
c. Or equal.

H. Public Address Ambient Noise Sensor
1. Drawing Reference: PANC
2. Manufacturer:
a. BiAmp Vocia ANC-1
b. Qsys
c. Or equal.

I. Public Address Line Monitor
1. Drawing Reference: PA-LM
2. Manufacturer:
a. BiAmp Vocia PLD-2
b. Qsys
c. Or equal.

J. Public Address Local Volume Control
1. Drawing Reference: PAVC
2. Manufacturer:
a. BiAmp Vocia WR-1
b. Qsys
c. Or equal.

2.3 PUBLIC ADDRESS CABLING

A. General. Provide wire and cable with electrical conductors of soft drawn annealed copper, bare or tinned, concentric stranded, conductivity not less than 98% of pure copper. Comply with applicable Code for insulation, jacket, marking and listing for applicable use.

B. Cable, Microphone/Line Level (General Purpose):
1. Drawing Reference: SP.
2. Description: The cable shall be a shielded, single twisted pair, with #20 AWG color coded stranded conductors and foil shield with drain wire.
3. Performance:
a. Conductors AWG: #20.
b. Conductors Stranding: 7 x 28.
c. D.C. Resistance Per 1000': 15 ohms maximum.
d. Shield: Aluminum-polyester foil with #20 AWG stranded tinned copper drain wire.
e. Diameter: 0.24" maximum.

4. Acceptable, subject to above:
   a. Alpha.
   b. Belden.
   c. West Penn.

C. Cable, Loudspeaker and D.C. Power:
   1. Drawing Reference: #12AWG
   2. Description: The cables shall be twisted pair, jacketed, unshielded cables, #12, #14, #16, or #18, as shown on drawings. Plenum rated where installed in open plenum return voids.
   3. Performance:
      a. Conductor, AWG: #12, #14, #16, and #18, as noted.
      b. Conductors, Stranding:
         1) 19 x 25 (#12),
         2) 19 x 27 (#14),
         3) 19 x 29 (#16),
         4) 16 x 39 (#18).
      c. D.C. Resistance Per 1000':
         1) 1.7 ohms (#12),
         2) 2.7 ohms #14),
         3) 4.27 ohms (#16),
         4) 6.48 ohms (#18).
      d. Diameter (maximum):
         1) 0.384" (#12),
         2) 0.332" (#14),
         3) 0.256" (#16),
         4) 0.224" (#18).
      e. Manufacturers
         1) Alpha.
         2) Belden.
         3) West Penn.
         4) Or equal.

2.4 CATEGORY RATE CABLING AND WORK AREA OUTLETS

A. ANSI/TIA Category 6 Cabling
   1. Drawing Reference: ** UTP6-4, where ** denotes cable count
   2. Provide as specified in Section 27 15 00 - Communications Horizontal Cabling.

B. High Speed, Category 6 Cabling, Plenum Rated
   1. Drawing Reference:** UTP6-4P, where ** denotes cable count
   2. Provide as specified in Section 27 15 00 - Communications Horizontal Cabling.

2.5 WORK AREA OUTLETS AND JACKS

1. Drawing Reference: Work Area Outlet Triangle with L subscript for Fire Alert Lighting Rough-in and Cabling.
2. Provide as specified in Section 27 15 00 - Communications Horizontal Cabling.

2.6 CABLE TERMINATION DEVICES AND RELATED, NON-CATEGORY RATED

A. Cable Termination Devices and Related:
   1. Screw type or Tubular Clamp Barrier Blocks:
      a. Manufacturers:
         1) Buchanan 125, 0625 Series.
         2) Electrovert.

3) TRW Cinch 140, 141, 142 Series.
4) Weidmuller.
5) Pass & Seymour/Legrand.
6) Phoenix.
7) or equal.

2. Tubular Clamp Barrier Blocks, High Density, Switch Block Section
   a. Drawing Reference: TB15.
   b. Features/Functions
      1) Paired screw terminals on opposite sides of insulating base.
      2) TB15 Base mounts to DIN rail, providing space beneath TB15 to dress field and source cabling.
      3) Terminates range of wire gages used by project – at least 30 gage to 10 gage.
      4) High density:
         a) At least 33 pairs of connections per foot for 12 and smaller gage terminations,
         b) At least 16 pairs of connections per foot for 10 gage terminations.
      5) Switch Block Section permits load, such as field devices, to be separated from monitoring panel for testing independent of source then restored without disturbing field wiring terminations.
      6) Rated at least fifteen (15) amperes at 300V AC/DC
   c. Approvals
      1) UL
   d. Manufacturers:
      1) Allen Bradley Isolation Switch Blocks,
         a) 1492-H7 for 30 to 12 gage
         b) 1492-CE9 for 10 gage.
      2) Tyco Buchanan 0135 Series.
      3) WECO Electrical Connectors
      4) Altech
      5) Curtis Industries
      6) Electrovert
      7) Weidmuller
      8) Pass & Seymour/Legrand
      9) Phoenix
      10) or equal.
3. Low Level Audio Cable Termination, Insulation Displacement Products. Coordinate with wire size, type and insulation
   a. Manufacturers:
      1) ADC "Dense Patch".
      2) ADC UP3, UP3 N.
      3) ADC I.C.O.N. Series.
      4) AMP "AMP BARREL".
      5) Gentner Electronics Flexiblock Series.
      6) Gentner Electronics EasyTerm Series.
      7) Siemon Model S66M450 with D10 Designation Strip.
      8) Leviton
      9) Any meeting 100TB requirements of Section 16765.
      10) Or equal.
4. Low Level Audio Cable Termination, "Christmas Tree" or "Vee" Blocks
   a. Manufacturers:
      1) ADC Model PJ 660 6.
      2) Or equal by Thomas and Betts
      3) or equal.

4)

2.7 SPARES

A. Provide spare equipment in manufacturer's original packing complete with all specified accessories and documentation.

B. Provide quantity not less than four (4) per cent (rounded up to the nearest full unit) of the quantity provided of each of the distributed loudspeaker and paging horn assemblies provided under this Section.

PART 3 - EXECUTION

3.1 GENERAL

A. The requirements of Sections 27 05 00, and 27 15 00 apply.

3.2 EQUIPMENT RACK TESTING AND ADJUSTING PROCEDURES

A. Gain control settings
1. Establish tentative normal settings for all gain controls.
2. Set all equalizers flat.
3. Set all automatic gain control devices to bypass.
4. Adjust all gain controls on equipment for optimum signal-to-noise ratio and signal balance and, unless they are sub-panel mounted, cap them to prevent tampering.
5. Unless specified or directed otherwise, adjust gains such that in a given system the "front end" operates at unity gain and maintains 10 dB of clip margin referenced to the first onset of clipping of the associated power amplifier(s).

B. Freedom from parasitic oscillation and radio frequency pickup:
1. Maintain previous setup.
2. Set up for each mode of operation specified in the functional requirements; verify that all systems are free from spurious oscillation and radio-frequency pickup.
3. Correct any such defects.

3.3 LOUDSPEAKER ASSEMBLY INSTALLATION

A. Loudspeakers:
1. Verify proper installation of loudspeaker enclosures and related support.
2. Verify that no loudspeaker assembly is subjected to stresses or loading effects in any way contributing to possible extraordinary failure.
3. Connect loudspeaker assemblies to the appropriate 70 volt-line transformer tap as applies.
4. Verify specified polarity.
5. Use insulated crimp connectors or insulated "bobtail" splices applied with manufacturer's recommended ratchet tooling. Wire nuts or "Scotchlock" connectors shall not be acceptable.
6. Verify that loudspeaker grille openings and loudspeaker components are clear of paint after finishing.
7. Perform preliminary loudspeaker tests specified herein.
8. Correct non-conforming conditions.
9. Adjust 70 volt-line transformer taps as required to realize uniform sound pressure level as specified herein.
10. Document final 70 volt-line transformer taps on the Record Drawings.

11. Correct all conditions giving rise to noise, rattle or other extraneous sounds owing to operation of a loudspeaker assembly under any specified operating condition.

B. Loudspeaker Assembly Testing and Adjusting Procedures
   1. Upon completion of the installation of all loudspeakers in an area, perform the following tests and record results.
   2. Correct non-conforming conditions, unless the cause is clearly outside the Work of this Section, in which case submit the apparent cause to the District's Project Manager.

C. Loudspeaker Line Impedance:
   1. At terminal cabinets at equipment rooms, measure the modulus of impedance of each loudspeaker line.
   2. Measure at at least 4 frequencies over the range from at least 31 Hz to 16 kHz.

D. Loudspeaker Polarity:
   1. Test the acoustic polarity of all loudspeakers using an Acoustic Polarity Tester.

E. Freedom from Buzzes, Rattles and Objectionable Distortion:
   1. Individually apply to each loudspeaker line a slow sinewave sweep from 50 Hz to 5 kHz at a level of 6 dB below rated power amplifier output voltage.
   2. Listen carefully for buzzes, rattles and objectionable distortion.

F. Uniformity of Coverage: Apply broadband Pink Noise.
   1. Adjust level to approximately 70-80 dBA at measurement locations.
   2. Measure in 4 kHz octave band at ear level.
   3. Adjust loudspeaker aiming and amplifier level or 70 Volt loudspeaker tap as applies for uniformity of coverage.

3.4 SYSTEMS PERFORMANCE TESTING AND ADJUSTING PROCEDURES

A. Upon completion of the installation of all equipment in an area, perform the following tests and record results.
   1. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals.
   2. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable.
   3. Submit test report.
   4. Correct all non-conforming conditions prior to requesting Acceptance Review and Testing.
   5. Perform at least the following procedures:
      a. Mechanical: Verify:
         1) Integrity of all support provisions.
         2) Absence of debris of any kind, tools, etc.
      b. Power and Ground: Verify:
         1) Grounding of devices and equipment.
         2) Integrity of signal and technical power system ground connections.
         3) Proper provision of power to devices and equipment.
      c. Signal Wiring, Verify:
         1) Integrity of all insulation, shield terminations and connections.
         2) Integrity of soldered connections. Absence of solder splatter, solder bridges.
         3) Routing and dressing of wire and cable.

4) Continuity, including conformance with wire designations on running sheets, field and shop drawings.
5) Absence of ground faults.
6) Polarity.

6. Use the proper sequence of energizing systems to minimize the risk of damage. Energize.
7. Electro/Acoustic Tests:
   a. Uniformity of coverage.
      1) Walk pattern of devices and adjust obvious irregularities.
8. System Overall:
   a. Verify levels.
   b. Provide permanent "wedge" type labels on all controls, as applies, to indicate correct settings after systems performance testing and
   c. adjustment procedures have been successfully completed.

3.5 DEMONSTRATE

A. Demonstrate Paging Functionality using all system inputs. Demonstrate paging system function through District's telephone system.

B. Control switch/attenuator functionality.

END OF SECTION

SECTION 28 0500

COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions and Division 1 Specification Sections, apply to this Section.

B. Provisions of this Section apply to Electronic Safety and Security Work, including the following Sections:
   1. Section 28 05 13 – Conductors and Cables for Electronic Safety and Security
   2. Section 28 05 28 – Pathways for Electronic Safety And Security

1.2 SCOPE OF WORK

A. Section includes, but is not necessarily limited to:
   1. Common standards and procedures for the Electronic Safety and Security Work.
   2. Design, engineer and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of the Work of this Division. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction.

1.3 REFERENCES

A. Usage in accordance with Section 01 42 19 - Reference Standards.

B. Conform to the applicable portions of the following standards agencies:
   1. American National Standards Institute (ANSI)
      a. ANSI C39.1 (1981; R 1992) Requirements for Electrical Analog Indicating Instruments
   2. ASTM INTERNATIONAL (ASTM)
      a. ASTM A 123/A 123M (2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
      b. ASTM B 32 (2004) Solder Metal
   3. ELECTRONIC INDUSTRIES ALLIANCE (EIA)
      a. EIA ANSI/EIA/TIA-232-F (2002) Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
   4. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
      a. NEMA ICS 2 (2000) Industrial Controls and Systems: Controllers, Contactors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC
      b. NEMA ICS 6 (1993; R 2001) Industrial Control and Systems: Enclosures
   5. SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS (SMPTE)
      a. SMPTE 170M (1999) Television - Composite Analog Video Signal - NTSC for Studio Applications
   6. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
      a. 47 CFR 15 Radio Frequency Devices
   7. UNDERWRITERS LABORATORIES (UL)
      a. UL 1037 (1999; Rev thru Sep 1999) Antitheft Alarms and Devices
      b. UL 1076 (1995; Rev thru Feb 1999) Proprietary Burglar Alarm Units and Systems

c. UL 1610 (1998; Rev Aug 2001) Central-Station Burglar-Alarm Units
d. UL 294 (1999; Rev thru Oct 2001) Access Control System Units
e. UL 636 (1996; Rev thru Mar 2001) Holdup Alarm Units and Systems
f. UL 639 (1997; Rev thru Sep 2002) Intrusion Detection Units
g. UL 681 (1999; Rev thru Jan 2001) Installation and Classification of Burglar and Holdup Alarm Systems
h. UL 796 (1999; Rev thru Dec 2003) Printed-Wiring Boards (1982 issue or latest revision).

1.4 DEFINITIONS

A. See also Section 01 42 10 - Abbreviations, Symbols, and Definitions, and Section 27 05 00 – Common Work Results for Communications.

B. General Abbreviations used in these specifications. Refer additionally to the abbreviations list appearing on the Drawings.

1.	ADA	Americans With Disabilities Act.
2.	AFC	Above Finished Ceiling.
3.	AFF	Above the Finished Floor.
4.	BLDG	Building
5.	CAT	Category
6.	CL	Centerline
7.	DIV	Division
8.	(E)	Existing
9.	FBO	Furnished By Owner
10.	HR	Home Run
11.	ID	Inside Diameter
12.	LAN	Local Area Network
13.	MAX	Maximum
14.	NIC	Not In Contract.
15.	OD	Outside Diameter
16.	OFE	Owner Furnished Equipment.
17.	PSRH	Project Standard Receptacle Height.
18.	PSSH	Project Standard Switch Height.
19.	TYP	Typical
20.	UON	Unless Otherwise Noted.

C. Definitions of Terms:
1. As defined in Section 28 13 00 – Access Control and Alarm Systems.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. At the Arena, Plaza, Garage and at Core Utility Rooms of the Office Towers.
1. Provide rough-in for the Owner Furnished access control system and field devices to enable the required access control and intrusion detection functions. Includes installation field devices, including Door Position Switches, in base building scope to support future systems implementation by Owner's Contractor(s) without requiring actions that would void door frame fire listings.
2. Provide rough-in for the Owner Furnished video surveillance system and cameras to enable viewing and recording images on the Owner's NVR system.

B. At the Tenant Areas of the Office Towers.
1. Provide rough-in for the Tenant Furnished access control system and field devices to enable the required access control and intrusion detection functions. Includes installation field devices, including Door Position Switches, in base building scope to

support future systems implementation by Tenant's Contractor(s) without requiring actions that would void door frame fire listings.

2. Provide rough-in for the Tenant Furnished video surveillance system and cameras to enable viewing and recording images on the Tenant Furnished Video Surveillance system.

1.6 SUBMITTALS

A. Submit the following according to Conditions of the Construction Contract and Division 1 Specification Sections.

B. General Requirements
1. Submit all materials for review arranged in same order as Specifications, individually referenced to Specification Section, Paragraph and Contract Drawing number. Conform in every detail as applies to each referencing Section.
2. Submit 8 ½"x 11" items bound in volumes and drawings in edge bound sets. Submit all drawings on sheets of the same size.
3. Make each specified submittal as a coordinated package complete with all information specified herein. Incomplete or uncoordinated submittals will be returned with no review action.

C. Contractor and Key Personnel Experience.
1. A minimum of 30 days prior to installation, submit documentation of the experience of the Electronic Safety and Security contractor(s) and of their key personnel.
2. Qualifications shall be provided for:
   a. the Electronic Safety and Security contractor(s),
   b. the Electronic Safety and Security installers,
   c. and the supervisor(s) (if different from the installers).
3. Refer to Quality Assurance paragraph in this section for complete requirements.

D. Progress Schedule: Comply with Section 01 32 13 - Project Coordination.

E. Manufacturer's Product Data:
1. Manufacturer's Product Data Sheets. Collate in sequence of List of Materials:
2. Data sheet for each item in each Electronic Security Section, including all accessories, clearly marked for proposed product required for the Project, to including but not limited to the following where required by the Project scope:
   a. Common Work
      1) Power Supplies
      2) UPS's
      3) Switches
      4) Relays
      5) Batteries
      6) Tamper resistant security fasteners
      7) Terminal blocks
      8) End-of-Line Resistors.
   b. Wiring
      1) Cabling of each type used on the project.
   c. Racks and Cabinets (where provided under the work of Division 28).
   d. Electronic Security Systems Pathway
      1) Raceway
      2) Raceway connectors
      3) Gutter
      4) Terminal Cans, Pull Boxes, Device Boxes
      5) Enclosures
      6) Means of support

e. Access Control and Intrusion Device Field Devices
   1) Door position sensors
   2) Request to exit devices

3. Material Safety Data Sheet, where applies.
4. List of Materials Schedule. For each item, include:
   a. Referencing Specification Section
   b. Referencing Paragraph
   c. Referencing Drawing, if specified only on plans
   d. Manufacturer.
   e. Model number.
   f. Listing, including name of Nationally Recognized Testing Laboratory.
   g. Precede each submittal book with a summary schedule, with columns for each item above and rows for each item submitted.
      1) Example:

Specification Section	Paragraph	Contract Drawing Reference	Manufacturer	Model No.	UL/CLA Listed
28 05 00	2.03C		XYZ	123	Y
28 13 00	2.07A1		AAA	34-56	Y
		T2.01	ZZY	456	Y

F. Functional description, provide
   1. A system description, including analysis and calculations used in sizing equipment required.
   2. Description to show how the equipment shall operate as a system to meet the performance requirements. The following information shall be supplied as a minimum:
      a. Description of site equipment and its configuration
      b. Protocol description
   3. Startup operations
   4. System expansion capability and method of implementation
   5. System power requirements and UPS sizing

G. Field (Installation) and Shop Drawings: Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Collate in sequence at least the following plans:
   1. Drawing index/symbol sheet.
   2. Floor plans. At scale of Contract Documents. Show:
      a. Device locations, type and circuit number(s).
      b. Mounting height.
      c. Conduit size.
      d. Rough-in.
      e. Wire type.
      f. Wire fill.
      g. Termination rooms, including BDF and IDF Closets where use of these spaces are indicated on the Bid Documents
   3. Sections/Elevations: At scale of Contract Documents:
      a. Mounting location reference.
      b. Terminal cabinets.
      c. Electrical power receptacles required for the work of this Section.
      d. Block wiring terminations
      e. Clearances

f. Backboard Wire and Cable Management
g. Electrical and Mechanical panels, including panel boards, EMS and fire alarm, and mechanical systems in vicinity of the work of these Sections.

4. System Conduit Riser Drawing. Submit drawings that clearly and completely indicate the function of each Electronic Safety and Security component. Indicate termination points of devices, and interconnections required for system operation. Indicate interconnection between modules and devices. Show:
   a. Terminal cabinets.
   b. Coordination with floor plans.
5. Single line diagram of Electronic Security and Safety Systems. Indicate the relationship of integrated components on one diagram and show power source, system controls, impedance matches; plus number, size, identification, and maximum lengths of interconnecting wires.
   a. Show at least:
      1) Equipment: Function, make, model.
      2) Rack number.
   b. Grounding and bonding scheme
   c. Terminal cabinets.
   d. Coordination with floor plans.
6. Mounting details:
   a. Identify each item requiring seismic restraint installation in accordance with CBC Chapter 16. Include floor mounted items weighing more than 400 pounds and wall mounted or suspended items weighing more than 20 pounds.
   b. Supports for such items shall be provided support, bracing, and anchorage, designed by the Contractor in accordance with the following criteria:
      1) Design to resist seismic forces in accordance with CBC Chapter 16.
      2) Minimum Design Parameters - As defined for the Project in Division, with respect to Occupancy Category, Site Classification, Seismic Design Category, Importance Factor, Spectral Acceleration and SDI.
   c. Specific details of restraints including anchor bolts submitted under the Section 27 05 29 – Hangers and Supports for Communications Systems for mounting and maximum loading at each location, showing compliance and coordination with Code and the project Architectural, Structural and Mechanical Documents.
   d. Stamped and signed by an Engineer licensed in the Project jurisdiction for work of this type.
      1) Submit an accompanying Engineering analysis stamped and signed by an Engineer licensed in California for work of this type, indicating that the Equipment Enclosure System will comply with California Building Code for the Project Seismic Zone when loaded with the weight of the equipment submitted.
      2) Show calculations on drawings or in bound volume for review by Authorities having jurisdiction.
   e. Show loads, type and strength of connections, sizes, dimensions, materials, etc.
   f. Provide details for:
      1) Equipment Rack anchorage.
7. Installation details
   a. Terminal cabinets: Draw elevations of terminal blocks corresponding to the Single Line Diagram.
   b. Firestopping,
   c. Details of flexible raceway connections to be made to vibrating equipment
   d. Details of J-Box and sealant application for the typical conditions listed in Section 27 05 48 – Noise and Vibration Controls for Communications Systems.
   e. California Access Compliance Manual and Americans with Disabilities Act (ADA) compliance.
8. Fabrication details

a. Receptacles.
b. Panels.
c. Special mounting provisions
d. Legends/engraving details. Half or full size:

9. Schedules of Application
   a. An itemized list of all items of equipment to be fitted with flexible electrical connections.
   b. Catalog cuts of the products to be applied as J-Box mastic and Acoustical Sealant, and a schedule of rooms to receive application of mastic and sealant at J-Boxes.

H. Test plan
   1. Project Site Test Reports:
      a. Schedule: Submit test reports in timely manner relative to Project schedule such that the Owner's Representative may conduct verification of submitted test data without delay of scheduled progress.
      b. Project Site test report: Submit following system completion and prior to and as condition precedent to Acceptance Review and Testing of the Work of this Section.
      c. Content: Include at least:
         1) Time and date of test.
         2) Personnel conducting test.
         3) Test equipment, including serial and date of calibration.
         4) Test object.
         5) Procedure used.
         6) Results of test
         7) Numerical or graphical presentation.
         8) Electronic file in format and media directed by the Owner's Representative.
      d. Refer additionally to the requirements of Part 3 of this Section and of the individual Electronic Safety and Security Sections.

I. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the Owner, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

J. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using format in Article 3 of General Conditions using format in Division 1 Section "Closeout Procedures".

1.7 QUALITY ASSURANCE

A. Procedures: In accordance with Section 01 45 00 - Quality Control.

B. Qualifications
   1. Installer's Qualifications
      a. Prior to installation, submit data of the installer's experience and qualifications. Show that the installer who will perform the work has a minimum of 2 years experience successfully installing Electronic Safety and Security Systems of the same type and design as specified herein. Include the names, locations, and points of contact of at least two installations of the same type and design as specified herein where the installer has installed such systems.
      b. Indicate the type of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 12 months.

C. Designated Supervisor: Provide a designated supervisor present and in responsible charge in the fabrication shop and on the Project Site during all phases of installation and testing of the Work of this Section. This supervisor shall be the same individual through the execution of the Work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.

D. Reference Documents: At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies.
1. A complete set of the latest stamped, actioned submittals of record.
2. A complete set of manufacturer's original operation, instruction and service manuals for each equipment item.

E. Test Equipment
1. Requirements:
a. Maintain and operate test equipment at the fabrication shop and the job site for both routine and Acceptance Testing of the Work of this Section.
b. Maintain test equipment at the job site while work is in progress from installation of equipment racks until Owner Acceptance of this Work; thereafter remove all of this test equipment from the job site.
c. Unless otherwise indicated, test equipment shall remain property of the Contractor.
d. Provide all required test cables, jigs and adapters.
e. Provide equipment with traceable calibration, with calibration date not greater than one year prior to the date of the use of the equipment to perform the specified testing.
2. Equipment: Specified in individual Sections.

F. Standard Products
1. Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section. All components must be of new condition, used or reconditioned products will not be accepted.
a. Alternative Qualifications. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.
2. Material and Equipment Manufacturing Date
a. Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

G. Manufacturer’s identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.
1. Evidence of “patching” after removal of tags or marks is not acceptable.

1.8 REGULATORY REQUIREMENTS

A. Regulations Applicable: Including but not limited to those defined in Section 01 41 00 - Regulatory Requirements.

1. Nothing in the Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules, or regulations.
2. Safety Agency Listing: All devices provided under the Work of this Section which are connected to the Project electrical system shall be listed by a Nationally Recognized Testing Laboratory, and shall be so labeled.
3. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Owner's Representative. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.9 DELIVERY, STORAGE AND HANDLING

A. Procedures:
1. In accordance with General Conditions and Division 1 Section "Product Requirements", as specified in the individual sections of Division 27 and the following.

B. General
1. Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for cabling and equipment placed in storage.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, non-condensing.

1.11 SEQUENCING

A. Comply with Section 01 10 00 - Summary and Section 01 32 16 – Project Schedules.

1.12 OPERATING AND MAINTENANCE DATA

A. Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the Electronic Safety and Security cabling and pathway system. Precede the manuals with a systems narrative specific to this Project, outlining the major systems functionality, the major systems components, and identifying which manuals document the performance of which subsystems.
1. Submit operations and maintenance data in accordance with Section 01 78 30 - Guarantees Bonds Service and Maintenance Contracts and as specified herein not later than 2 months prior to the date of beneficial occupancy.

B. Spare Parts
1. In addition to the requirements of Section 01 78 30 - Guarantees Bonds Service and Maintenance Contracts, provide a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

1.13 PROJECT RECORD DOCUMENTS

A. Comply with 01 78 00 - Closeout Submittals, and the following.
1. Record Drawings
a. Content
1) Provide a least as required for the Shop and Installation Drawings defined elsewhere in this Section.

2) Contractor shall be responsible for updating building and Electronic Safety and Security plans to reflect as-built conditions.
3) Indicate actual work on Drawings; indicate actual products used, replace vendor neutral nomenclature used in bid set with makes and models of actual installed devices.

b. CAD.
1) Use a computer aided drafting (CAD) system in the preparation of record drawings for this Project. CAD system shall produce files in AutoCAD® .DWG format, latest release at time of Project bid closure. Campus Standard, no substitution permitted.
2) Except where prohibited by Contract, Owner's Representative will furnish CAD backgrounds in AutoCAD® .DWG format, for use by the Contractor in preparing Record Drawings.
3) Disk copy of Record Drawings: Provide 2 separate disc copies of each drawing file in the format noted above. Submit on Owner directed media format.

c. Reproduceables: As specified in Division 1.

1.14 WARRANTY SERVICE

A. In addition to provisions of General Conditions and Division 1 Section "Product Requirements", provide the following.
1. Response Time:
a. Provide an access control manufacturer qualified technician familiar with the work at the Project Site within 24 hours after receipt of a notice of non-emergency malfunction.
b. Provide an access control manufacturer qualified technician familiar with the work at the Project Site within 4 hours after receipt of a notice of an emergency malfunction. An emergency malfunction is defined as one causing gate or door openings to be either inaccessible or unsecured.
c. Provide the Owner's Representative with telephone number attended 8 hours a day, 7 days a week, to be called in the event of a malfunction.

B. Provide all additional Warranties as defined in each Electronic Safety and Security Systems Section.

1.15 CLOSEOUT

A. Punch List: Perform any and all remedial work, at no claim for additional cost or time. Where required, retest and submit Test Report. Notify the Owner's Representative of completion of Punch List.

B. Portable Equipment: Furnish all portable equipment and spares to the Owner's Representative, along with complete documentation of the materials presented. Where applicable, furnish portable equipment in the original manufacturer's packing.

C. Operating and Maintenance Data: Install framed operating and maintenance instructions. Submit Manuals.

D. Project Record Documents: Submit print and digital copies. Digital files shall be in AutoCAD .dwg format, latest release at time of Project bidding..

E. Keys: If applicable, replace construction locks with permanent locks. Provide 5 sets of keys to the Owner's Representative.

F. Instruction: Conduct specified instruction.

G. Warranty: Submit Warranty dated to run from date of Substantial Completion of the Project.

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the Owner.

2.2 GENERAL

A. Where a particular material, device, piece of equipment or system is specified directly, the current manufacturer's specification for the same shall be considered to be a part of these specifications, as if completely contained herein in every detail.

B. Each material, device or piece of equipment shall comply with all of the manufacturer's current published specifications for that item.

C. Products shall be made by manufacturers regularly engaged in the production of such products.

D. Provide quantity as shown on Contract Drawings, or as otherwise indicated.

E. Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the Work of this Section as if specified in full herein.

F. Unless recycled content is specified, provide new materials.

G. Provide the manufacturer's latest design/model, permanently labeled with the manufacturer's name, model number and serial number.

H. Where products are of similar type or use, provide products of the same manufacturer, unless otherwise indicated.

I. Components
   1. UL or third party certified. Cabling and interconnecting hardware and components for Electronic Safety and Security systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.
   2. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance.
      a. The label or listing by the specified organization will be acceptable evidence of compliance.
      b. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Owner’s Representative.
      c. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

J. Enclosures:

1. Provide steel frames and enclosures designed and wired to eliminate all induced currents.
2. Make bolted connections with self-locking devices.
3. All enclosures should be appropriate to environment of installation – refer to the requirements of Section 28 05 28 – Pathways for Electronic Safety and Security.

K. Finishes: Any item or component of the Work of this Section which is visible shall comply with the following.
1. Finishes noted or scheduled on the Contract Drawings take precedence.
2. Where design location requires that products, materials or equipment are visible to the public, no manufacturer's logos larger than 1/2 inch shall be visible. Unless otherwise noted or directed, neatly remove or permanently paint out such logos.
3. Where finishes are not noted or otherwise defined in the Contract Documents, submit manufacturer's standard finish samples for selection by the Owner’s Representative.

2.3 LABELING

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Unless otherwise indicated, provide black text on a white background.

C. Shall be preprinted or computer printed type. Hand written labels are not acceptable.

D. Manufacturers
1. Brother P-Touch
2. Brady
3. Or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine existing conditions before starting work. Submit conflicts in a timely manner for resolution

3.2 GENERAL

A. Conform to UL 681, UL 1037, and UL 1076, the appropriate installation manual and the requirements of each specification section for each equipment type, whichever is most restrictive . Components within the system shall be configured with appropriate "service points" to pinpoint system trouble in less than 20 minutes.

3.3 PREPARATION

A. Prepare and sequence the work to minimize disruption to each room environment and any existing Electronic Safety and Security systems.

B. Protection: Cover all computers, electronic equipment, desks, chairs, furniture and other articles when working at ceiling level and/or performing dust producing tasks.

3.4 LABELING

A. Field devices: Each Electronic Security System initiating device and each annunciating device shall be labeled with the assigned ID matching the device ID used in the Access Control programming and set-up screens.
   1. The ID shall incorporate the device abbreviation, the architectural door number and a sequential number assigned to each device of the same type occurring at the door opening in the form Door Number - Device Abbreviation – Sequential Number - .
      a. Example: One LA at door number 101A: 101A-LA-1.
      b. Example: Two DO's at door 121: 121-DO-1, 121-DO-2.
   2. Apply label to an unobtrusive spot on the device, cut to minimum practical size before applying.

B. Panels. Attach to the interior of each control a panel clear plastic holder in this holder place a laser printed list of the door and card reader relay points zone numbers and other signals that may be transmitted to the central station, the type of device, exactly what the alarm and restoral signals indicate. This list shall be typed on 8-½" x 11" paper provide a copy of these list(s) in Microsoft Word on electronic media format delivered to the Owner's Representative.

3.5 REPAIR AND RESTORATION

A. Where working in spaces occupied by the Owner, return to their original positions any furniture or articles relocated to perform the work.

3.6 CLEANING

A. Where working in spaces occupied by the Owner:
   1. Immediately after completing work within each space, clean up and remove all materials, scrap and dust.
   2. All scrap material in work area shall be picked up and removed from the building at the end of each day. See also Division 1 for additional requirements.
   3. All dust resulting from work performed shall be vacuumed up daily.
   4. All scrap material shall be removed from Campus and disposed of in an authorized disposal site. Refer to Section 01 74 19 - Construction Waste Management and Disposal.

3.7 SYSTEMS PERFORMANCE TESTING AND ADJUSTING PROCEDURES

A. General Procedures
   1. It shall be the responsibility of the Security Contractor to demonstrate to the Owner's Representative that the security system is complete and functional as per these specifications. For intrusion detection field devices test shall ensure that the requisite degree of intrusion detection is provided.
   2. Acceptance testing shall be scheduled by the Security Contractor thorough established project channels
   3. Furnish all necessary instruments and equipment required for conducting tests.

B. Device Level Tests
   1. Initially, test each sensor and subsystem component individually.
   2. Test all wire for shorts, open circuits, or grounding.
   3. Immediately correct any defective work

C. Systems Tests.
   1. When the function of each component within a particular subsystem such as each sensor within a particular zone is verified, certify that subsystem of the entire

Electronic Safety and Security System is satisfactorily meeting required specifications. Test each subsystem similarly until each detection zone has been certified.

2. When subsystem certification is complete, test entire integrated system to ensure that subsystem elements are compatible and function as a complete system. Integrated system test shall be accomplished in linear fashion, end-to-end, and shall verify that each simulated intrusion performed within each detection zone produces an appropriate alarm or signal.
3. Integrated system test shall also verify that alarm is correctly annunciated at the terminal block associated with the field devices,

D. Contractor Testing
1. Provide for approval, not later than 30 days prior to formal inspection and test, a detailed operational test plan of how each component, subsystem, and entire Electronic Safety and Security System will be tested.
2. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Submit prior to request for final payment.
3. Test each individual circuit and device for proper operation in the presence of telecommunications personnel. Correct all failures and retest at contractors expense to verify corrections. Correct as built drawings, O & M manuals, programming sheets and system programming to reflect the Owner's final occupancy room numbers.
4. Provide Owner's Acceptance Form with a check box associated with each card reader and input point. A check mark in the box will indicate that each point has been correctly installed and that communication between the controller and the server has been established. This form shall be completed prior to Owner acceptance of the system.

3.8 COMMISSIONING AND ACCEPTANCE

A. General:
1. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.

B. Results Expected:
1. Electronic Security Systems shall be complete and ready for use.
2. Testing, start-up and cleaning work shall be complete.
3. Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner.

C. Inspections
1. There shall be three phases of commissioning inspections:
   a. Rough-in inspection
   b. Above-ceiling inspection (after cables are placed)
   c. Final inspection and testing
2. The Contractor shall verify that the installation and materials used have been inspected before they are enclosed within building features, or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected and approved.

D. Rough-in inspection. Once electrical rough-in and pathways have been installed, but prior to walls and ceilings being installed, the Contractor shall request of the Owner's Representative, in writing, for the official rough-in inspection to take place. The Owner's Representative will then schedule a time to be on-site to conduct this inspection.
1. At a minimum, the Owner's Representative will evaluate the following items:
   a. Accurate location and height above finished floor for all outlet boxes.

b. Accurate dimensions (particularly depth) of all outlet boxes and diameter of in-wall conduit serving outlet boxes.
c. Gutter size, location and clearance.
d. Location and size of all other electronic security systems conduits or pathways.
e. Location, spacing and clearance of and around electronic security systems racks and wall-mounted equipment.
f. That electronic security systems hard wired power and power receptacles, where installed under the work of this project, meet the design requirements.

2. The Owner's Representative is then to issue a written report to the Contractor identifying all items which currently do not meet the construction document requirements. All items are to be resolved prior to walls and ceilings being closed up. This report is not necessarily all-inclusive; should issues be discovered later in the project, the Contractor is still responsible for corrections/repairs.

E. Above-ceiling inspection
1. Once all electronic security systems cabling has been installed and properly supported and walls have been painted, but prior to the installation of ceiling tiles/material, contractor shall request of the design team, in writing, for the official above-ceiling inspection. The Owner's Representative will then schedule a time to be on-site to conduct this inspection

2. At a minimum, the Owner's Representative will evaluate the following items:
a. That all items from the previous inspection have been corrected.
b. That electronic security systems cabling is routed correctly and adequately supported.
c. That electronic security systems cabling is not painted or over-sprayed.
d. That the installed electronic security systems cabling matches what was specified/submitted.
e. That there are no kinks, splices, or other damage to the installed electronic security systems cabling.
f. That all field devices are properly supported, oriented and labeled.
g. That all penetrations through fire-rated walls are properly firestopped, including fire blocking materials installed in the annular spaces; and that the firestops are properly labeled.

3. The Owner's Representative is then to issue a written report to the Contractor identifying all items which currently do not meet the construction document requirements. This report is not necessarily all- inclusive; should issues be discovered later in the project, the appropriate communications subcontractor is still responsible for corrections/repairs.

F. Acceptance Review and Testing Procedures
1. The Owner's Representative will witness formal Acceptance Tests after receipt of written certification that all prior Punch List work is complete and that Contractor's functionality tests have been completed and that system is ready for final inspection. This request shall be made 3 weeks before substantial completion. The Owner's Representative will then schedule a time to be on-site to conduct this inspection.
2. The Contractor shall provide the following for the acceptance testing.
a. Personnel: Provide services of the designated supervisor, ACAS manufacturer representative and additional manufacturer qualified technicians familiar with work of this Project. Provide quantity of technicians as required to comply with Project Schedule.
b. All tools appropriate for performance of adjustment of and corrections to this Work. Include spare wire and connectors and specified tooling for application.
c. Ladders, scaffolding and/or lifts as required to access high devices.

d. All test equipment.
e. Complete set of latest stamped, actioned submittals of record for reference.
f. Complete set of Test Reports.
g. Complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.

3. The Contractor shall execute the test plan required in Submittals section and as approved and/or modified by the Owner's Representative. The testing must demonstrate complete operation of all systems and equipment, including any portable equipment.
4. These procedures may be performed at any hour of the day or night as required by the Owner's Representative to comply with the Project Schedule and avoid conflict with Owner staff or student activities. Provide all specified personnel and equipment at any time without claim for additional cost or time.
5. At a minimum, the Owner's Representative will check the following items:
   a. Mechanical/Physical Installation.
      1) That all items from the previous inspections have been corrected.
      2) That all electronic security systems equipment and cabling terminal rooms is installed per the contract documents, including all required terminal blocks, pull boxes, termination resistors and electronic security systems grounding.
      3) All other items necessary to guarantee contract documents are met and complete and functioning communications systems are installed.
      4) All cables and electronic security systems field devices and pathway are properly labeled.
      5) All penetrations through fire-rated walls are properly fire-stopped, including fire blocking materials installed in the annular spaces; and that the firestops are properly labeled.
   b. Functionality Demonstration
      1) Demonstrate functionality of each installed device is consistent with the read range, sensitivity and immunity to false alarms as specified by the device manufacturer.
      2) Functional demonstration to also include, but not limited to the following active components and all related items installed under the work of the project:
         a) Batteries
         b) Cameras
         c) Card readers
         d) Door position sensors
         e) Duress alarm components
         f) Electrified hinges
         g) Electrified latches
         h) Electrified strikes
         i) Glass break sensors
         j) Key pad controllers
         k) Local alarm devices
         l) Motion detectors
         m) Power supplies
         n) Relays
         o) Request to exit devices
         p) Servers
         q) Switches
         r) UPS devices
6. Access Control Infrastructure:
   a. Demonstrate that operation of each opening, including access controlled doors and gates. Refer to the System Performance Requirements and Schedule of Programmatic Outcomes by Door Opening in Section 28 13 00 – Access

Control and Alarm Systems is in full conformance with the specified functionality, including each C-Cure status item associated with the scheduled UCSC Door Class.

7. Door Position, Window and Hatch Switches
   a. Demonstrate functionality of each device. Demonstrate that operation of each monitored door by 1/2" or less from the fully closed position causes the position switch to change state.
8. Uninterrupted Power Systems:
   a. Disconnect normal power service. Demonstrate that the system remains in full operation for the specified time.

G. Adjust: As directed by the Owner's Representative.

3.9 POST ACCEPTANCE TEST REMEDIATION

A. Temporary Equipment: Provide and operate, without claim for additional cost or time, temporary equipment and/or systems to provide reasonably equivalent function, as determined by the Owner's Representative, in place of the Work of this Section which is incomplete or found not in conformance with the Contract Documents as of seven (7) days prior to the scheduled completion date. Provide such temporary equipment until Acceptance of the Work of this Section. Thereafter, remove such temporary equipment.

B. Correct:
   1. In timely manner, correct identified Work of this Section which is incomplete or found not in conformance with the Contract Documents to comply with the Contract Documents, as reasonably determined by the Owner's Representative.
   2. Conduct additional tests to in the presence of the Owner's representative to demonstrate that system conforms to the Contract Documents.

END OF SECTION

SECTION 28 0513

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes wiring standards for work of Electronic Safety and Security Systems

B. Related Work Under Other Sections
   1. Section 27 10 00 – Structured Cabling, Basic Materials & Methods
      a. Defines standards and methods for termination of IP-based cabling used for IP cameras and IP work area outlets necessary to support access control systems installed under the work of Division 28.
   2. Section 27 15 00 – Communications Horizontal Cabling
      a. Defines materials and execution standards for installation of TIA/ANSI standard category media installed under the work of Division 27 to provide work area outlets for final connection by the work of Division 28 to cameras and IP alarm system panels.
   3. Section 28 05 00 – Common Work Results for Electronic Safety and Security.
   4. Section 28 05 26 – Grounding and Bonding For Electronic Safety And Security
   5. Section 28 05 28 – Pathways for Electronic Safety And Security

1.3 SUBMITTALS

A. Conform with the requirements of Conditions of Construction Contract, Division 1 Specification and Section 28 05 00 - Common Work Results for Electronic Safety and Security.

1.4 REFERENCES

A. American Society For Testing and Materials (ASTM)
   1. ASTM A228/A228M-02 Steel Wire, Music Spring Quality.
   2. ASTM D 709(2001) Laminated Thermosetting Materials

B. VFederal Communications Commission (FCC)
   1. The Code of Federal Regulations, Title 47, Telecommunications, Chapter 1 - FCC Part 68 (1982 issue or latest revision) (47 CFR 68) .

C. Institute of Electrical and Electronic Engineers
   1. IEEE 383-2003 Standard for Qualifying Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations
   2. IEEE 100-00 The Authoritative Dictionary of IEEE Standards Terms

D. Insulated Cable Engineers Association (ICEA)
   1. ICEA S-56-434 (1983, 5th Ed.) Reaffirmed October 18, 1991 Polyolefin Insulated Communication Cables for Outdoor Use.
   2. ANSI/ICEA S-83-596-2011 Indoor Optical Fiber Cables

3. ANSI/ICEA S-84-608-2010 Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor
4. ANSI/ICEA S-86-634-2011 Buried Distribution & Service Wire, Filled Polyolefin Insulated, Copper Conductor.
5. ANSI/ICEA S-87-640-2011 Fiber Optic Outside Plant Communications Cable
6. ICEA S-102-700-2004 – ICEA Standard For Category 6 Individually Unshielded Twisted Pair Indoor Cables (With Or Without An Overall Shield) For Use In Communications Wiring Systems Technical Requirements
7. ICEA S-103-701-2011 Riser Cables Technical Requirements

E. National Electrical Manufacturers Association (NEMA)
1. NEMA WC 63.1(2000) Twisted Pair Premise Voice and Data Communications Cables

F. National Fire Protection Association (NFPA)
1. NFPA 70 National Electrical Code

G. Telecommunications Industry Association (ANSI/TIA)
1. ANSI/TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises
2. ANSI/TIA-568-C.1, Commercial Building Telecommunications Cabling Standard, 2009
3. ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard, published 2009
4. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard, published 2008, including errata issued in October, 2008.
5. ANSI/TIA 569-C (2012) Telecommunications Pathways and Spaces
6. ANSI/TIA-606-B (2012) Administration Standard Telecommunications Infrastructure
7. ANSI- J-STD-607-B (2011) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

H. Underwriters Laboratories, Inc. (UL)
1. UL 444(2002; Bul. 2002, 2003) Communications Cables
2. UL 910(1998) Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air
3. UL 1286(1999; R 2004) Office Furnishings
4. UL 1581 Reference Standard for Electrical Wires, Cables, and Flexible Cords. Oct. 2001
5. UL 1666(2000; R 2002) Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
6. UL 1863(2000; R 2004) Communications Circuit Accessories
7. UL 969 (1995; R 2001) Marking and Labeling Systems

1.5 QUALITY ASSURANCE

A. Conform with the requirements of Conditions of Construction Contract, Division 1 Specification and Section 28 05 00 - Common Work Results for Electronic Safety and Security.

1.6 DELIVERY, STORAGE AND HANDLING

A. Conform with the requirements of Conditions of Construction Contract, Division 1 Specification and Section 28 05 00 - Common Work Results for Electronic Safety and Security.

1.7 WARRANTY

A. Conform with the requirements of Conditions of Construction Contract, Division 1 Specification and Section 28 05 00 - Common Work Results for Electronic Safety and Security.

PART 2 - PRODUCTS

2.1 CABLING

A. General
1. Where not otherwise specified or indicated, conform to manufacturers most stringent recommendations with respect to pair count, gage, conductor construction and shielding for indicated run length.
2. Conform to Code requirements with respect to acceptable jacket construction for each application and condition. Provide NEC/CEC CMP listed cable construction at plenum at environmental air and underfloor applications.
3. Analog Video Cabling, Copper Coax and Related. Provide cable with electrical conductors of soft drawn annealed copper, bare or tinned, solid or concentric stranded as applies, conductivity not less than 98% of pure copper. Comply with applicable Code for insulation, jacket, marking and listing for applicable use.
4. Manufacturers:
a. Alpha
b. Belden
c. Commscope/Isotec
d. West Penn
e. or equal.

B. Card Reader Cabling
1. Construction:
a. Conform to Code requirements with respect to acceptable jacket construction for each application and condition
b. 4 pair
c. 22 ga. minimum
d. Overall foil shield with drain wire.
e. Manufacturers:
1) Belden
2) Alpha
3) Commscope/Isotec
4) West Penn
5) or equal.
f. Manufacturers, Alternate Construction:
1) Provide Category 6 cabling as specified in Section 27 15 00.

C. Release Button, Door Switch
1. 2 stranded conductors, 22-18 gauge minimum
2. Manufacturers:
a. Belden 8442, 8461, 5300UE, 5500UE, 6300UE, 6500UE
b. Alpha
c. Commscope/Isotec
d. West Penn
e. or equal.

D. Request to Exit, Motion Detector, Glass Break
1. 4 stranded conductors, 22-18 gauge minimum

2. Manufacturers:
   a. Belden 5302UE, 5502UE, 6302UE, 6502UE
   b. Alpha
   c. Commscope/Isotec
   d. West Penn
   e. or equal.

E. Combination dual detector
1. 6 stranded conductors, 22-18 gauge minimum
2. Manufacturers:
   a. Belden 5304UE, 5504UE, 6304UE, 6504UE
   b. Alpha
   c. Commscope/Isotec
   d. West Penn
   e. or equal.

F. Lock Power and General Low Voltage Power, Indoor Applications
1. 2 stranded conductors, 16-18 gauge minimum. Size to exceed manufacturers minimum recommendations for voltage drop for required run lengths.
2. Manufacturers:
   a. Belden 5300UE, 5200UE, 6300UE, 6200UE
   b. Alpha
   c. Commscope/Isotec
   d. West Penn
   e. or equal.

G. RS-232 Cabling
1. At least 2-3 pairs, actual pair count as required by interface.
2. 22 gauge minimum, paired construction.
3. Overall foil shield with drain wire
4. Manufacturers:
   a. Belden 9855, 89855
   b. Alpha
   c. Commscope/Isotec
   d. West Penn
   e. or equal.

H. RS-485 Cabling
1. At least 2 pairs, or as required by interface.
2. 18 gauge minimum, paired construction.
3. Overall foil and braid shield with drain wire
4. Manufacturers:
   a. Belden 9842, 82842
   b. Alpha
   c. Commscope/Isotec
   d. West Penn
   e. or equal.

I. Control Cabling, Underground, in ducts
1. As specified for the applications above with waterblocking construction consisting of two ply tape designed to swell on exposure to water.
2. Jacket is sunlight and moisture resistant
3. NEC CM or CL3 listed or better. Transition to listed cabling type within 50 feet of entering building.
4. Manufacturer listed for underground application subject to extended exposure to standing water.

5. Manufacturer:
   a. West Penn Aquaseal
   b. Alpha
   c. Belden
   d. Commscope/Isotec
   e. or equal.

J. Cable, Precision Video:
   1. Drawing Reference: PVideo.
   2. Description: 100% sweep tested (0.01 to 100 MHz) double braided shield solid center conductor 75 ohms coaxial precision video cable.
   3. Performance:
      a. Cable Type: Coaxial precision video.
      b. Center Conductor AWG: At least twenty (20) bare copper. Copper clad steel center conductors not acceptable. Increase gauge for longer runs as recommended by camera manufacturer.
      c. Jacket
         1) Underground: Flooded, waterblocked. Suitable for continuous immersion in water.
         2) Riser and General Applications:
         3) Underfloor and in environmental airspace: Plenum
      d. Insulation: Polyethylene.
      e. Shield: Tinned copper double braid, 95% coverage.
      f. Nominal Impedance: 75 ohms.
      g. Velocity of Propagation: at least 66%.
      h. Maximum Attenuation Per 100':
         1) 1 MHz: 0.25 dB
         2) 4.5 MHz: 0.45 dB.
         3) 10 MHz: 0.78 dB.
   4. Jacket: Polyethylene.
   5. Diameter: 0.305" maximum.
   6. Manufacturers
      a. Interior Application
         1) Belden 8281A, 8281B, 543945, 643948
         2) Commscope/Isotek IR201V59
         3) West Penn
         4) or equal
      b. Underground Outside Plant, as for above with flooded jacket, at least NEC CM rating.
         1) Belden 5339W5
         2) Commscope/Isotek
         3) West Penn
         4) or equal
      c. Siamese cabling with specified coaxial cable and integral camera control cabling:
         1) Belden
         2) Commscope/Isotek
         3) West Penn
         4) or equal

2.2 CABLE TERMINATION DEVICES AND RELATED, NON-CATEGORY RATED

A. Screw type or Tubular Clamp Barrier Blocks:
   1. Buchanan 125, 0625 Series.
   2. Electrovert equivalent.
   3. TRW Cinch 140, 141, 142 Series.

4. Weidmuller
5. Pass & Seymour/Legrand equivalent.
6. Phoenix
7. or equal.

B. Tubular Clamp Barrier Blocks, High Density, Switch Block Section
   1. Drawing Reference: TB15.
   2. Features/Functions
      a. Paired screw terminals on opposite sides of insulating base.
      b. TB15 Base mounts to DIN rail, providing space beneath TB15 to dress field and source cabling.
      c. Terminates range of wire gages used by project – at least 30 gage to 10 gage.
      d. High density:
         1) At least 33 pairs of connections per foot for 12 and smaller gage terminations,
         2) At least 16 pairs of connections per foot for 10 gage terminations.
      e. Switch Block Section permits load, such as field devices, to be separated from monitoring panel for testing independent of source then restored without disturbing field wiring terminations.
      f. Rated at least fifteen (15) amperes at 300V AC/DC
   3. Approvals
      a. UL
   4. Manufacturers:
      a. Allen Bradley Isolation Switch Blocks,
         1) 1492-H7 for 30 to 12 gage
         2) 1492-CE9 for 10 gage.
      b. Tyco Buchanan 0135 Series.
      c. WECO Electrical Connectors
      d. Altech
      e. Curtis Industries
      f. Electrovert
      g. Weidmuller
      h. Pass & Seymour/Legrand
      i. Phoenix
      j. or equal.

C. Video connector, BNC type, 75 ohms, cord, crimp applied. Coordinate with cable.
   1. Amp.
   2. Amphenol.
   3. Augat/LRC Products
   4. Canare.
   5. Kings.
   6. RFI/Celltronics.
   7. Trompeter.
   8. or equal.

2.3 PATCH CORDS

A. Category 6 Patch Cords
   1. Reference: Cat 6 Patch Cords
   2. Features/Function/Construction:
      a. Manufactured product – field/contractor assembled patch cords not acceptable.
      b. Manufacturer certified to exceed EIA/TIA 568 C.1 Category 6 performance and construction standards.
      c. Snagless Boot Covers

d. Color: Green, Aqua or Turquoise, unless directed otherwise by the Owner's Representative. In no event the color of the supplied voice patch cabling match that used by the Owner furnished data systems patch cords

3. Length: As required to meet function
4. Quantity: As required to meet function
5. Manufacturers:
   a. Belden
   b. Belkin
   c. Leviton
   d. Systimax/Commscope
   e. AMP
   f. Hubbell
   g. Siemon
   h. Or equal.

2.4 ELECTRONIC SECURITY SYSTEMS CABLING LABELS, INTERIOR

A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.

C. Provide vinyl substrate with a white printing area and black print. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.

D. Shall be flexible vinyl or other substrates to apply easy and flex as cables are bent.

E. Shall use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing.

F. Manufacturers:
   1. Brady
   2. Brother
   3. Panduit
   4. Or equal.

2.5 ELECTRONIC SECURITY SYSTEMS CABLE LABELS, OUTSIDE PLANT

A. Cable Tags in Manholes, Handholes, and Vaults
   1. Provide tags for communications cable or wire located in manholes, handholes, and vaults.
      a. The tags shall be polyethylene.
      b. Machine printed - Do not provide handwritten letters.
   2. Polyethylene Cable Tags
      a. Provide tags of polyethylene that have an average tensile strength of 22.4 MPa (3250 pounds per square inch) 3250 pounds per square inch; and that are two millimeter (0.08 inch) 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 77 degrees C 170 degrees F.
      b. Provide 1.3 mm (0.05 inch) 0.05 inch (minimum) thick black polyethylene tag holder.
      c. Provide a one-piece nylon, self-locking tie at each end of the cable tag.
      d. Ties shall have a minimum loop tensile strength of 778.75 N (175 pounds) 175 pounds. The cable tags shall have black block letters, numbers, and symbols 25 mm (one inch) one inch high on a yellow background.

e. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.

3. Manufacturers:
   a. Panduit
   b. Brady
   c. or equal.

PART 3 - EXECUTION

3.1 WIRING CLASSIFICATION AND RELATED

A. Audio Signal Wiring Classification:
   1. Type A-l: Microphone level wiring less than -30 dBu, 20 Hz to 20 kHz.
   2. Type A-2: Line level wiring -30 dBu to +24 dBu, 20 Hz to 20 kHz.
   3. Type A-3: Loudspeaker level or circuit wiring greater than +24 dBu, from 20 Hz to 20 kHz.

B. Video and Related Signal Wiring Classification:
   1. Type V-1: Baseband and composite video wiring 1 volt peak-to-peak into 75 ohms, 0 to 10.0 MHz.
   2. Type V-2: Synchronization and switching pulse wiring 4 volts peak-to-peak into 75 ohms, 15.62 to 15.75 kHz.
   3. Type V-3: Color subcarrier wiring 0 to 4 volts peak-to-peak into 75 ohms, 3.57 to 4.43 MHz.
   4. Type V-4: MATV system wiring 0.1 to 1000 microVolts peak-to-peak into 50 or 75 ohms, 47 to 890 MHz.

C. Control Signal Wiring Classifications:
   1. Type C-1: DC control wiring 0 to 50 volts.
   2. Type C-2: Synchronous control or data wiring 0 to 40 volts, peak-to-peak.
   3. Type C-3: AC control wiring 0 to 48 volts, 60 Hz.

D. Additional Wiring Classifications:
   1. Type M-1: DC power wiring 0 to 48 volts.
   2. Type M-2: AC power wiring greater than 50 volts, 60 Hz.
   3. Wiring Combinations:

E. Except as indicated herein, conduit, wireways and cable bundles shall contain only wiring of a single classification. The following combinations are acceptable in conduit, or cable harnesses. Additional acceptable combinations may be indicated on the Drawings.
   1. Types A-1, C-1, and M-1.
   2. Types A-2, C-l, C-2, and M-l, runs less than 20 feet.
   3. Types A-2, C-1, and M-1.
   4. Types A-3, C-1, C-2, and M-1.
   5. Types A-2, V-1, and V-3.
   6. Types V-1, V-2, V-3, and C-1.
   7. Types M-2 and C-3.

3.2 WIRING PRACTICE

A. All wiring of Division 28 to be installed in raceway except above accessible ceilings.
   1. Separate raceway systems, including backboxes and conduit, shall be provided for to electromagnetically isolate electric lock and door motor operators, local door alarms and other similarly powered sources of electro-magnetic noise from door position switches, card reader, door release buttons, duress alarms and similar low power,

electromagnetic noise sensitive applications. Refer to Wiring Classification and Related above and comply.

2. Minimum conduit size for multiple conductor runs shall be ¾". In each control panel 2 empty ¾ conduits shall be installed for future use. These conduits shall be routed to an accessible area above the ceiling or to a location approved by Owner. Run circuits for AC separate from circuits using DC. Each supervisory/data loop shall be run separately from any other supervisory/data loops they shall not be permitted to share the same conduit. From security alarm control panel provide one ¾" conduit to nearest telephone backboard or panel location for tie-in to Owner furnished central station. Provide min 1" conduit to each card access or exterior door, unless otherwise shown or scheduled on the plans
3. Conduits including flexible metal and armored cable shall terminate in the sensor or device enclosure.
4. Ends of conduit shall be fitted with insulated bushings. Exposed conductors at ends of conduits external to sensors and devices are not acceptable.
5. Refer to additional requirements in Section 28 05 28 - Pathways For Electronic Safety And Security.

B. All field wiring shall run continuous from device to device no splices shall be permitted except at specified terminal blocks installed in lockable termination cabinets.
   1. The use of wire nuts and crimp type connectors shall not be permitted.
   2. Where shielded wire is used it shall be connected to an earth ground at the panel. Tin terminated shield drain wires and insulate with heat shrinkable tubing.
   3. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections. No wire or cable shall be supported by a connection point.
   4. Provide service loops where harnesses of different classes cross, or where hinged panels are to be interconnected.
   5. Security alarm conductor terminations in control panels, termination cabinets, junction boxes and annunciator panels to be made on specified terminal strips with a separate point for each conductor.
      a. All such strips to be number identified as shown in wiring diagram attached to inside of door of control panel.
      b. Connect wiring neatly to terminals strips.
      c. Set up termination of cabling so that section of the system may be isolated or shorted out for servicing.

C. No control panel shall be mounted where is not readily accessible the highest connection point shall not be above 6’6"' nor shall the bottom of the panel be below 30".

D. All necessary interconnections, services, and adjustments required for a complete and operable system shall be provided. All installation work must be done in accordance with the safety requirements set forth in the general requirements of ANSI C2 and NFPA 70.

E. Coordinate insulation displacement (quick connect) terminal devices with wire size and type. Comply with manufacturer's recommendations. Make connections with automatic impact type tooling set to recommended force.

F. Security alarm conductor terminations in control panels and termination panels to be made on terminal strips with a separate point for each conductor. All such strips to be number or labeled identified as shown in wiring diagram attached to inside of door of control panel. Connect wiring neatly to terminals strips. Bundle with nylon cable straps. Set up termination of cabling so that sections of the system may be isolated or shorted out for servicing.

G. Mount end-of-line resistor for each circuit at the device. Glass break devices may be grouped orderly to a zone. Do not allow glassbreak zones to cover more than one side of

the building without approval from Owner. Connect glass break detectors to C-Cure DGP panel and provide programming of campus C-Cure database to enable remote reset.

H. Correct unacceptable wiring conditions including but not limited to:
1. Deformed, brittle or cracked insulation.
2. Torn or worn cable jacket.
3. Excessively scored cable jackets.
4. Insulation shrunken or stripped further than 1/8" away from the actual point of connection within a connector, or on a punch block.
5. Ungrommeted, unbushed, or uninsulated wire or cable entries.
6. Deformation or improper radius of wire or cable.

3.3 TERMINATION CABINETS

A. Where termination cabinets are used they shall be installed in or on walls. Each termination cabinet shall have a hinged cover with a lock installed flush with the cover. These locks shall be keyed alike. Each termination cabinet shall be marked with a sign with the words "Sec. Termination Cabinet" attached to the front cover. This sign shall be constructed from red laminated plastic with 1/4" white engraved letters.

3.4 UNDERGROUND WIRING PRACTICE

A. General
1. Provide safety barriers and flag persons for all open manholes and pullboxes that are located in areas accessible to the public.
2. Provide traffic control in accordance with the requirements of Division 1.
3. Conform to OSHA guidelines when accessing manholes and handholes, inclusive of the requirement for air sampling. Provide continuous measurements. Provide the Owner’s Representative with contractor maintained logs of air samples taken at most two hours apart.
4. Provide sufficient personnel to permit one individual to remain above the surface at all times, in visual contact with persons in manholes and similar. Provide the observer with a appropriate means of obtaining assistance.
5. Provide ladders for access to manholes. Do not permit workers to use cables or splice cases as ladders.
6. Install a 3/8" nylon pullrope with all underground cables placed by this project.

B. Cable Pulling
1. Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables.
2. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation.
3. Use flexible cable feeds to convey cables through manhole opening and into duct runs.
4. Accumulate cable slack at each manhole or junction box where space permits by training cable around the interior to form one complete loop.
5. Maintain minimum allowable bending radii in forming such loops.
6. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into outdoor pedestals or other enclosures.
7. Cable with tape shield shall have a bending radius not less than 12 times the overall diameter of the completed cable.
8. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

C. Cables in Manholes, Pull boxes and Handholes.

1. Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths.
2. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators.
3. In existing manholes and handholes where new ducts are to be terminated or where new cables are to be installed, locate the existing installation of cables, cable supports and grounding as required for a uniform installation with cables carefully arranged and supported.
4. Where underground cable splices are called for on the plans, support cable splices in underground structures by racks on each side of the splice.
5. Located splices to prevent cyclic bending in the spliced sheath.
6. Install cables at middle and bottom of cable racks, leaving top space opening or future cables, except as otherwise indicated for existing installations.

D. Service Loop at Building Entry
1. For outside plant entering a communications room, provide at least 20 feet of cable in excess of the minimum required to reach terminal device by a dressed route. Form into a storage loop, typically around the perimeter of the backboard and fix in place as directed by the Owner's Representative.

3.5 SPLICING

A. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.
1. At designated splices, maintain conductor color code across all splices.
a. All shielded cables shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels or equipment enclosures.
b. Within buildings, make splices only in designated terminal cabinets and/or on designated equipment backboards.

3.6 PULLING IN

A. Verify that all raceway has been de-burred and properly joined, coupled, and terminated prior to installation of cables. Verify that all raceway is clear of foreign matter and substances prior to installation of wire or cable.

B. Inspect all conduit bends to verify proper radius. Comply with Code for minimum permissible radius and maximum permissible deformation.

C. Apply a chemically inert lubricant to all wire and cable prior to pulling in conduit. Do not subject wire and cable to tension greater than that recommended by the manufacturer. Use multi-spool rollers where cable is pulled in place around bends. Do not pull reverse bends.

D. Provide a box loop for all wire and cable routed through junction boxes or distribution panels. Cable loops and bends shall not be bent at a radius greater than that recommended by the manufacturer.

3.7 SUPPORT

A. Support: Provide support for all cabling. Conform to the most restrictive of the California Electric Code and Section 28 05 28 Pathways for Electronic Safety and Security. Provide support for all cabling. Conform to the restrictions of the California Electric Code and Section 27 05 29. Secure all wire and cable run vertically for continuous distances greater than thirty (30) feet. Secure robust non-coaxial cables with screw-flange nylon cable ties or similar devices appropriate to weight of cable. For all other cables, provide symmetrical conforming nonmetallic bushings or woven cable grips appropriate to weight of cable.

B. Separation from sources of Electromagnetic Interference: Conform with the requirements of ANSI/TIA-569-C, 9.3 Pathway Separation from EMI sources. Secure all wire and cable run vertically for continuous distances greater than thirty (30) feet. Secure robust non-coaxial cables with screw-flange nylon cable ties or similar devices appropriate to weight of cable. For all other cables, provide symmetrical conforming nonmetallic bushings or woven cable grips appropriate to weight of cable.

C. Field Device Wiring
   1. Wire each device as a home run from the device the terminal block
   2. Loop or Zone wiring not acceptable unless addressable devices are specified and provided. Wire all potential monitoring and signaling points (each pin) of each field device and alarm sensor, including internal tamper sensors.
   3. At electric strikes and electric locks, provide end-of-line resistors, diodes or MOV's where device does not already include such components. Document where such devices have been added on As-Built drawings.

D. Card Reader Wiring
   1. Verify that the slack loops called for on the plans are provided.

3.8 LABELING

A. Label each end of each cable to indicate its terminal point.
   1. For field devices, use the device label assigned per the requirements of Section 28 05 00 - Common Work Results for Electronic Safety and Security.

END OF SECTION

SECTION 28 0528

PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Work In Other Sections. Related work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
1. Section 28 05 00 – Common Work Results for Electronic Safety and Security
2. Section 28 05 13 – Conductors and Cables for Electronic Safety and Security
3. Section 28 05 26 – Grounding and Bonding for Electronic Safety and Security

1.2 SUMMARY

A. This section includes provision of electronic security systems pathways as specified in this Section and as shown diagrammatically on the plans. Provide electronic security systems pathways in accordance with the CEC, ANSI/TIA-569-C (2012) Telecommunications Pathways and Spaces, as specified in this Section and as shown on the plans, whichever is most restrictive. Provide system furniture pathways in accordance with UL 1286.

B. Contractor to design complete Electronic Safety and Security pathway system including provision of the following
1. Rigid steel conduit and fittings.
2. Intermediate metal conduit and fittings.
3. Electrical metallic tubing and fittings.
4. Non-metallic raceway and fittings.
5. Flexible metallic conduit and fittings.
6. Liquidtight flexible metallic conduit and fittings.
7. Miscellaneous conduit fittings and products.
8. Junction Boxes
9. Hinged cover enclosures.
10. Pullboxes and Terminal Cabinets.
11. Wireway
12. Strut supports
13. Beam clamps
14. Concrete Fasteners
15. Touch-Up Materials
16. Conduit supports.
17. Equipment supports.
18. Fastening hardware

C. Provide fire penetration sealant systems at all rated wall and floor/ceiling penetrations as required. Additionally, provide where indicated, which may be in excess of Code but required to meet Owner’s operational and functional requirements.

D. At Hazardous Occupancies, installation conforms to the requirements of California Electric Code for Class and Division rating of spaces.

E. Fastening System Description
1. Provide devices specified in this Section and related Sections for support of electronic safety equipment specified for this Project.
2. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.
3. Seismic Design Requirements
a. Identify each item requiring seismic restraint installation in accordance with CBC Chapter 16. Include floor mounted items weighing more than 400 pounds and wall mounted or suspended items weighing more than 20 pounds.
b. Supports for such items, including racks, conduit, cable trays and similar shall be provided support, bracing, and anchorage, designed by the Contractor in accordance with the following criteria:
c. Design to resist seismic forces in accordance with CBC Chapter 16.
d. Minimum Design Parameters - As defined for the Building, with respect to Occupancy Category, Site Classification, Seismic Design Category, Importance Factor, Spectral Acceleration and SDI.

1.3 REFERENCES

A. Usage: In accordance with Section 01 41 00 – Regulatory Requirements.
1. American Institute Of Steel Construction (AISC)
a. AISC 325 (2005) Steel Construction Manual
2. American National Standards Institute (ANSI)
a. ANSI C80.1 1994 Rigid Steel Conduit - Zinc Coated
b. ANSI C80.3 1991 Electrical Metallic Tubing - Zinc Coated
3. American Society For Testing and Materials (ASTM)
a. ASTM A123/A123M-02 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
b. ASTM A153/A153M-04 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
c. ASTM B633-98e1 Specification for Electro-deposited Coatings of Zinc on Iron and Steel.
d. ASTM A653/A653M-04a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. National Electrical Manufacturers Association (NEMA)
a. NEMA 250-2003 Enclosures for Electrical Equipment (1000 Volts Maximum)
b. NEMA FB 1 (ANSI/NEMA FB 1-2003) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
c. FB 2.10 2000 Selection and Installation Guidelines For Fittings For Use With Non-Flexible Metallic Conduit Or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, And Electrical Metallic Tubing).
d. FB 2.20 2000 Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable
e. NEMA ICS 6 1988 (Rev. 1) Enclosures for Industrial Control and Systems
f. NEMA OS 3-2002 Selection and Installation Guidelines for Electrical Outlet Boxes.
g. NEMA RN 1-1998 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
h. NEMA TC 7 2000 Smooth Wall Coilable Polyethylene Electrical Plastic Duct
i. NEMA TC 13 2000 Electrical Nonmetallic Tubing (ENT).
j. NEMA TC 14 1984(R 1986) Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings
5. Underwriters Laboratories, Inc. (UL)
a. UL 1 2000 Flexible Metal Conduit
b. UL 6 2004 Electrical Rigid Metal Conduit - Steel
c. UL 50 (1995; R 1999, Bul. 2001) Enclosures for Electrical Equipment

d. UL 360 1986 (Bul. 1991) (R 1993) Liquid-Tight Flexible Steel Conduit
e. UL 514A 1991 (R 2004) Metallic Outlet Boxes
f. UL 514B 1989 (R 2004) Conduit, Tubing and Cable Fittings
g. UL 514C 1996 (R 2000) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
h. UL 651 1989 (R 1989) (Bul. 1993) Schedule 40 and 80 Rigid PVC Conduit.
i. UL 797 1993 (R 2004) Electrical Metallic Tubing - Steel
j. UL 1242 1983 (R1993) (Bul. 1993) Intermediate Metal Conduit.
k. UL 1286(1999; R 2001, Bul. 2002) Office Furnishings
l. UL 1479 Fire Tests of Through Penetration Firestops
m. UL Fire Resistance Directories

1.4 SUBMITTALS

A. Conform with the requirements of Conditions of Construction Contract, Division 1 Specification, Section 28 05 00 - Common Work Results for Electronic Safety and Security and the following:
1. As part of the project submittals, the contractor to provide engineered shop drawings indicating the proposed design for mounting all work of this Division as defined under the Seismic Design Requirements and defined elsewhere in this Section, inclusive of mounting systems, equipment mounted at the exterior, inclusive of its effective wind load under the range of conditions expected.
a. Shop drawings to be accompanied by anchorage calculations indicating that it shall remain attached to the mounting surface after experiencing forces in conformance with California Code of Regulations, Title 24, 2007 California Building Code.
b. Structural Calculations shall be prepared and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.

1.5 QUALITY ASSURANCE

A. Conform with the requirements of Conditions of Construction Contract, Division 1 Specification and Section 28 05 00 - Common Work Results for Electronic Safety and Security.

B. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

C. Only products and applications listed in this Section may be used on the project unless otherwise submitted and approved by the Owner’s Representative.

1.6 DELIVERY, STORAGE AND HANDLING

A. Conform with the requirements of Conditions of Construction Contract, Division 1 Specification and Section 28 05 00 - Common Work Results for Electronic Safety and Security.

1.7 WARRANTY

A. Conform with the requirements of Conditions of Construction Contract, Division 1 Specification and Section 28 05 00 - Common Work Results for Electronic Safety and Security.

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the Owner.

1.2 ACCEPTABLE MATERIALS

B. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section.

2.2 GENERAL

A. Provide the following types of conduit systems listed by their commonly used generic name.

2.3 RACEWAY

A. Manufacturers:
   1. Raceway:
      a. Allied Tube and Conduit Co.
      b. Triangle PWC, Inc.
      c. Western Tube and Conduit Corp.
      d. Spring City Electrical Manufacturing Co.
      e. Occidental Coating Co. (OCAL).
      f. Alflex Corp.
      g. American Flexible Metal Conduit Co.
      h. Anaconda.
      i. Or equal.
   2. Stainless Steel Raceway and Fittings
      a. Calbrite
      b. Allied Tube and Conduit
      c. Or equal.
   3. Fittings:
      a. Appleton Electric Co.
      b. OZ/Gedney.
      c. Thomas & Betts Corp.
      d. Spring City Electrical Manufacturing Co.
      e. Occidental Coating Co. (OCAL).
      f. Carlon.
      g. or equal.

B. Rigid Steel Conduit.
   1. Drawing and Spec Reference: RSC.
   2. Construction:
      a. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.
      b. Compression type couplings, locknuts, bushings, and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.
      c. Three piece couplings: Electroplated, cast malleable iron.
      d. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150 degree C minimum.

e. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
f. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150 degrees C.
g. All fittings and connectors shall be threaded.

C. Coated Rigid Steel Conduit:
1. Drawing and Spec Reference: CRSC.
2. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
3. Fittings:
a. Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.
b. Fittings over-sleeve to extend 1 conduit diameter or 1-1/2" beyond fitting, whichever is less.
4. Performance:
a. Tensile Strength: 3500 psi.
5. Approvals:
a. NEMA RN1 (Type 40 - 40 mils thick)
b. CalTrans Type 2
6. Manufacturers:
a. Plastibond by RobRoy Industries.
b. Occal-40 by Occidental Coating Company.
c. KorKap by Plastic Applicators.
d. Ocal-Blue
e. or equal.

D. Intermediate Metal Conduit
1. Drawing Reference: IMC
2. Conduit: Hot dip galvanized steel meeting the requirements of CEC Article 345 and conforming to ANSI C80.6 and UL 1242.
3. Fittings: Compression type couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

E. Electrical Metallic Tubing.
1. Drawing and Spec Reference: EMT.
2. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 specifications and shall meet UL classifications.
3. Raintight compression couplings: Electroplate steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.
4. Raintight compression connectors: Electroplated steel or cast malleable iron, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.
5. Use of set-screw couplings and connectors is not permitted.

F. Flexible Conduit:
1. Drawing Reference: FLEX
2. Construction:
a. Flexible steel, zinc coated on both inside and outside by hot-dipping process.
b. Interlocking spirally wound continuous steel strip.
c. 3/4" minimum size.
3. Fittings: Compression type connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats.

Exception: Pressure cast screw-in connectors shall be acceptable for fixture connection in suspended ceilings and cut-in outlet boxes within existing furred walls.

4. Approvals:
   a. UL 1

G. Liquidtight Flexible Metallic Conduit
1. Drawing Reference: Liquidtight
2. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.
3. Fittings: Compression type connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

H. Conduit, Stainless Steel
1. Constructed of Type 316 Stainless Steel with either EMT, IMC type stainless steel fittings.
2. Approvals
   a. UL6A

I. PVC Conduit
1. Drawing and Spec Reference: PVC.
2. Construction:
   a. 4" trade diameter, unless otherwise noted.
   b. Poly-vinyl chloride.
   c. Schedule by Application
      1) Straight segments, Schedule 40.
      2) Flat elbows, Schedule 40.
      3) Vertical elbows sweep up to grade, Schedule 80.
      4) Above grade, Schedule 80.
   d. Elbows.
      1) Where innerduct liner is scheduled – CRSC.
      2) Elsewhere, Schedule 80.
      3) 90° C rated.
      4) Solvent welded joints, joints by pipe manufacturer.
   e. Application.
      1) Soil Backfill/Direct Burial
         a) RUS Type II, Type C or Type DB
         b) Schedule 40.
      2) Concrete Encasement:
         a) PVC Type DB-120,
         b) RUS Type I, Type B or Type EB
         c) Any meeting Soil Backfill/Direct Burial.
      3) Boring
         a) HDPE.
         b) RUS Type Flexible Plastic.
   f. Performance:
      1) Tensile Strength: 7,000 psi at 73.4° F.
      2) Flexural Strength: 11,000 psi.
      3) Compressive Strength: 8,600 psi.
   g. Approvals:
      1) RUS Listed for Telephone Cable Installation 5-99 Edition, or latest release thereof.
      2) NEMA TC-2, PVC Type EPC-40 and EPC-80.
      3) NEMA TC-3.

4) NEMA TC14 Fiberglass Conduit.
5) UL 514 fittings.
6) UL 651.
7) ANSI C33.91.

h. Manufacturers:
1) RUS Listed:

Manufacturer	RUS Listed for	Manufacturer Part Number
Allwire, Inc.	Flexible plastic	ALLDUCT
American Pipe & Plastics	Plastic	Type B. C. and D
	Plastic	Type EB and DB
	Plastic	PVC Multi-Duct (2,3,4 and 6-way)
Americon International	Flexible plastic	HDPE Duct
	Plastic	PVC Type C
Apache Plastics, Inc.	Plastic	Type EB and Type DB
ARMCO	Plastic	Smooth-Cor Type B and Type C
Arnco	Flexible plastic	HDPE Conduit
Bay Plastics, Inc.	Plastic	Type B and Type C
Bristolpipe	Plastic	Type B. C. and D
	Plastic	Type EB and Type DB
Can-Tex	Plastic	Type EB and Type DB
	Plastic	Type B, C, and D
Carlon	Plastic	Type EB and Type DB
	Plastic	Type B. C. and D
	Plastic	Multi-Gard
Certain-Teed Products Corp.	Plastic	Type EB and Type DB
CIBA-GEIGY	Fiberglass	T & D Conduit
Condux International, Inc.	Concrete	Condux
	Plastic	Type EB and Type DB
CSR Polypipe	Flexible plastic	HDPE Duct
Dura-line	Flexible plastic	HDPE Duct
Eagle Pacific Industries, Inc.	Plastic	Type EB and Type DB
	Flexible plastic	HDPE Coiled Duct
Endot Industries	Flexible plastic	HDPE Duct
Freedom Plastics, Inc.	Plastic	Type C
Hercules, Inc.	Flexible plastic	Corflo plastic conduit
Hurlbut Plastic Pipe	Plastic	Type C
Ingomar Plastic Pipe	Plastic	Type B and Type C
J-M Manufacturing Company	Plastic	Types C, EB, and DB
Kyova	Plastic	Type EB and Type DB
LCP National Plastics. Inc.	Plastic	Type EB and Type DB

	Plastic	Type B and Type C
Northern Pipe Products	Plastic	Type B, C, and D
OMNI	Flexible plastic	HDPE Duct
Petroflex	Flexible plastic	HDPE Duct
	Flexible plastic	Corrugated HDPE Duct
Phillips Products Co., Inc.	Flexible plastic	Driscon 3200
Phone Ducs	Plastic	Multiple plastic conduit (4, 6, & 9 Way)
PLEXCO	Flexible plastic	PLEXCO Duct
PWPipe	Plastic	Type EB and Type DB
Pyramid Industries, Inc.	Plastic	Type EB and Type DM
	Flexible plastic	HDPE Conduit
Quail Plastics	Plastic	Type EB and Type DB
Queen City Plastics	Plastic	Type EB and Type DB
River City Plastics	Plastic	Type EB and Type DB
Sedco	Plastic	Type EB and Type DB
Southern Pipe, Inc.	Plastic	PVC Types EB, DB, and Sch. 40
Tamaqua Cable Products	Flexible plastic	HDPE Duct
Tridyn Industries	Plastic	Type EB and Type DB
Vassallo Industries	Plastic	Type B and Type C
Wesflex	Flexible plastic	Flex-Con

2) or equal

J. Fiberglass Conduit
1. Drawing Reference: Fiberglass
2. Construction:
   a. Trade Standard Sizes
   b. Meets NEMA TC 14
   c. Complete system of joints and threaded steel conduit couplers
3. Manufacturers:
   a. TVC Communication/Vikimatic Fiberglass Conduit
   b. Champion Fiberglass
   c. FRE Composite
   d. or equal.

2.4 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

A. General
1. UL 514B.
2. Listed in UL Electrical Construction Materials List.

B. Conduit Fittings, Insulated Throat Grounding Bushings
1. Description
   a. Threaded for Rigid Steel Conduit and Intermediate Metal Conduit.
   b. UL Listed for use with copper conductors.

c. Thermoplastic insulated liner for 105 degrees Celsius.
d. Body of malleable iron, zinc plated; or die cast zinc.

2. Manufacturer
   a. Thomas & Betts (Steel City) BG-801 Series
   b. O-Z/Gedney
   c. or equal.

C. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.

D. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.

E. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.

F. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate .75-inch deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless steel jacket clamps. Unit shall comply with UL467 and UL514.

1. Manufacturer:
   a. OZ/Gedney Type DX
   b. Steel City Type EDF
   c. or equal.

G. Fire rated penetration seals:

1. UL classified.
2. Conduit penetrations in fire rated separation shall be sealed with a UL classified assembly consisting of fill, void or cavity materials.
3. The fire rated sealant material shall be the product best suited for each type of penetration, and may be a caulk, putty, composite sheet or wrap/strip.
4. Penetrations of rated floors shall be sealed with an assembly having both F and T ratings at least equal to rating of the floor.
5. Penetrations of rated walls shall be sealed with an assembly having an F rating at least equal to the rating of the wall.

H. Standard products not herein specified:

1. Submit for review a listing of standard electrical conduit hardware and fittings not herein specified prior to use or installation, i.e. locknuts, bushings, etc.
2. Listing shall include manufacturers name, part numbers, and a written description of the item indicating type of material and construction.
3. Miscellaneous components shall be equal in quality, material, and construction to similar items herein specified.

I. Hazardous area fittings: UL listed for the application.

2.5 JUNCTION AND DEVICE BOXES

A. Junction and Device Boxes

1. Drawing References: As shown on Symbol Schedule

2. Construction:
   a. Concealed/Flush Mounted:
   b. One or two piece welded knockout boxes. Junction boxes with knockouts are not to be used for surface mounted locations or exposed locations.
   c. UL 514A, cadmium or zinc-coated 1.25 oz/sq. ft., if ferrous metal.
   d. Pressed sheet steel, for flush indoor locations.
   e. UL 514C approved if non-metallic.
   f. At hollow masonry, tile walls and plaster walls, provide with device rings as required.
   g. Surface mounted:
      1) Conform to the Junction and/or PullBox construction scheduled on the Plans. Where construction not otherwise scheduled or noted on the plans, conform to the following.:
         a) Cast iron with threaded hubs and mounting lugs.
         b) Gasketed cover with spring lid.
      2) Concrete floor embedded:
         a) Cast iron concrete pour boxes with screwed brass cover, unless otherwise noted.
         b) Cadmium plated screw cover attachment at least 6" on center.
   h. If size not otherwise noted, at least 4S (4" square) by 2-1/8" deep, or Code minimum size, whichever is larger.
      1) Wherever 4S is indicated, contractor may at their option substitute 4-11/16" or 5” (5S) square boxes while maintaining the minimum depth required by these specifications and the drawings.
      2) At recessed masonry wall installations, provide gangable masonry boxes.
   i. Provide complete with approved type of connectors and required accessories, including attachment lugs or hangers. Provide raised device covers as required to accept scheduled device.
3. Approvals.
   a. UL 514A
4. Manufacturers:
   a. Interior, flush:
      1) Steel City.
      2) Bowers
      3) Randl Industries, Inc. (5S Boxes).
      4) or equal.
   b. Interior, flush 5S Boxes
      1) Randl, Inc. 5 Square Telecommunications Boxes
      2) or equal.
   c. Surface mount or exterior, exposed with cover of same construction.
      1) Appleton
      2) Pyle-National
      3) or equal.
   d. Other conditions:
      1) Any meeting approvals and requirements.

2.6 CABINETS AND ENCLOSURES

A. Terminal Cabinets:
   1. Drawing Reference: As Scheduled.
   2. All security system enclosures to be equipped with tamper detection. All enclosures should be appropriate to the environment. External enclosures must meet standard to withstand high moisture sea air.
   3. Construction:
      a. Interior Applications:

1) Zinc Coated Sheet Steel, code gauge with standard concentric knockouts for conduit terminations.
2) Finish: Manufacturer's standard gray baked enamel finish.
3) Covers: Trim fitted, continuous hinged steel door, flush catch – lockable and keyed to match. Screw fastened doors not acceptable.
a) Door face to be not less than 95% of panel interior dimensions.

b. Exterior Applications
1) Enclosures to be NEMA 4X Type 316 Stainless Steel or non-metallic
c. Interior dimensions not less than those scheduled.
d. Provide with 3/4" fire retardant treated ply backboard.

4. Mounting:
a. Flush cabinets shall be furnished with concealed trim clamps and shall be not less than 4 inches deep.
b. Surface cabinets shall be furnished with screw cover trim, flush hinged door and shall not be less than 6 inches deep.
c. Interior Applications:
1) NEMA 250 Type 1, unless otherwise noted. Refer to plans and schedules.
d. Exterior Applications:
1) NEMA 250 Type - NEMA 4X.

5. Manufacturers:
a. B-Line Electrical Enclosures
b. Circle AW Products.
c. Hammond
d. Henessey.
e. Hoffman.
f. Myers Electric Products
g. Rittal.
h. or equal.

2.7 WIREWAY

A. Lay-In Wireway
1. Drawing Reference: Gutter
2. Features/Functions/Construction
a. NEMA Type 1, unless otherwise noted.
b. ANSI 61 Gray polyester powder finish inside and outside.
c. Screw fastened cover completely removable to provide complete access to interior.
d. 6"x6" cross-section minimum, size for 30% fill maximum
3. Approvals
a. UL 870
b. NEMA Type 1
4. Manufacturers
a. Hoffman Lay-In Type 1 Wireway
b. Square D
c. Circle AW
d. or equal

2.8 THROUGH PENETRATIONS SEALANT SYSTEMS

A. At a minimum, follow all manufacturer instructions. In case of discrepancy between manufacturer and contractor requirements, the more stringent shall apply. In the case of conflicting instructions, report any discrepancy to the Owner’s Representative in a timely fashion so as not to impact the construction timeline.

B. Application: Through Penetration Sealant Assemblies, Renenterable

1. Zero-maintenance firestop assemblies shall be used at all penetrations of rated partitions when the pathway on one or both sides of the wall, ceiling or floor is open, such as J-hooks or cable tray.
2. Communications cable tray or ladder rack shall not be continued through a fire-rated wall. Stop the tray or ladder rack, install multiple zero- maintenance firestop assemblies as needed, and continue the tray or ladder rack on the other side. Ensure grounding of the cable tray is continuous through the wall.
3. Electronic security system conduit sleeves through a single fire-rated wall shall not be used. For these applications, a zero-maintenance firestop assembly is required.

C. Application: Firestopping for Conduits and Other Closed Pathways
1. Firestopping is required for all fire-rated penetrations where a electronic security system conduit or other closed pathway penetrates one or more membranes of a fire-rated wall floor or ceiling
2. Required for all electronic security system outlets located on fire-rated walls. Systems shall be UL CLIV tested

D. For all penetrations for electronic security system openings through fire-rated walls, floors and ceilings, install the same manufacturer's product for that type of penetration throughout the project.

E. Coordinate with all other trades prior to installation:
1. To ensure that through penetration firestop systems are installed according to specified requirements.
2. To ensure that sizing of openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems is appropriate.

F. All penetrations through fire-rated building structures (walls, ceilings and floors) shall be sealed with an appropriate firestop system that at least matches the fire rating of the structure. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire-rated structure).
1. Any penetrating item i.e., riser slots, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.
2. Through penetrations shall be sealed on both sides of the structure.
3. Electronic security system outlet back-boxes installed in fire-rated walls shall be completely enclosed in an appropriate firestopping assembly within the wall.
4. Conduit sleeves shall not be used for penetrating fire-rated floors, ceilings and walls. A zero-maintenance firestop assembly shall be used instead.

G. Verify the locations of all fire-rated walls prior to installation.

H. Firestopping assemblies must make a gas, smoke and water tight seal when activated in a fire.

I. Multiple cable bundles planned to penetrate a fire-rated wall and entering the same space within 10 feet of each other shall be consolidated in to a single penetration, unless one or both penetrations are membrane penetrations.

J. Ambient Conditions:
1. Do not install firestopping products when ambient or substrate temperatures are outside the limitations recommended by the manufacturer.
2. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.
3. Maintain the minimum temperature before, during, and for a minimum 3 days after installation of materials.

K. Schedule installation of firestopping after completion of the penetrating item (e.g., conduit) installation but prior to the covering or concealing of openings.

L. Before beginning installation:
1. Examine and clean the affected surfaces, as they shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.
2. Provide masking and temporary covering to protect adjacent surfaces.
3. Do not proceed until unsatisfactory conditions have been corrected.

M. After installation:
1. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
2. Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.
3. Do not cover installed firestopping assemblies until inspected by the Owner's Representative.

N. All firestop systems (including the cabling through them) and identification labels shall be installed prior to the Owner Representative's above-ceiling inspection.

O. Labeling
1. At all firestop locations, install a permanent label near the firestop on each side of the wall, ceiling or floor. Labels shall be pre-printed and include:
a. Manufacturer of the firestop.
b. Name of product and UL System Number.
c. Name of installer and company name
d. Date of installation.
e. Rating of the wall/system (F and T ratings).
2. One location may have multiple labels (e.g. for a firestop in the annular space around a conduit penetration and a firestop within the conduit around the cables).
3. Labels shall not be painted over or otherwise obscured or defaced.

2.9 SUPPORTING DEVICES

A. General
1. Supports to be sized to suit load and selected to match mounting conditions

B. Manufacturers
1. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
a. Concrete fasteners:
1) Phillips "Red-Head".
2) Remington.
3) Ramset.
4) Hilti
5) Simpson Strong-Tie
6) or equal.
b. Concrete inserts and construction channel:
1) Unistrut Corp.
2) GS Metals "Globe Strut."
3) Thomas & Betts "Kindorf" Corp.
4) Or equal.
c. Conduit straps:
1) O-Z/Gedney.
2) Erico "Caddy" Fastening Products.
3) Thomas & Betts "Kindorf" Corp.

4) Or equal.

d. Beam Clamps
   1) Cooper B-Line
   2) SuperStrut
   3) Unistrut
   4) or equal

e. Aircraft Cable Sway Braces
   1) Mason Industries
   2) M.W. Sausse/Vibrex
   3) Loos & Company, Inc.
   4) or equal.

C. Concrete Fasteners
   1. Provide expansion-shield type concrete anchors.
   2. Provide powder driven concrete fasteners with washers. Obtain approval by Owner's Representative prior to use.

D. Concrete Inserts
   1. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.

E. Aircraft cable sway braces
   1. Steel rope sized to meet load.

F. Construction Channel:
   1. Construction:
      a. 1-5/8" square galvanized channel formed from U.S.S.G No. 12 or 0.109 inch cold formed steel with 17/32-inch diameter bolt holes, and 1-1/2 inch on center in the base of the channel.
      b. 10 foot sections.
   2. All supporting materials by same manufacturer.

G. Beam Clamps
   1. Malleable iron electro-galvanized steel beam clamps selected to match building structural steel members.

H. Conduit Straps
   1. One hole strap, steel or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.
      a. Use malleable strap with spacers for exterior and wet locations.
      b. Use steel strap without spacers for interior locations.
   2. Steel channel conduit strap for support from construction channel.
   3. Steel conduit hanger for pendant support with threaded rod
   4. Steel wire conduit support strap for support from independent #12 gauge hanger wires.

I. Threaded rods, couplings, screws and nuts:
   1. Electrolytically coated with zinc, 2 oz. zinc per square foot of surface, ASTM A123 or A153.

J. Miscellaneous Parts
   1. Hot dipped galvanized after fabrication; after cutting, de-burring and hole drilling. Coated with zinc, 2 oz. zinc per square foot of surface, ASTM A123 or A153.

K. Exterior/Wet Service Application

1. Electronic security systems hangers or supports in wet areas or areas exposed to outside air including but not limited to building exterior, Tank Farm, AH-1 Mechanical Room, Greenhouse Interior or similar, shall be need to be suitably corrosion resistant, constructed of either 316 stainless steel or non-metallic
2. Manufacturers:
   a. Cooper Industries
   b. Champion Fiberglass
   c. Enduro Composites
   d. Seasafe
   e. Or equal.

L. Paint/Tape for Touch-up:
   1. Zinc: CRC "Zinc-It", Glyptal, Enterprise Galvanizing “Galambra”, or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. The Owner’s Representative reserves the right to request additional supports where in their sole opinion said supports are required. Any additional supports shall be installed at no additional cost to the Owner.

3.2 EXAMINATION

A. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.3 PREPARATION

A. Coordinate size, shape and location of concrete pads required for equipment installation with the work of the other trades

B. Lay out support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.

C. Where shown on the Drawings or Specifications, install freestanding Electronic Safety and Security equipment on concrete pads.

3.4 CONDUIT APPLICATION

A. General: Install the following types of conduits and fittings in the locations listed, unless otherwise noted in the drawings:
   1. Exterior, Exposed:
      a. Type 316 Stainless Steel. with either watertight EMT or IMC type stainless steel fittings. Provide non-metallic or 316 SS supports.
   2. Interior, Exposed, Wet and Damp Locations:
      a. Type CRSC.
   3. Interior, Hazardous Locations
      a. Type RSC
      b. Type IMC, where permitted by the CEC.
   4. Interior, exposed or concealed, dry locations:
      a. RSC, if subject to physical abuse.
      b. EMT, if not subject to physical abuse.
   5. Interior, concealed, damp locations, including in masonry walls.

a. RSC
6. Embedded in Concrete
   a. RSC or rigid non-metallic conduit.
   b. PVC Type Schedule 40.
7. Transition from walls, floor boxes and monuments to open plan furniture systems:
   a. Liquidtight

3.5 GENERAL REQUIREMENTS

A. Refer to the manufacturer's instructions and conform thereto.

B. Distribution Pathway via EMT Raceway:
1. EMT conduit is to be installed meeting the NEC handbook Article 348 Installation Specifications.
2. Provide escutcheon plates for all through wall conduit stubs.
3. All ends of conduits shall be cut square, reamed and fitted with insulated bushing.
4. All conduit which passes through fire walls shall be sealed with fire stop putty after all station wire has been installed.

3.6 MOUNTING AND INSTALLATION– DEVICE BOXES

A. Conform to the more restrictive of NEMA OS 3-2002 and the following.

B. Provide backboxes at all Electronic Safety and Security systems devices. Installation of device plates directly to wall surface without use of a backbox, unless specifically directed on plans, is unacceptable.

C. The distance between pull boxes shall not exceed 150 feet or more than two 90 degree bends.

D. Align boxes plumb with floor and surrounding construction. At door frames, locate 4" from frame. Verify placement with Owner’s Representative details to ensure that box clears all trim, etc.

E. Support and fasten boxes securely. At stud walls use rigid bar hangers, attached to hanger with stud and nut.

F. At existing locations, provide cutting, patching and finishing as required to maintain or restore finishes so that resulting installation is integrated into the Architectural decor of the particular location.

G. Mounting Height: the mounting height of a wall-mounted outlet box is defined as the height from the finished floor to the horizontal center line of the cover plate.

H. Mount outlet boxes with the long axis vertical. Three or more gang boxes shall be mounted with the long axis horizontal.

I. Install wiring jacks and outlet devices only in boxes which are clean; free from excess building materials, dirt, and debris.

J. Install wiring jacks and outlet devices after wiring work is complete.

3.7 TERMINAL CABINETS, JUNCTION BOXES, AND PULL BOXES

A. General

1. Thoroughly examine site conditions for acceptance of cabinets and enclosures installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

B. Set cabinets and enclosures plumb and symmetrical with building lines. Furnish and install all construction channel bolts, angles, etc. required to mount all equipment furnished under this Section of the Specifications.

C. Cabinets and enclosures shall be anchored and braced to withstand seismic forces calculated in accordance with standards referenced in Section 27 05 29 – Hangers and Supports for Electronic Safety and Security Systems.

D. "Train" interior wiring, bundle and clamp using specified plastic wire wraps. Separate power and signal wiring.

E. Replace doors or trim exhibiting dents, bends, warps or poor fit that may impede ready access, security or integrity.

F. Terminate conduit in cabinet with lock nut and grounding bushing.

G. Cleaning
1. Touch-up paint any marks, blemishes or other finish damage suffered during installation.
2. Vacuum clean cabinet on completion of installation.

3.8 SUPPORT

A. Provide supports for raceways as specified in this Section.

B. All raceways installed in exposed dry locations shall be grouped in a like arrangement and supported by means of conduit straps, wall brackets or trapeze hangers in accordance with Code and the requirements of this Section. Fasten all hangers from the building structural system.

C. Provide supports and mounting attachments per the most restrictive of Code and the following Install no more than one coupling or device between supports.

Raceway Size (inches)	No of cables in run	Location	Support Spacing (feet)	
			RSC	EMT
Horizontal Runs				
½, 3/4	1-2	Flat Ceiling Wall Runs	5	5
½, 3/4	1-2	Where Access Limited To Building Structure	7	7
½, 3/4	3≥	Any Location	7	7
1≥	1-2	Flat Ceiling Or Wall	6	6
1≥	1-2	Where Access Limited To Building Structure	10	10
1≥	3≥	Any Locations	10	10
ANY	ANY	Concealed	10	10
Vertical Runs				
½, 3/4	ANY	Exposed	7	7
1, 1-1/4	ANY	Exposed	8	8

1-1/2≥	ANY	Exposed	10	10

D. The Owner's Representative reserves the right to request additional supports where in their sole opinion said supports are required. Any additional supports shall be installed at no additional cost to the Owner.

3.9 RACEWAY INSTALLATION

A. Access control and intrusion detection systems shall be installed in entirely in raceway sized for 30% cable fill maximum, including:
   1. Rough-in for the field devices as detailed and scheduled on the plans.
   2. Pull cabinets located at regular intervals in the building, sized to accommodate the access control and intrusion detection cabling.
      a. Size raceway between pull cabinets to accommodate fill of field devices.
      b. Provide two separate raceway systems
         1) one for power cabling, including power for door locks and field devices.
         2) one for Access Control and Intrusion Detection System field devices, including card readers, motion detectors, glass break sensors, request-to-exit sensors and similar.
   3. Wireway at backboard of BDF and IDF to terminate the raceway arriving from the pull cabinets and directly from the field devices.
   4. Terminal cabinets at backboard of BD and IDF to enclose the TB15's used to terminate the field wiring installed under the work of this contract.

B. General
   1. Raceway runs are shown schematically – Contractor to provide design and implementation of complete pathway system. Install concealed unless specifically shown otherwise. Supports, pull boxes, junction boxes and similar generally not indicated. Provide where designated in addition to those required by the Contractor's design.
      a. All raceway in new construction shall be run concealed, unless exposed construction is called for on the plans. Bring to the Owner Representatives any field conditions requiring exposed electronic security systems pathway and receive direction prior to proceeding.
         1) Conduit entries to device backboxes shall be made from the rear or side where concealed by architectural finish materials and shall not be exposed to public view and/or tampering.
      b. Install exposed conduit and raceway parallel and perpendicular to nearby surfaces or exposed structural members, and follow the surface contours. Level and square conduit and raceway runs.
      c. Raceway runs shall be mechanically and electrically continuous between all each equipment rack and utility demarcation point, receptacle and/or surface raceway strip, as applies.
      d. Each conduit shall enter and be securely connected to a cabinet, junction box, pull box, or outlet by means of a locknut on the outside and a bushing on the inside or by means of a liquid-tight, threaded, self-locking, cold-weld type wedge adapter.
      e. Conduit connections to enclosures will not interfere with components inside enclosure such as batteries, circuit boards, locking mechanisms etc.
      f. Conduit to be connected to enclosures via knockouts from factory. Additional penetrations are not permitted.
      g. Bends
         1) All bends or elbows shall have a minimum radius as follows:

Conduit Size (Inches)	Min. Radius (Inches)
3/4	8
1	12

1-1/4	18
2	24
2-1/2	24
3	30
3-1/2	30
4	30
5	36
6	42

2) Use factory elbows or machine bends for conduit bends 1-1/4" and larger.

h. Make bends and offsets so the inside diameter is not effectively reduced. Make bends in parallel or banked runs from the same center line so that the bends are parallel.

i. Install at least one (1) 3/8", 200 pound strength nylon pull cord in all empty raceways.

j. Raceways crossing building expansion joints or in straight runs exceeding 100 feet shall be provided with UL listed expansion fittings.

k. Install conduit seals and drains to prevent accumulated moisture in conduits from entering Electronic Safety and Security Systems enclosures.

2. Do not install conduit in concrete slabs unless specifically directed by Owner's Representative. Embedded conduits in concrete slab walls, and columns shall be installed in center third between upper and lower layers of reinforcing steel as directed by the Owner's Representative. Space conduits 8" on center except at cabinet locations where slab thickness shall be increased as directed by the Owner's Representative.
3. All conduits to be kept 12" away from steam or hot water lines. Install horizontal conduit and raceway runs below water and steam piping.
4. Conduit dropping down to equipment shall be as straight as possible without any offsets, parallel or perpendicular to walls, ceilings and other building features.
5. Conduit installed on any equipment shall be run symmetrical with the equipment and in such a manner as to:
   a. not to be exposed to damage;
   b. not interfere with access to components of the equipment that will interfere with maintenance operation or;
   c. not to be in a manner that the Owner deems detrimental to its operation.
6. Whenever an installation such as that listed occurs, the Contractor shall make all necessary changes at no additional cost to the Owner.
7. All cut ends of conduit, scratches, tool marks, etc. on any metallic raceway installed in the ground or on the exterior of the building shall be treated with two coats of specified Touch Up Paint/Tape.
8. Exposed conduit and metallic surface raceway installed in finished spaces shall be painted to match surrounding surfaces using paint and methods directed by the Owner's Representative.
9. All raceways stubbing up into equipment or racks shall be sealed. Raceways with conductors shall be plugged with duct-seal. Spare raceways shall be capped. Prevent foreign matter from entering conduit and raceway; use temporary closure protection. Replace conduits containing concrete, varnish or other foreign material.
10. Complete installation of conduit and raceway runs before starting installation of cables/wires within conduit and raceway.
11. Use specified conduit and raceway fittings that are of types compatible with the associated conduit and raceway and suitable for the use and location. Join and terminate conduit and raceway with fittings designed and approved for the purpose of the conduit and raceway system and make up tight.

12. Where chase nipples are used, align the raceway and coupling square to the box and tighten the chase nipple so no threads are exposed.
13. Horizontal conduit or EMT runs, where required and permitted, shall be installed as close to ceiling or ceiling beams as practical.
14. Conduit and EMT connected to wall outlets shall be run in such a manner that they will not cross water, steam or waste pipes or radiator branches.
15. Conduit and EMT shall not be run through beams, purlins or columns except where permission is granted by Owner's Representative in writing.
16. Bond installed metallic raceway in accordance with the requirements of the CEC.

3.10 RACEWAY FOR ACCESS CONTROL AND INTRUSION DETECTION SYSTEMS

A. Refer to general requirements herein above.

B. Access control and intrusion detection systems shall be installed in entirely in raceway below ceiling line in pathway size for 30% fill maximum, including:
   1. Rough-in for the field devices as detailed and scheduled on the plans.
   2. Surface mounted device boxes, including those intended to mount card readers, local alarm sounders and cameras, to be penetrated from the rear (through the backing construction assembly) to prevent exposing the device to tampering. Surface mount device boxes should be free of knockouts at the sides of the box exposed to public access/view.
   3. Pull cabinets located at regular intervals in the building, sized to accommodate the access control and intrusion detection cabling. Locate pull cans outside of public view.
      a. Size raceway between pull cabinets to accommodate fill of field devices.
      b. Coordinate backbox size to ensure that pathway connections to enclosures shall not interfere with components installed inside enclosure including batteries, circuit boards, locking mechanisms, etc. Undersized enclosures exhibiting interference with installed components to be replaced by the Contractor at no expense to the Owner.
      c. Pathway including flexible metal and armored cable shall terminate in the sensor or device enclosure.
      d. Ends of conduit shall be fitted with insulated bushings. Provide continuous complete non-flexible pathways, from device, including pull boxes for all field devices. Leaving exposed conductors at ends of conduits external to sensors and devices not acceptable except above accessible ceiling line.
   4. Gutter at backboard indicated security electronics termination points sized for 30% fill maximum, to terminate the raceway arriving from the pull cabinets and directly from the field devices pathway systems.
   5. Mounting field devices to the cover of surface mounted junction boxes is unacceptable and will be replaced at no cost to the Owner.

C. Steel wireway/gutter and terminal cabinets to be provided at backboards of indicated termination rooms to full enclose the electronic security systems access control and alarm systems wiring, terminal devices, TB15's and terminal blocks used to terminate the field wiring installed under the work of this contract as described elsewhere herein.

3.11 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only.

B. Install UL listed sealing fittings that prevent passage of explosive vapors in accordance with the manufacturers written instructions. Locate fittings at suitable, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank coverplate having a finish similar to that of adjacent plates or surfaces.

C. Install raceway sealing fittings at the following points and elsewhere as indicated:
   1. Where conduits enter or leave hazardous locations.

3.12 REUSE OF EXISTING CONDUIT

A. General
   1. Existing conduit is to be used as a pathway only where so shown on the drawings.
   2. Prior to beginning work involving the use of an existing conduit, the Contractor shall consult with the Owner's Representative in order to establish whether or not the conduit contains active service.
   3. If no active service exists within the conduit, all cable is to be removed, and work is to proceed.
   4. If active service does exist within the conduit and it has been determined that service needs to be disrupted, then work on that conduit shall not proceed until a schedule of service outage has been established by Owner's Representative. Once given direction to proceed, the Contractor shall within the time period of one (1) working day; remove the old cable, install, terminate and test the new cables, and notify the Owner's Representative the work using the specific conduit has been completed. The Owner's Representative shall be responsible for the disconnection and reconnecting of the active service cross-connects within the terminal closet(s).

B. Conduit preparation procedure:
   1. Remove existing wires and cables (if any).
   2. Run a mandrel ½" smaller than the inside diameter of the conduit through the conduit receiving new wires and cables.
   3. If the specified size mandrel will not pass through the existing conduit, start with a smaller size mandrel and increase mandrel size until the specified sized mandrel will pass.
   4. Run a wire brush and clean rag with an outside diameter 1/8" larger than the inside of the conduit through the conduit receiving new wires and cables.
   5. Repeat above until conduit is clean and materials detrimental to the wire and cables to be installed no longer exit conduit with the clean rag.

3.13 WIREWAY INSTALLATION

A. Install complete wireway system at electronic security systems backboards, including track, cover plate, device boxes, inside and outside elbows, splice plates, T's, transitions and extension rings and end caps as required.

B. Any existing surface raceway and/or exposed cabling along the indicated pathway of the raceway to be installed shall be removed prior to the installation of the new raceway. If the existing cabling contains active service, then Contractor shall consult with the Owner's Representative as to how best maintain the existing service before proceeding with the work.

C. Provide and install the proper factory fabricated corners, support clips, end connectors, etc. as required.

D. Corners and joints are to be cut neatly and finished using connector components of specified system. Where components are not available using specified system, to meet requirements of drawings, provide cleanly mitered joints, EMT and/or surface backboxes specified elsewhere herein.

E. All installed surface raceway shall be inspected for marks, scratches, gaps between sections or improper fitting of connector parts. All such damage shall be repaired to the Owner's Representatives satisfaction, or the raceway shall be removed and replaced.

F. Remove sharp corners and edges prior to installation of cable.

G. Attachment of raceway to walls, floors, and partitions:
1. Attach raceway to the supporting surface with mechanical fasteners applied to building structure per the most restrictive of manufacturer's directions, Code, or these provisions.
2. All surface raceway shall be installed so that its edges are parallel to the vertical or horizontal edge of the surface on which they are mounted. All surface raceway, found not to be installed in this manner, shall be removed and re-installed correctly.
3. Surface raceway shall be secured at 2'-0" intervals (2 spaced screws for 2" and wider raceways) with wood screws into wooden framing or self drilling wall anchors (ITWBildex "Heavy Duty E-Z Toggle", no known equal) into sheetrock or plastic inserts with pre-assembled drive screw for concrete (ITT-HOLUB "HI-DRIVE" nail anchors, no known equal) Powder (explosive charge) driven anchors are not acceptable. The use of adhesives as the sole means for fastening to any surface is not allowed.
4. Screws used in fastening surface raceway shall be no less than 3/4" in length.
5. The proper support clips, as called for by the manufacturer, for securing surface raceway to walls or floors are to be used per the manufacturer's instructions.

3.14 PENETRATIONS

A. Gypsum Wall Board Penetrations: Provide circular penetrations maximum 1/8" inch larger than outer diameter of conduit being used. On both sides of the wall fill space between conduit and wall with joint compound, depth to match gypsum board thickness.

B. As specified elsewhere herein, install UL listed fire-stop system whenever a raceway penetrates a firewall in conformance with the manufacturer's directions, the published systems assembly requirements, CBC Section 709 and 710 and CEC 300-21, whichever is the most restrictive. At cable tray penetrations, provide pillow type removable fire stop per CBC Section 709 and 710, the published systems assembly requirements and the manufacturer's directions, whichever is the most restrictive.

C. All Electronic Safety and Security systems conduit openings in walls and floors are the responsibility of the Contractor. Install sleeves shown on the drawings when the concrete is poured. Any openings required after the concrete has set maybe core drilled.

3.15 THROUGH PENETRATIONS SEALANT SYSTEMS

A. At a minimum, follow all manufacturer instructions. In case of discrepancy between manufacturer and contractor requirements, the more stringent shall apply. In the case of conflicting instructions, report any discrepancy to the Owner's Representative in a timely fashion so as not to impact the construction timeline.

B. Application: Through Penetration Sealant Assemblies, Renenterable
1. Zero-maintenance firestop assemblies shall be used when the pathway on one or both sides of the wall, ceiling or floor is open, such as J-hooks or cable tray.
2. Communications cable tray or ladder rack shall not be continued through a fire-rated wall. Stop the tray or ladder rack, install multiple zero- maintenance firestop assemblies as needed, and continue the tray or ladder rack on the other side. Ensure grounding of the cable tray is continuous through the wall.
3. Electronic security system conduit sleeves through a single fire-rated wall shall not be used. For these applications, a zero-maintenance firestop assembly is required.

C. Application: Firestopping for Conduits and Other Closed Pathways

1. Firestopping is required for all fire-rated penetrations where a electronic security system conduit or other closed pathway penetrates one or more membranes of a fire-rated wall floor or ceiling
2. Required for all teleelectronic security system outlets located on fire-rated walls. Systems shall be UL CLIV tested

D. For all penetrations for electronic security system openings through fire-rated walls, floors and ceilings, install the same manufacturer's product for that type of penetration throughout the project.

E. Coordinate with all other trades prior to installation:
1. To ensure that through penetration firestop systems are installed according to specified requirements.
2. To ensure that sizing of openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems is appropriate.

F. All penetrations through fire-rated building structures (walls, ceilings and floors) shall be sealed with an appropriate firestop system that at least matches the fire rating of the structure. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire-rated structure).
1. Any penetrating item i.e., riser slots, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.
2. Through penetrations shall be sealed on both sides of the structure.
3. Electronic security system outlet back-boxes installed in fire-rated walls shall be completely enclosed in an appropriate firestopping assembly within the wall.
4. Conduit sleeves shall not be used for penetrating fire-rated floors, ceilings and walls. A zero-maintenance firestop assembly shall be used instead.

G. Verify the locations of all fire-rated walls prior to installation.

H. Firestopping assemblies must make a gas, smoke and water tight seal when activated in a fire.

I. Multiple cable bundles planned to penetrate a fire-rated wall and entering the same space within 10 feet of each other shall be consolidated in to a single penetration, unless one or both penetrations are membrane penetrations.

J. Ambient Conditions:
1. Do not install firestopping products when ambient or substrate temperatures are outside the limitations recommended by the manufacturer.
2. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.
3. Maintain the minimum temperature before, during, and for a minimum 3 days after installation of materials.

K. Schedule installation of firestopping after completion of the penetrating item (e.g., conduit) installation but prior to the covering or concealing of openings.

L. Before beginning installation:
1. Examine and clean the affected surfaces, as they shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.
2. Provide masking and temporary covering to protect adjacent surfaces.
3. Do not proceed until unsatisfactory conditions have been corrected.

M. After installation:

1. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
2. Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.
3. Do not cover installed firestopping assemblies until inspected by the Owner's Representative.

N. All firestop systems (including the cabling through them) and identification labels shall be installed prior to the Owner Representative's above-ceiling inspection.

O. Labeling
1. At all firestop locations, install a permanent label near the firestop on each side of the wall, ceiling or floor. Labels shall be pre-printed and include:
   a. Manufacturer of the firestop.
   b. Name of product and UL System Number.
   c. Name of installer and company name
   d. Date of installation.
   e. Rating of the wall/system (F and T ratings).
2. One location may have multiple labels (e.g. for a firestop in the annular space around a conduit penetration and a firestop within the conduit around the cables).
3. Labels shall not be painted over or otherwise obscured or defaced.

3.16 SUPPORT INSTALLATION

A. Furnish and install supporting devices as noted throughout the Electronic Safety and Security Systems work.

B. Electronic Safety and Security device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.

C. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using powder actuated tools, precast inserts, expansion anchors, preset inserts or beam clamps.

D. Use powder actuated tools, self-drilling anchors, expansion anchor, or preset inserts on concrete surfaces.

E. Use sheet metal screws in sheet metal studs and wood screws in wood construction.

F. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or acoustical ceiling suspension wires.

G. Do not drill structural steel members unless first approved in writing by the Owner's Representative.

H. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

I. Install surface-mounted cabinets with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.

J. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.17 ERECTION OF METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.18 WOOD SUPPORTS

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

END OF SECTION

28 1300

ACCESS CONTROL AND ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Related Work in Other Sections:

1. Division 8 – Door Hardware

2. Section 27 15 00 – Communications Horizontal Cabling

    a. Provides the structured cabling to the access control and intrusion detection panels.

3. Section 28 05 00 – Common Work Results for Electronic Safety and Security

4. Section 28 05 13 – Conductors and Cables for Electronic Safety and Security

5. Section 28 05 28 – Pathways for Electronic Safety and Security

6. Section 28 23 00 – Video Surveillance

B. By the City

1. Ethernet Network switches connected to structured cabling installed at the Telecommunications Rooms by Division 27 under the work of this Project.

2. Microsoft Windows ActiveDirectory directory services for use in assigning access groups and users by the Contractor. Refer to the minimum functional directory services capabilities provided by the access control system provided under the work of this Section.

1.3 SCOPE

A. Work of Division 28 includes provision of a Unified Security Platform (USP), including fully integrated access control and video surveillance systems as described in Section 28 23 00 and this Section. Work of section 28 13 00 includes (but is not necessarily limited to) provision of the access control subsystem portion of the USP, including but not limited to:

1. Access Control System.

    a. Work of this Project provides a new enterprise grade access control system with headend server and storage located at the Telecom Rooms in building 1 and 2. The Access Control (ACS) shall include all intelligent field advanced processing controller, communication devices, card readers, combination card readers/keypads, access cards, I/O boards, power supplies, enclosures, mounting

hardware, and all other equipment as specified herein. All material shall be the manufacturer's standard catalog products.

b. Monitoring

1) The ACS shall allow system administrators to separate the creation and viewing of objects into partitions. ACS operators shall be associated with partitions and this shall determine which objects operators have the ability to create and or view.

a) The ACS partitions shall include but not be limited to the following objects:

Personnel

Clearances

Doors

Controllers with all associated hardware (readers, inputs, outputs, etc).

Video servers with all associated objects (cameras, tours, views, etc).

Application layouts

Events

Dynamic views

Maps

Reports, forms, results

Holidays

Badge layouts

Queries

Images

b) Graphical User Interface (GUI)

a) The ACAS shall employ a standard Windows graphical user interface (GUI). A mouse and keyboard shall be the primary operator interface with the system. Operator screens shall utilize all standard Windows-style functions such as drop-down menus, context menus, radio buttons, and lists, as appropriate. The interface shall utilize a 'tree structure' similar to Windows Explorer.

b) Administration Operator Interface

a) The ACAS shall employ an Administration Operator Interface to control the following:

Hardware (readers, inputs, outputs, door controls, other systems, future fully integrated video surveillance systems,).

Configuration of personnel records, operators and operator privileges.

Graphical Maps.

Application Layouts.

Dynamic Views.

Queries.

Import/Export of objects, including images.

System Variables.

Reports (either periodic or one-time).

System functions (event command and control, actions, schedules).

Display of a list of objects in a grid that can have their values modified and respond to real-time status changes.

Scheduling of backups.

Monitoring of system settings and performance.

Designing of and printing of badges.

The GUI shall be configurable by the system administrator to control the views and access of each Monitoring Station operator.

b) At the workstations, ACS system provides for real time monitoring of system status including graphical maps of the areas under the control of the system indicating alarm conditions correlated with camera call up of the cameras installed under the work of Section 28 23 00 for the cameras with views of the area of alarm as described elsewhere in this Section.

c) System views can be broken into up to 16 tiled focus areas within a single workstation's display to permit simultaneous display of multiple content (example: graphical map, event log, display of user record associated with event, and multiple camera views around event).

2) Workstation and web interface. System permits monitoring of full system feature set from web interface to permit monitoring from a remote sites if required by the City's operations.

c. Input and output points.

1) Work of this project installs new Card Readers at selected door openings as indicated on the plans.

2) Work of this project interfaces the ACS to field devices installed under the work of this Section:
   a) Door position switches.
   b) Local door alarms
   c) Electric locks and electric strikes
   d) Request to exit devices, including:

a) Door hardware with integral REX button functionality.

3) Work of this project interfaces to devices installed under the work of other Sections:
a) Power Door Operators and their controls

2. Intrusion Detection System

a. If the provided ACS system is not listed as a UL Listed 1076 Proprietary Burglar Alarm Unit, provide a separate commercial burglar alarm system consisting of intrusion detection panel and field devices, connected to the surrounding ACS alarm interface using SDK based IP signalling.

1.4 submittals

A. Refer to the requirements of Section 28 05 00 – Common Work Results for Electronic Safety and Security.

1.5 TRAINING

A. Train the City's Representatives in operation of the installed video management system. Provide a least three separate training tracks focused on the training needs of specific stakeholder groups within the City’s operation and technical staff including at least Operator Staff, Administrators and Citys Technical/Information Technology Support Staff.

1. For the Operator Staff provide at least eight hour classroom type training sessions, covering the basic theory and operation of the Access Control and Intrusion Detection system and provide up to 20 hours support for the initial systems operator during first use. Schedule the three different sessions at different times of the day/days of the week to accommodate the different schedules of the City’s staff.

2. For the Administrator Staff provide at least eight hours classroom type training in the theory and both basic and advanced operation and functions of the Access Control and Intrusion Detection system. Provide hands-on Training for the Command Center Administrator Staff, provide up to 8 hours hands-on support for in basic and advanced systems operations.

3. For the Citys Technical/Information Technology Support Staff and third party integrators staff provide eight hours classroom and hands-on training in Access Control and Intrusion Detection system functionality, IP communications protocols used, device handshaking, record importing and overall data flow through the system. Review directory tree integration mechanisms and requirements for tree maintenance. Review methods for bare metal recovery of operations. Review Access Control and Intrusion Detection manufacturer’s approved methods for software upgrades and hardware replacement, including failed disks in the storage array.

4. For each Training session, Document the training provided using a camera and video recorder and provide a copy of the recorded training to the City for future reference and use in training new staff.

1.6 quality assurance

A. General:

1. Conform to Section 28 05 00 - Common Work Results For Electronic Safety and Security.

2. The manufacturers of all hardware and software components employed in the system shall be established vendors to the access control/security monitoring industry for no less than five (5) years.

3. The security system integrator shall have been regularly engaged in the installation and maintenance of integrated access control systems similar in size and scope to that outlined herein for a period of no less than five (5) years. The installing integrator shall be certified by the manufacturer to be able to install and configure the Enterprise version of the manufacturer's access control system.

4. The security system integrator shall supply information attesting to the fact that their firm is an authorized product dealer for the system proposed at the Project site.

5. The security system integrator shall supply information attesting to the fact that their installation and service technicians are competent factory trained personnel capable of maintaining the systems of this scale and of providing reasonable service time.

6. The security system integrator shall provide a minimum of three (3) references whose systems are of similar complexity and have been installed and maintained by the security system integrator in the last five (5) years.

7. There shall be a local representative and factory authorized local service organization that shall carry a complete stock of parts and provide maintenance for these systems. Local shall be defined as an area in a 50 mile radius of installed location

B. Standards Agencies.

1. The ACS shall be tested and listed by Underwriters Laboratories (UL) for UL 294 for Access Control System Units.

2. Additionally, conform to the applicable portions of the following standards defined in 28 05 00 – Common Work Results for Electronic Safety and Security.

1.7 Definitions

A. ACS – Access Control System. The integrated system installed by the work of this Contract comprising the access control system, intrusion detection system and panic/duress alarms, including both central processing hardware and the remote field devices.

B. CSA – Client Software Application

C. DGP. Data Gathering Panel. Intelligent access control and alarm systems panel connected to the ACS network and to card readers, access control and intrusion detection field devices as specified elsewhere in this Section.

D. DGM – Dynamic Graphical Maps

E. ALPR – Automatic License Plate Recognition

F. SDK – Software Development Kit

G. SMA – Software Maintenance Agreement

H. SSM – Server Software Module

I. UI – User Interface

J. USP – Unified Security Platform

K. USW – Unified Web Client

L. VMS – Video Management System

1.8 Door SEQUENCE OF Operations.

A. The following outlines the minimum functionality that should be achieved at each opening equipped with card reader control.

B. Assumes doors are in armed condition.

1. Doors with Card Reader on One Side

a. Presentation of valid card at unsecure side:

1) Performs real-time lookup of card against current database to validate card status relative to door opening, day of week and time of day.

2) Provides positive success visual feedback - green light or similar - to card holder

3) Permits cardholder to operate door.

4) Logs entry in access database, including at minimum card number, door number and timestamp

5) Shunts alarm generation for door open status for City selected variable period (adjustable over a range of at least 10 seconds to 1 minute adjustable through ACAS software).

6) If double door opening, permits operation of second leaf during the City selected variable period without generating alarm.

b. Presentation of invalid or unreadable card at unsecure side of door:

1) performs real-time lookup of card against current database to validate card status relative to door opening, day of week and time of day.

2) provides positive failed visual feedback - red light or similar - to card holder and denies operation of door.

3) logs entry in access database, including at minimum card number (if readable), door number and timestamp

c. Approach to door opening from secure side

1) Doors equipped with Request to Exit: If occupant breaks approach beam from side farthest from door first, followed by beams closer to door, shunts generation of alarm on door operation for Construction Administrator selected variable period as for Card Readers above.

2) Doors equipped with Request to Exit equivalent in handle/crash bar: If occupant signals intent to exit from secure side by mechanically operating door hardware, shunts generation of alarm on door operation for City selected variable period as for Card Readers above.

3) Doors equipped with Release Button: On operating Release Button, shunts generation of alarm on door operation for City selected variable period as for Card Readers above.

4) If double door opening, permits operation of second leaf during the City selected variable period without generating alarm.

2. Doors with Card Readers on both sides, one side is secure, one side is unsecure.

a. Operation, General

1) Unless otherwise indicated, doors with dual card readers have an unsecure and secure side. A CR symbol appears on the unsecure side; a CRS symbol appears on the secure side. Neither magnetic locks nor delayed egress systems are to be installed. A valid card is necessary to operate the door from the unsecure side as for doors with single card readers

2) A valid card is necessary to shunt the door alarm when operating the door from the secure side. Failure to present a valid card does not prevent door from operating.

b. Presentation of valid card at unsecure side:

1) performs realtime lookup of card against current database to validate card status relative to door opening, day of week and time of day.

2) provides positive success visual feedback - green light or similar - to card holder

3) permits cardholder to operate door.

4) logs entry in access database, including at minimum card number, door number and timestamp

5) shunts alarm generation for door open status for City selected variable period (adjustable over a range of at least 10 seconds to 1 minute).

6) If double door opening, permits operation of second leaf during the City selected variable period without generating alarm.

c. Presentation of invalid or unreadable card at either side of door:

1) performs real-time lookup of card against current database to validate card status relative to door opening, day of week and time of day.

2) provides positive failed visual feedback - red light or similar - to card holder and, at unsecure side, denies operation of door

3) logs entry in access database, including at minimum card number (if readable), door number and timestamp

d. Presentation of valid card at secure side.

1) performs realtime lookup of card against current database to validate card status relative to door opening, day of week and time of day.

2) provides positive success visual feedback - green light or similar - to card holder

3) logs entry in access database, including at minimum card number, door number and timestamp

4) shunts alarm generation for door open status for City selected variable period (adjustable over a range of at least 10 seconds to 1 minute).

5) If double door opening, permits operation of second leaf during the City selected variable period without generating alarm.

3. Doors with Card Readers on both sides, both sides unsecure.

a. Operation, General

1) Where indicated by CR symbols on both sides of the door, the door opening to require a valid card to operate the door from either side.

2) Such door configurations shall not be installed where the door is part of an emergency egress path of travel.

b. Presentation of a valid card at either side:

1) performs realtime lookup of card against current database to validate card status relative to door opening, day of week and time of day.

2) provides positive success visual feedback - green light or similar - to card holder

3) permits cardholder to operate door.

4) logs entry in access database, including at minimum card number, door number and timestamp

5) shunts alarm generation for door open status for City selected variable period (adjustable over a range of at least 10 seconds to 1 minute).

6) If double door opening, permits operation of second leaf during the City selected variable period without generating alarm.

c. Presentation of invalid or unreadable card at either side of door:

1) performs real-time lookup of card against current database to validate card status relative to door opening, day of week and time of day.

2) provides positive failed visual feedback - red light or similar - to card holder and denies operation of door

3) logs entry in access database, including at minimum card number (if readable), door number and timestamp

4. Doors left open ("propped open") beyond the designated period generate an alarm at the central control panel indicating door and condition. If a local door alarm is shown in the vicinity of the door, causes the local door alarm to sound. Local alarms for door prop should provide an intermittent tone 30 seconds before going into alarm and triggering a solid tone upon alarm. Local door alarm can be cleared either from the access control system control screen or locally using designated key. Use of a key to silence the LA sounding, but shall not interrupt processing of other ACS events associated with event.

5. Doors operated while armed without presentation of a valid card, valid operation of a Request to Exit Device, operation of a release button or release by central control panel to generate an alarm at the central control panel indicating door and condition. If a local door alarm is shown in the vicinity of the door, causes the local door alarm to sound, Local door alarm can be cleared either from the access control system control screen or locally using designated key.

6. Doors provided with powered door operators to be configured to operate as follows:

a. Unsecure side

1) Depressing the door operator button without first presenting a valid card results and no action.

2) Depressing door operator button after presenting a valid card causes the DGP to signal the door operator to initiate door opening after the associated electric lock mechanism has been released.
a) In a double door, where the handle in an electric latch cannot be retracted remotely, this may include releasing an electric strike in the normally passive leaf of the opening.
b) City’s Representative to provide direction as to the length of time for which the door operator button to remain operational following receipt of a valid card.

b. Secure side

1) Depressing door operator button causes the DGP to signal the door operator to initiate door opening after the associated electric lock mechanism has been released.
a) In a double door, where the handle in an electric latch cannot be retracted remotely, this may include releasing an electric strike in the normally passive leaf of the opening.

C. Gate Operation

1. Presentation of valid card or vehicle emitter at unsecure side:

a. performs real-time lookup of card against current database to validate card status relative to gate, day of week and time of day.

b. provides positive success visual feedback - green light or similar - to card holder.

c. signals gate controller to operate gate.

d. logs entry in access database, including at minimum card number, door number and timestamp

e. shunts alarm generation for gate open status for City's Representative selected variable period (adjustable over a range of at least 30 seconds to 2 minutes).

2. Presentation of invalid or unreadable card at unsecure side of gate:

a. performs real-time lookup of card against current database to validate card status relative to gate, day of week and time of day.

b. provides positive failed visual feedback - red light or similar - to card holder and denies operation of gate logs entry in access database, including at minimum card number (if readable), door number and timestamp

3. Approach to gate from secure side

a. detector loop or similar device detects presence of vehicle at exit point.

b. receives signal from gate operator on action to operate Gate.

c. shunts alarm generation for gate open status for City's Representative selected variable period (adjustable over a range of at least 30 seconds to 2 minutes).

4. Detects forced operation of gate/operation of gate without use of valid card, remote release by Controller or in response to inductive loop detector or its functional equivalent.

a. generates an alarm at the central control panel indicating gate location and condition

D. Tamper Monitoring

1. Tampering with the DGP (removing its cover panel) or of other monitored electronic security system pullbox covers to be reported to the central ACS monitoring station. Restoral events (replacement of cover) to similarly be reported to the central ACS monitoring station.

1.9 coordination

A. Coordinate the work of this contract with the related work of at least the following parties:

1. City’s Physical Security Staff

2. City’s IT staff and the IT Integrators working for the City

PART 2 - Products

2.1 UNAUTHORIZED MATERIALS

A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the City.

2.2 ACCEPTABLE MATERIALS

A. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section

2.3 Electronic Access Control System

A. General Requirements

1. The ACS shall be an enterprise class IP access control software solution. It shall be fully embedded within a Unified Security Platform (USP). The USP shall allow the seamless unification of the ACS with an IP video management system (VMS).

2. The ACS shall be highly scalable to support configurations consisting of at least double the number of doors indicated as the work of this Project.

3. The ACS shall support an unrestricted number of logs and historical transactions (events and alarms) with the maximum allowed being limited only by the amount of hard disk space available.

4. The ACS shall support a variety of access control functionalities, including but not limited to:

a. Controller (Unit) management, door management, elevator management, and area management.

b. Cardholder and cardholder group management, credential management, and access rule management.

c. Badge printing and template creation.

d. Visitor Management. (Specifier, additional license required)

e. People counting, area presence tracking, and mustering.

f. Offering a framework for third party hardware integration such as card and signature scanner.

5. Certification

a. The ACS shall be certified

1) UL-294

2) ULC-S319

3) EN-60839-11-1

B. Failover and Standby Requirements

1. The USP shall support native and off-the-shelf failover options.

2. Failover Directory. Provide failover directory capability as follows:

a. The Standby Directory shall act as a replacement SSM on hot standby, ready to take over as the acting Directory in case the primary Directory fails. The failover shall occur in less than 1 minute. No action from the user shall be required.

b. The USP shall provide at least (1) Directories on standby, lined up to take over as the acting Directory in a cascading fashion. Under the work of this Project, provide for the ability to failover from the Primary directory to one backup standby directory.

c. The Standby Directory shall keep its configuration database synchronized with the primary Directory.

d. The Standby Directory shall support disaster recovery scenarios where a server can be located in another geographic area (or building) and only take over if all other Directories become offline.

e. The Standby Directory shall support synchronization of the configuration databases using a backup and restore mechanism. The synchronization period shall be configurable from 15 minutes to 1 week.

f. The Standby Directory shall support real-time synchronization of the configuration databases using SQL Mirroring or SQL Always On.

C. ACS Access Management

1. The ACS shall be based on an open architecture able to support multiple access control hardware manufacturers. The ACS shall be able to integrate with multiple non-proprietary interface modules and controllers, access readers, and other third party applications.

2. The ACS shall be an IP enabled solution. All communication between the ACS and hardware controllers shall be based on standard TCP/IP protocol.

3. Access Manager Role

a. The Access Manager Role shall be the server that synchronizes all access control hardware units under its control, such as door controllers and IO modules. It shall also be able to validate and log all access activities and events when the door controllers and IO modules are online.

b. The Access Manager Role shall maintain the communication link with the hardware controllers under its control. It shall also continuously monitor whether the controllers are online or offline.

c. Synchronization of hardware units shall be automated and transparent to users and shall occur in the background. It shall also be possible to manually synchronize units or to synchronize units on a schedule.

d. The Access Manager Role shall support doors and controllers located within one or more facilities. The Access Server shall support a minimum of 200 readers and up to 1024 readers per computer. Provide Access Servers in quantities as required to manage the indicated quantity of readers plus 40% growth without additional hardware or software.

4. The Access Server shall store all access events associated with the doors, areas, hardware zones (hardware input points), elevators, and controllers under its direct control.

D. ACS Hardware Compatibility List

1. The ACS shall have an open architecture that supports the integration of third party IP-based door controllers and IO modules. The ACS shall simultaneously support mixed configurations of access control hardware from multiple vendors.

2. The ACS shall support multiple types of hardware devices: single-reader controllers, 2-reader controllers, 1- to 64-reader controllers, integrated readers and door controllers, and Power-over-Ethernet (PoE) enabled door controllers.

3. The ACS shall support most industry standard card readers that output card data using the Wiegand protocol and Clock-and-Data.

4. The ACS shall support the following IP-enabled controllers:

a. The access control manufacturer's Master Controller

b. The access control manufacturer's

c. HID VertX

d. HID VertX EVO

e. HID Edge

f. HID Edge EVO

g. Mercury controllers and SIO modules

h. Mercury M5 Bridge

i. Assa Abloy Aperio RS485 8 to 1 hub

j. Assa Abloy IP Locks (no DSR required)

1) Corbin Russwin

2) Sargent Passport

3) Sargent Profile

4) IN120

k. Salto Sallis RS485 and PoE routers

l. Schlage AD-300 and AD-400 electronic locks

m. Axis A1001

n. STid RS485 readers

o. DDS AS34/TPL4

5. The following USB enrollment readers shall be supported – provide as required to match enrollment reader provided under the work of this Project:

a. RF Ideas AIR ID Enroll iCLASS ID# USB reader for enrolling HID iCLASS cards

b. RF Idea AIR ID Enroll pcProx Plus w/iCLASS reader for enrolling proximity and iCLASS cards

c. STid STR-W35-E/PH5-5AA

d. HID Omnikey 5x2x USB readers

E. Seamless Unification with VMS

1. Through the USP, the ACS shall support integration with an IP Video Surveillance System or MVS. Integration with an IP video surveillance system shall permit the user to view live and recorded video.

2. Users shall be able to associate one or more video cameras to the following entity types: doors, elevator, and hardware zone (input points) and more.

3. The Monitoring UI shall present a true Unified Security Interface for access control and video surveillance. Advanced live video viewing and playback of archived video shall be available through the Monitoring UI.

4. It shall be possible to view video associated with access control events when viewing a report.

F. ACS Controller (Unit) Management

1. The ACS shall support the discovery, configuration, and management of IP enabled controllers and IO modules (hardware units). A user shall be permitted to add, delete, or modify a controller if he or she has the appropriate privileges.

2. The ACS shall support automatic unit discovery. The user shall establish the settings for discovery ports and for the types of unit discovery and the ACS shall automatically detect all connected devices.

3. The ACS shall support a unit swap utility for swapping out an existing controller with a new controller. The unit swap utility shall avoid the reprogramming of the system whenever a unit is replaced. All logs and events from the old unit shall be maintained.

4. The ACS shall support pre-configuration of the system prior to the physical hardware installation.

G. ACS Cardholder And Cardholder Group Management

1. The ACS shall support the configuration and management of cardholders and cardholder groups. A user shall be able to add, delete, or modify a cardholder or cardholder group if he or she has the appropriate privileges.

2. Custom fields shall be supported for both cardholders and cardholder groups.

3. The ACS shall permit the following activation/expiration options for a cardholder's profile: delayed activation of a cardholder's profile, expiration based on the date of first use of credentials, or expiration on a user-defined date.

4. It shall be possible to associate a picture to a cardholder's profile. The picture shall be imported from a file, captured with a digital camera, or captured from a video surveillance camera. When a cardholder event occurs, the picture of the cardholder shall be displayed in the Monitoring UI. The ACS shall support multiple standard picture formats.

5. Cardholder groups shall enable the grouping of cardholders to facilitate mass changes to system settings. It shall be possible to assign cardholder groups to access rules, thus avoiding the assignment of one cardholder at a time.

6. It shall be possible to search by picture association, custom fields, names and credential codes.

7. It shall be possible to select multiple cardholders for immediate deactivation or reactivation.

8. The ACS shall provide the synchronization of cardholders and cardholders group through Microsoft Active Directory including the credentials and pictures of the cardholders.

H. ACS Credential Management

1. The ACS shall support the configuration and management of credentials, e.g. access cards and keypad PIN numbers. A user shall be able to add, delete, or modify a credential if the user has the appropriate privileges.

2. Users shall be able to add Custom Fields (user-defined fields) to credentials. Creating a new credential shall be accomplished either manually or automatically.

3. Automatic creation shall allow the user to create a credential entity by presenting a credential to a selected reader. The ACS shall read the card data and associate it to the credential entity. It shall be possible to automatically enroll any card format (128 bits or less).

4. The ACS shall support multiple credentials per cardholder without necessitating duplicate cardholder information. The ACS shall automatically detect and prevent attempts to register an already-registered credential.

5. Batch enrollment of credentials shall be supported.

6. The ACS shall provide a workflow for badge issuance and card requests.

I. ACS Custom Card Formats

1. A custom card format feature shall allow the administrator to add additional custom card formats using an intuitive tool within the Configuration UI. The custom card format tool shall be flexible in the following ways:

   a. Once enrolled, new custom card formats shall appear in the card format lists for manual card enrollment.

   b. An unrestricted number of additional custom card formats can be added.

c. Shall support credential with up to 256 bits.

d. The administrator shall be able to set the following options when defining a new format:

1) The order in which card fields appear in the user interface or CSA.

2) Whether a field is hidden from or visible to an operator.

3) Whether a field is read only or modifiable by an operator.

4) Complex parity checking schemes.

5) The order and location of a field's data. Location can be defined on a bit-by-bit basis.

J. ACS Badge Designer

1. The badge designer shall allow the creation of badge templates that define the content and presentation format of a cardholder badge to be printed.

2. Badge production shall consist of selecting the credential, the badge template, and clicking print.

3. Batch printing of cards shall be available.

4. The contents of a badge template can include: cardholder's first and last name, picture, custom fields, bitmap graphics, lines, ovals, rectangles, dynamic text labels linked to custom fields and static text labels, and barcodes (Interleaved 2 of 5, Extended Code 39).

5. Copy and paste of badge template objects shall be available.

6. It shall be possible to set the border thickness, and color, the fill color of badge objects (content), and the color of text labels.

7. Settings, such as object transparency, text orientation, and auto-sizing of text shall be available or transparent to the user.

8. Supported badge formats shall be (portrait and landscape): CR70 (2.875" x 2.125"), CR80 (3.37" x 2.125"), CR90 (3.63" x 2.37"), CR100 (3.88" x 2.63"), and custom card sizes.

9. Dual-sided badges shall be supported.

10. A badge template import and export function shall be available to allow the sharing of badge templates between distinct or independent ACS.

11. Chromakey shall be supported.

K. ACS Door Management

1. The ACS shall support the configuration and management of doors. A user shall be able to add, delete, or modify a door if he or she has the appropriate privileges.

2. The ACS shall permit multiple access rules to be associated to a door.

3. The ACS shall support the following forms of authentication: Card Only, Card or Keypad (PIN), or Card and Keypad (PIN). It shall be possible to define a schedule for when Card Only or Card and Keypad authentication modes shall be required.

4. It shall be possible to set an extended grant time on a per-door basis (in addition to the standard grant time). Cardholder properties shall include the option of using the extended grant time. When flagged cardholders are granted access, the door shall be unlocked for the duration of the extended grant time instead of the standard grant time.

5. The ACS shall allow the configuration of the relocking mode on doors such as on door open, after a definite time, or on door close.

6. The ACS shall support the ability to enforce the use of two valid reads from different cardholders to grant access to an area.

7. The ACS shall support the ability to enable access rules for other cardholders once a supervisor has accessed an area.

8. The ACS shall support the ability to enable unlocking schedule on a door once an employee has entered the facility.

9. Readerless doors.

    a. The ACS shall support doors configured solely with a lock, a REX, and a door contact but without readers.

    b. The implementation of a readerless door shall be possible with the use of standard access hardware IO modules. External hardware such as timers, shall not be required.

    c. Unlocking schedules shall be programmable for readerless doors.

    d. Standard door activity reports shall also be possible with readerless doors.

10. Unlocking schedules and exceptions to unlocking schedules shall be associated with a door. An unlocking schedule shall determine when a door should be automatically unlocked. The ACS shall also support the use of a specific offline unlocking schedule. Exceptions to unlocking schedules shall be used to define time periods during which unlocking schedules shall not be applied, such as during statutory holidays.

11. The ACS shall support one or more cameras per door. Video shall then be associated to door access events, such as access grant or access denied.

L. ACS Elevator Management

1. The ACS shall support the configuration and management of elevators. A user shall be able to add, delete, or modify an elevator if he or she has the appropriate privileges.

2. The ACS shall be able to control access to specific floors using a reader within the elevator cab. Control shall be available through the use of a controller with an interface to a reader and to multiple output modules with relays.

3. Elevator floor selections shall be tracked using a controller with an interface to multiple input modules. Floor tracking shall be available within an elevator activity report.

4. The elevator control module shall continue to function in offline mode should communication between the ACS and the controller fail.

5. The ACS shall support one or more cameras per elevator cab. Video shall then be associated to elevator access events, such as access grant or access denied.

M. ACS Visitor Management

1. The ACS shall support the configuration and management of visitors. A user shall be able to enroll or remove a visitor if he or she has the appropriate privileges. The ACS shall support the check-in and check-out of visitors from the Monitoring UI.

2. A visitor check-in wizard shall facilitate the enrollment process, allowing a user to specify the visitor's specific information.

3. The ACS shall permit the following credential options during visitor check-in:

   a. Use an existing credential.

   b. Automatically create a new credential.

   c. Manually create a new credential.

4. The ACS shall support the creation of a pool of visitor credentials in advance. Existing visitor credentials shall be assigned to visitors during the check-in process.

5. The ACS shall permit cardholder groups to be designated as "available for visitors". Users shall be able to define the access privileges for the cardholder groups (visitor cardholder groups) in advance. During visitor check-in, the user shall select the appropriate visitor cardholder group to associate with a visitor. All of the visitor cardholder group access privileges shall be automatically transferred to the visitor. This feature shall permit the creation of multiple types of visitor groups and associated privileges, such as for contractors, VIPs, and day visitors. Visitors added to a visitor cardholder group in the Monitoring UI shall be automatically updated in the Configuration UI cardholder group screen.

6. A visitor's profile shall support the real-time modification of visitor information after a visitor has checked-in.

7. The ACS shall also provide comprehensive visitor tracking and visitor reporting. Through the real-time tracking feature, the ACS shall generate a real-time and historical visitor activity listing in the Monitoring UI. The ACS shall also generate visitor-specific reports that provide comprehensive listings of visitors as well as full details on their movement.

8. It shall be possible to exempt a visitor from any antipassback rules in effect.

9. The operator shall be able to print visitor badges during the check-in process. The printing of both paper badges (visitor without an assigned credential) and actual credentials shall be supported.

10. Visitor management and reporting shall be available through the Web Client as well.

11. It shall be possible to locate a visitor`s information or profile by swiping the visitor`s credential (card) at a USB reader.

12. It shall be possible to tag the person visited to the visitor's profile.

13. It shall be possible to require that the visitor must have an escort to enter an area and that the escort must badge-in to confirm the access of the visitor.

N. ACS People Counting & Area Presence Tracking (Mustering)

1. The ACS shall support people counting (or area presence tracking). The ACS shall be able to monitor and report the number of cardholders in an area in real-time and for all areas. Monitoring shall be based on the entire access control infrastructure, for both local areas and those in remote geographic locations. People counting can also be used to perform mustering.

2. The ACS shall report area presence counts in the UI. Area presence tracks shall dynamically track the total number of cardholders in an area. Displayed data shall be updated dynamically.

3. The ACS shall be able to generate an area presence report listing the cardholders located in one or more areas, accessible through the Monitoring UI. It shall be possible to filter the report by area and time period. The report shall also include activity from sub-areas (nested areas).

4. Through people counting, the ACS shall be able to generate First Person In and Last Person Out events. The First Person In event shall detect when the first cardholder enters an empty area. The Last Person Out event shall detect when the last cardholder leaves an area. It shall be possible to trigger actions from both events such as sending a message or triggering an alarm.

5. The ACS shall be able to determine the entry of a cardholder based on a dedicated sensor.

O. ACS Custom Fields (User-Defined Fields)

1. The ACS shall permit the creation of custom fields. Up to 1,000 custom fields shall be supported.

2. Custom fields shall be supported for the following entities: cardholders, cardholder groups, credentials, and visitors.

3. Supported custom fields shall include: text, integers, decimal numbers, dates, Boolean, and images (graphics).

4. Users shall be able to define a default value for a custom field.

5. The creation of new custom field types shall be possible. New custom field types shall be based on the standard custom fields supported. They shall support user-defined values from which an operator must make a selection.

6. Administrators have the ability to define which users can view and modify specific custom fields. This shall limit the access to custom field data to users with pre-defined privileges. The ACS shall support querying and report generation using custom fields.

7. Custom fields can be grouped and ordered within these groups as defined by the user.

8. Values for custom fields can be imported using the Import Tool.

P. ACS Import Tool

1. The ACS shall support an integrated Import Tool to facilitate the import of existing cardholder and credential data. The import of data shall be through the use the CSV file format. The tool shall be available from the Configuration UI.

2. The Import Tool shall also support the ability to manually import data that has been exported from a third party database if it is in CSV format.

3. The import tool shall permit the import of the following data:

   a. Cardholder name, descriptions, picture, email, and status.

   b. Cardholder group information.

   c. Credential name, status, format, and card number (including credentials with custom formats).

   d. Partition information.

   e. Custom fields.

4. Full flexibility in selecting the fields to be imported during an import session shall be available.

5. The option to use a custom and unique cardholder key shall be specified during the import process to ensure that cardholders with duplicate names will not have their data overwritten. Cardholder key generation shall be automated. The end user shall have the option to select which fields will be used to create this unique key, e.g. credential number, custom fields, cardholder name.

6. The ACS shall also support re-importing a CSV file containing new information to update existing information in the ACS database. Re-importing shall enable bulk amendments to existing access control data.

Q. General Client Software Requirements

1. The Client Software Applications (CSA) shall provide the user interface for USP configuration and monitoring over any network and be accessible locally or from a remote connection.

2. The CSA shall consist of the Configuration UI for system configuration and the Monitoring UI for monitoring. The CSA shall be Windows-based and provide an easy-to-use graphical user interface (UI).

3. The CSA for monitoring shall support running in 64-bit mode.

4. The Server Administrator shall be used to configure the server database(s). It shall be web-based and accessible locally on the SSM or across the network.

5. The CSA shall seamlessly merge access control, license plate recognition (ALPR), and video functionalities within the same user application.

6. The USP shall use the latest user interface (UI) development and programming technologies such as Microsoft WPF (Windows Presentation Foundation), the XAML markup language, and the .NET software framework.

7. All applications shall provide an authentication mechanism, which verifies the validity of the user. As such, the administrator (who has all rights and privileges) can define specific access rights and privileges for each user in the system.

8. Logging on to a CSA shall be done either through locally stored USP user accounts and passwords or using the operators Windows credentials when Active Directory integration is enabled.

9. Using the City's Microsoft Active Directory facility, the CSA and USP shall authenticate users using their Windows credentials. As a result, the USP will benefit from Active Directory password authentication and strong security features.

10. The CSA shall support multiple languages, including but not limited to the following: English, French, Arabic, Czech, Dutch, German, Hebrew, Hungarian, Italian, Japanese, Korean, Norwegian, Persian (Farsi), Polish, Portuguese (Brazilian), Simplified and Traditional Chinese, Russian, Spanish, Swedish, Thai, Turkish and Vietnamese.

11. To enhance usability and operator efficiency, the Configuration UI and Monitoring UI shall support many of the latest UI such as:

    a. A customizable Home Page that includes favorite and recently used tasks.

    b. Task-oriented approach for administrator/operator activities where each type of activity (surveillance, visitor management, individual reports, and more) is an operator task.

    c. Consolidated and consistent workflows for video, ALPR, and access control.

    d. Single click functionality for reporting and tracking. The Monitoring UI shall support both single-click reporting for access control, ALPR, and video, as well as single-click tracking of areas, cameras, doors, zones, cardholders, elevators, ALPR entities, and more. Single-click reporting or tracking shall create a new task with the selected entities to report on or track.

12. Configuration UI and Monitoring UI Home Page and Tasks

    a. The Configuration UI and Monitoring UI shall be task-oriented.

    b. A task shall be user interface design patterns whose goal is to simplify the user interface by grouping related features from different systems such as video and access, in the same display window. Features shall be grouped together in a task based on their shared ability to help the user perform a specific task.

    c. Tasks shall be accessible via the Home Page of either the Configuration or the Surveillance CSA.

    d. Newly created tasks shall be accessible via the Configuration UI or the Monitoring UI taskbar.

    e. Similar tasks shall be grouped into the following categories:

1) Operation: Access control management, LRP management, and more.

2) Investigation: access control activity reports, visitor activity reports, alarm reports, and more.

3) Maintenance: Access control and, troubleshooters, audit trails, health-related reports, and more.

f. An operator shall be able to launch a specific task only if he or she has the appropriate privileges.

g. The Home Page content shall be customizable through the use of privileges to hide tasks that an operator should not have access to and through a list of favorite and recently used tasks. In addition, editing a USP XML file to add new tasks on the fly shall also be possible.

h. The Contractor shall provide up to 40 of simultaneous Clients.

R. Configuration User Interface (UI)

1. General

a. The Configuration UI application shall allow the administrator or users with appropriate privileges to change the system configuration. The Configuration UI shall provide decentralized configuration and administration of the USP system from anywhere on the IP network.

b. The configuration of all embedded ACS, VMS, and ALPR systems shall be accessible via the Configuration UI.

c. The Configuration UI shall have a home page with single-click access to various tasks.

d. The Configuration UI shall include a variety of tools such as troubleshooting utilities, import tools, and a unit discover tool, amongst many more.

e. The Configuration UI shall include a static reporting interface to:

1) View historical events based on entity activity. The user shall be able to perform such actions as printing a report and troubleshooting a specific access event from the reporting view.

2) View audit trails that show a history of user/administrator changes to an entity.

f. Common entities such as users, schedules, alarms and many more, can be reused by all embedded systems (ACS, VMS, and ALPR).

S. ACS Client User Interface (UI)

1. The Monitoring UI shall fulfill the role of a Unified Security Interface that is able to monitor video, ALPR, and access control events and alarms, as well as view live and recorded video.

2. The Monitoring UI shall provide a graphical user interface to control and monitor the USP over any IP network. It shall allow administrators and operators with appropriate privileges to monitor their unified security platform, run reports, and manage alarms.

3. To enhance usability and operator efficiency, the Monitoring UI shall support the following UI concepts:

    a. Dynamically adaptive interface that adjusts in real-time to what the operator is doing.

    b. A dynamic dashboard loaded with entity-specific widgets (e.g. door and camera widgets).

    c. Use of transparent overlays that can display multiple types of data in a seamless fashion.

    d. Display tile menus and quick commands.

    e. Consolidated and consistent workflows.

    f. Tile menus and quick commands easily accessible within every display tile of the user workspace.

    g. Single click functionality for reporting and tracking. The Monitoring UI shall support both single-click reporting for access control, ALPR, and video, as well as single-click tracking of areas, cameras, doors, zones, cardholders, elevators, ALPR entities, and more. Single-click reporting or tracking shall create a new task with the selected entities to report on or to track.

4. Monitoring UI Home Page and Tasks

    a. Similar tasks shall be grouped into the following categories:

        1) Operation: Access control/LRP/video surveillance, visitor management, mustering, access control and video alarm monitoring, and more.

        2) Investigation: Video bookmark/motion/archive reports, access control activity reports, visitor activity reports, alarm reports, ALPR activity reports, and more.

        3) Maintenance: Access control and video configuration reports, troubleshooters, audit trails, and more.

5. Dynamically Adaptive UI, Dashboard, and Widgets

    a. The Monitoring UI shall dynamically adapt to what the operator is doing. This shall be accomplished through the concept of widgets that are grouped in the Monitoring UI dashboard.

    b. Widgets shall be mini-applications or mini-groupings in the Monitoring UI dashboard that let the operator perform common tasks and provide them with fast access to information and actions.

    c. With a single click on an entity (e.g. door or camera) the specific widgets associated to that entity appear and other non-relevant widgets disappear

dynamically (instantly). Widgets shall bring the operator information such as door status and camera stream information, as well as user actions, such as door unlock, PTZ controls, and more.

d. Specific widgets include those for a door, camera, alarm, zone, display tile, video stream (statistics), PTZ camera, and more.

6. Operator Workflows

a. A workflow shall be a sequence of operations an operator or administrator shall execute to complete an activity. The “flow” relates to a clearly defined timeline or sequence for executing the activity.

b. The Monitoring UI shall be equipped with consistent workflows for the ALPR, video, and access control systems that it unifies.

c. Generating or printing a report, setting up or acknowledging an alarm, or creating an incident report shall follow the same process (workflow) whether the operator is working with video, ALPR, or access control, or with both video and access control.

7. Each task within the Monitoring UI shall consist of one or more of the following items:

a. Event list.

b. Logical tree. Doors, cameras, zones, ALPR units, and elevators shall be grouped under Areas in a hierarchical fashion.

c. Entities list of all entities being tracked.

d. Display tiles with various patterns (1 x 1, 2 x 2, and more).

e. Display tile menu with various commands related to cameras, doors, PTZ, and tile controls.

f. Dashboard with widgets.

8. The Monitoring UI shall support multiple event lists and display tile patterns, including:

a. Event/alarm list layout only

b. Display tile layout only

c. Display tile and alarm/event list combination

d. ALPR map and alarm/event list combination

9. User workspace customization

a. The user shall have full control over the user workspace through a variety of user-selectable customization options. Administrators shall also be able to limit what users and operators can modify in their workspace through privileges.

b. Once customized, the user shall be able to save his or her workspace.

c. The user workspace shall be accessible by a specific user from any client application on the network.

d. Display tile patterns shall be customizable.

e. Event or alarm lists shall span anywhere from a portion of the screen up to the entire screen and shall be resizable by the user. The length of event or alarm lists shall be user-defined. Scroll bars shall enable the user to navigate through lengthy lists of events and alarms.

f. The Monitoring UI shall support multiple display tile patterns (e.g. 1 display tile (1x1 matrix), 16 tiles (8x8 matrix), and multiple additional variations).

g. The Monitoring UI shall support as many monitors as the PC video adapters and Windows Operating System are capable of accepting.

h. Additional customization options include: show/hide window panes, show/hide menus/toolbars, show/hide overlaid information on video, resize different window panes, and choice of tile display pattern on a per task basis.

10. The Monitoring UI shall provide an interface to support the following tasks and activities common to access control, ALPR, and video:

a. Monitoring the events from a live security system (ACS and/or VMS and/or ALPR).

b. Generating reports, including custom reports.

c. Monitoring and acknowledging alarms.

d. Creating and editing incidents and generating incident reports.

e. Displaying dynamic graphical maps and floor plans as well as executing actions from dynamic graphical maps and floor plans.

f. Management and execution of hot actions and macros.

11. The Monitoring UI shall be able to monitor the activity of the following entities in real-time: areas, ALPR entities, doors, elevators, cameras, cardholders, cardholder groups, zones (input points), and more. The Monitoring UI shall provide an interface to support the following access control tasks and capabilities:

a. Monitoring and management of access events and alarms.

b. Viewing of cardholder picture or badge IDs.

c. Verification of cardholder picture IDs against live video.

d. Visitor management.

e. People counting or mustering, including resetting the people count in an area.

f. Door control, including remotely unlocking doors, overriding a door’s unlocking schedules, and enabling door maintenance mode.

g. Forgiving antipassback.

h. Generation of ACS configuration and activity reports.

i. Viewing of HTML files including alarm instructions.

12. Entity Monitoring

a. The USP shall permit the user to select multiple entities to monitor from the Monitoring UI by adding the entities one by one to the tracking list.

b. The Monitoring UI shall provide the option to filter which events shall be displayed in the display tile layout and/or event list layout.

c. It shall be possible to lock a Monitoring UI display tile so that it only tracks the activity of a specific entity (e.g. specific door or camera).

d. The user shall be able to drag and drop an event from an event list (or an alarm from an alarm list) onto a display tile to view a license plate read, cardholder picture ID, badge ID, or live/archived video, among other options.

e. Event, alarm, monitoring/tracking, and report lists shall contain cardholder pictures where applicable.

f. The user shall be permitted to start or pause the viewing of events within each display tile.

13. Display Tile Packing and Unpacking

a. The Monitoring UI shall support single-click unpacking and packing for, areas, doors, zones, and alarms.

b. The packing and unpacking of entities shall allow operators to quickly obtain additional information and camera views of a specific entity.

c. The unpacking of an entity shall display associated entities. For example, unpacking a door with multiple associated cameras shall display all cameras associated with that door. Unpacking shall reconfigure the display tiles to be able to display all associated entities. For example, unpacking a door (or a zone or alarm) that is currently in a 1 x 1 tile configuration and that has 3 cameras tied to it will create a 1 x 3 display tile arrangement for viewing all associated entities.

d. Packing will return the display to the original tile pattern.

14. The following additional tools or utilities shall be available from the Monitoring UI: create credentials, create cardholders, and access control troubleshooter.

T. Server Administrator User Interface Requirements

1. The Server Administrator shall be used to configure the SSM and the Directory Role (main configuration) and its database(s), to apply the license, and more.

2. The Server Administrator shall be a web-based application. Through the Server Administrator, it shall be possible to access the SSM across the network or locally on the server.

3. Access to the Server Administrator shall be protected via login name, password, and encrypted communications.

4. The Server Administrator shall allow the administrator (user) to perform the following functions:

   a. Manage the system license.

   b. Configure the database(s) and database server for the Directory Role,

   c. Activate/Deactivate the Directory Role.

   d. Manually back up the Directory Role database(s) and/or restore the server database(s), as well as configure scheduled backups of the databases.

   e. Define the client-to-server communications security settings.

   f. Configure the network communications hardware, including connection addresses and ports.

U. Unified Web Client (UWC) General Requirements

1. The USP shall support a unified web client (UWC) for access control and video.

2. The UWC shall be a truly thin client with no download required other than an internet web browser or standard web browser plugins.

3. The UWC shall be platform independent and run within Microsoft Internet Explorer, Firefox, Safari, and Google Chrome.

4. Web pages for the web client shall be managed and pushed by the Mobile Server. Microsoft IIS or any other web hosting service shall not be required given that all the web pages shall be hosted by the Mobile Server.

5. Functionalities:

   a. Login using name and password or Active Directory support shall be available.

   b. Encrypted communications for all transactions.

   c. Print reports and export to CSV file.

   d. Customer logo customization shall be available for multi-tenant and hosted services applications.

   e. Access Control

      1) Cardholder and group (add/modify/delete).

      2) Credential management (modify/delete).

      3) Unlock door.

      4) Door Activities report.

f. Alarms

1) Alarm report.

V. Smartphone and Tablet App General Requirements

1. The USP shall support mobile apps for various off-the-shelf smartphones and tablets. The mobile apps shall communicate with the Mobile Server of the USP over any WiFi or mobile network connection.

2. Mobile apps shall communicate with the UPS via a Mobile Server (same as the Unified Web Client or UWC). Communication between the mobile device and the Mobile Server shall support optional encryption.

3. Supported device manufacturers shall include (refer to Mobile App specifications for latest compatibility list):

a. Apple iPod Touch, iPhone, and iPad.

b. Android-compatible smartphones and tablets.

c. Windows and Windows Phone 8.1.

4. It shall be possible to download the mobile apps from the Central application store (Apple iTunes App Store, Google Play, Windows Store).

5. Functionalities

a. Live monitoring and command and control of the USP.

b. Receive alarm push notifications from the Apple Push Notification Server or from the Google Android push server.

c. Alarm management (view and acknowledge alarms, video tied to alarms).

d. View USP hierarchy and search for entities.

e. Access Control

1) View cardholder picture with access-related events.

2) Monitor door status.

3) Unlock door.

4) Override unlocking or locking schedule.

5) Set door in maintenance mode.

W. Health Monitor

1. The USP shall monitor the health of the system, log health-related events, and calculate statistics.

2. USP services, roles, agents, units, and client apps will trigger health events.

3. The USP shall populate the Windows Event Log with health events related to USP roles, services, and client apps.

4. A dedicated role, the Health Monitoring Role, shall perform the following actions:

   a. Monitor the health of the entire system and log events.

   b. Calculate statistics within a specified time frame (hours, days, months).

   c. Calculates availability for clients, servers and video/access/ALPR units.

5. A Health Monitoring task and Health History reporting task shall be available for live and historical reporting.

6. A web-based, centralized health dashboard shall be available to remotely view unit and role health events of the USP.

7. Detailed system care statistics will be available through a web-based dashboard providing health metrics of USP entities and roles, including Uptime and mean-time-between-failures.

8. Health events shall be accessible via the SDK (can be used to create SNMP traps).

X. USP General Requirements

1. The Unified Security Platform (USP) shall be an enterprise class IP-enabled security and safety software solution.

2. The USP shall support the seamless unification of IP access control system (ACS), IP video management system (VMS), and IP automatic license plate recognition system (ALPR) under a single platform. The USP user interface (UI) applications shall present a unified security interface for the management, configuration, monitoring, and reporting of embedded ACS, VMS, and ALPR systems and associated edge devices.

3. Functionalities available with the USP shall include:

   a. Configuration of embedded systems, such as ACS, ALPR, and VMS systems.

   b. Live event monitoring.

   c. Live video monitoring and playback of archived video.

   d. Alarm management.

   e. Reporting, including creating custom report templates and incident reports.

   f. Microsoft Active Directory integration for synchronizing USP user accounts and ACS cardholder accounts.

   g. Intrusion device and panel integration (live monitoring, reporting, and arming/disarming).

   h. point of sale, and more).

   i. Dynamic graphical map viewing.

4. The USP shall be deployed in one or more of the following types of installations:

   a. Unified access, ALPR, video platform, and any combination thereof.

   b. Standalone access control, platform.

   c. Unified access and video platform that federates multiple remote ACS and VMS.

   d. Standalone access control that federates multiple independent remote ACS.

5. Licensing

   a. A single central license shall be applied centrally on the configuration server.

   b. There shall be no requirement to apply a license at every server computer or client workstation.

   c. Based on selected options, one or more embedded systems shall be enabled or disabled.

6. Hardware and Software Requirements

   a. The USP and embedded systems (video, license plate recognition, and access control) shall be designed to run on a standard PC-based platform loaded with a Windows operating system. The preferred operating system shall be coordinated with the City following the manufacturer supported operating systems.

   b. The core client/server software shall be built in its entirety using the Microsoft .NET software framework and the C# (C-Sharp) programming language.

   c. The USP database server(s) shall be built on Microsoft's SQL Server. The preferred SQL version shall be coordinated with the City and compatible with the USP.

   d. The USP shall be compatible with virtual environments, including VMware and Microsoft Hyper-V.

   e. The USP shall use the latest user interface (UI) development and programming technologies such as Microsoft WPF (Windows Presentation Foundation), the XAML markup language, and .NET software framework.

Y. USP Architecture

1. The USP shall be based on a client/server model. The USP shall consist of a standard Server Software Module (SSM) and Client Software Applications (CSA).

2. The USP shall be an IP enabled solution. All communication between the SSM and CSA shall be based on standard TCP/IP protocol and shall use TLS encryption with digital certificates to secure the communication channel.

3. The SSM shall be a Windows service that can be configured to start when the operating system is booted and run in the background. The SSM shall automatically launch at computer startup, regardless of whether or not a user is logged on the machine.

4. Users shall be able to deploy the SSM on a single server or across several servers for a distributed architecture. The USP shall not be restricted in the number of SSM deployed.

5. The USP shall protect against potential database server failure and continue to run through standard off-the-shelf solutions.

6. The USP shall support up to one thousand instances of CSA connected at the same time. However, an unrestricted number of CSA can be installed at any time.

7. The USP shall support an unrestricted number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.

8. Roles-Based Architecture

    a. The USP shall consist of a role-based architecture, with each SSM hosting one or more roles.

    b. Each role shall execute a specific set of tasks related to either core system, automatic license plate recognition (ALPR), video (VMS), or access control (ACS) functionalities, among many others. Installation shall be streamlined through the ability of the USP to allow administrators to:

        1) Deploy one or several SSM across the network prior to activating roles.

        2) Activate and deactivate roles as needed on each and every SSM.

        3) Centralize role configuration and management.

        4) Support remote configuration.

        5) Move roles over from one SSM to another.

    c. Each role, where needed, shall have its own database to store events and role-specific configuration information.

    d. Roles without databases, such as The Federation feature, Active Directory, and Global Cardholder Management, shall support near real-time standby without any third party failover software being required.

    e. Directory Role

        1) The Directory Role shall manage the central database that contains all the system information and component configuration of the USP.

        2) The Directory Role shall authenticate users and give access to the USP based on predefined user access rights or privileges, and security partition settings.

        3) The Directory Role shall support the configuration/management of the following components common to the ACS, ALPR, and VMS sub-systems:
            a) Security Partitions, users and user groups.
            b) Areas.
            c) Zones, input/output (IO) linking rules, and custom output behavior.
            d) Alarms. Schedules, and scheduled tasks.

e) Custom events.
f) Macros or custom scripts.

4) The Directory Role shall support the configuration/management of the following components specific to VMS:
   a) Video servers and their peripherals (e.g. audio, IOs, and serial ports).
   b) PTZ.
   c) Camera sequences.
   d) Recording and archiving schedules.

5) The Directory Role shall support the configuration/management of the following components specific to ACS:
   a) Door controllers, and input and output (IO) modules.
   b) Doors, Elevators, and Access rules.
   c) Cardholders and cardholder groups, credentials, and badge templates.

6) The Directory Role shall support the configuration/management of the following components specific to ALPR:
   a) ALPR units and cameras.
   b) Hotlists, permit lists, and overtime rules.

f. The Video Archiver Role shall be responsible for managing cameras and encoders under its control and archiving

g. The Media Router Role shall be responsible for routing video and audio streams across local and wide area networks from the source (e.g. DVS) to the destination (e.g. CSA).

h. The Access Manager Role shall be responsible for synchronizing access control hardware units under its control, such as door controllers and IO modules. This role shall also be responsible for validating and logging all access activities and events when the door controllers and IO modules are online.

i. The Automatic License Plate Recognition (ALPR) Role shall be responsible for synchronizing fixed ALPR units (cameras) and mobile ALPR applications under its control. The ALPR Role shall also be responsible for logging all ALPR activities and events.

j. The Zone Manager Role shall be responsible for managing all software zones (collection of inputs) and logging associated zone events. Zones shall consist of inputs from both access control and video devices.

k. The Health Monitoring Role shall be responsible for monitoring and logging health events and warnings from the various client applications, roles, and services that are part of the USP. This role shall also be responsible for logging events within the Windows Event Log and for generating reports on health statistics and health history.

l. The Intrusion Manager Role shall be responsible for managing third party intrusion devices such as alarm panels and perimeter detection devices. This role shall also be responsible for logging all intrusion events in a database.

m. Additional Roles

1) The Active Directory Role shall be responsible for synchronizing user accounts and cardholder accounts with a Microsoft Active Directory server.

9. Server Monitoring Service (Watchdog)

a. The USP shall include a Server Monitoring Service that continuously monitors the state of the Server Software Module (SSM) service.

b. The Server Monitoring Service shall be a Windows service that automatically launches at system startup, regardless of whether or not a user is logged into his account.

c. The Server Monitoring Service shall be installed on all PCs/servers running an SSM. In the event of a malfunction or failure, the Server Monitoring Service shall restart the failed service. As a last resort, the Server Monitoring Service shall reboot the PC/server should it be unable to restart the service.

Z. USP Video and Access Control Unification

1. The Monitoring UI shall present a true Unified Security Interface for live monitoring and reporting of the ACS and VMS. Advanced live video viewing and playback of archived video shall be available through the Monitoring UI.

2. The Configuration UI shall present a true Unified Security Interface for the configuration and management of the ACS and VMS.

3. The user shall be able to associate one or more video cameras to the following entity types: areas, doors, elevators, zones, alarms, intrusion panels, and more.

4. It shall be possible to view video associated to access control events when viewing a report.

5. It shall be possible to view video associated to intrusion panel events when viewing a report.

AA. USP Alarm Management

1. The USP shall support the following Alarm Management functionality:

a. Create and modify user-defined alarms. An unrestricted number of user-defined alarms shall be supported.

b. Assign a time schedule or a coverage period to an alarm. An alarm shall be triggered only if it is a valid alarm for the current time period.

c. Set the priority level of an alarm and its reactivation threshold.

d. Define whether to display live or recorded video, still frames or a mix once the alarm is triggered.

e. Provide the ability to display live and recorded video within the same video tile using picture-in-picture (PiP) mode.

f. Provide the ability to group alarms by source and by type.

g. Define the time period after which the alarm is automatically acknowledged.

h. Define the recipients of an alarm. Alarm notifications shall be routed to one or more recipients. Recipients shall be assigned a priority level that prioritizes the order of reception of an alarm.

i. Define the alarm broadcast mode. Alarm notifications shall be sent using either a sequential or an all-at-once broadcast mode.

j. Define whether to display the source of the alarm, one or more entities, or an HTML page.

k. Specify whether an incident report is mandatory during acknowledgment.

2. The workflows to create, modify, add instructions and procedures, and acknowledge an alarm shall be consistent for access control, ALPR, and video alarms.

3. Alarms shall be federated, allowing global alarm management across multiple independent USP, ACS, and VMS systems.

4. The USP shall also support alarm notification to an email address or any device using the SMTP protocol.

5. The ability to create alarm-related instructions shall be supported through the display of one or more HTML pages following an alarm event. The HTML pages shall be user-defined and can be interlinked.

6. Alarm unpacking and packing shall be supported where all the entities associated to an alarm can be display in the Monitoring UI with the single click of a button.

7. The user shall have the ability to acknowledge alarms, create an incident upon alarm acknowledgement, and put an alarm to snooze.

8. The user shall be able to spontaneously trigger alarms based on something he or she sees in the system.

9. An alarm shall be configured in such a way that it remains visible until the source condition has been acknowledged.

10. The user shall be able to investigate an alarm without acknowledging it.

BB. USP Threat Levels

1. The USP shall support Threat Levels to dynamically change the system behavior to respond to critical events.

2. Threat Levels shall be activated and deactivated by the CSA operator with the right privilege.

3. Threat Levels shall be set on an area or on the entire system thru a common single interface for video and access control.

4. Threat Levels shall affect the system behavior by executing any action available in the USP such as: trigger output, start recording, block camera, override recording quality, arm zone, set a door in maintenance mode, and more.

5. The following specific actions shall be available with Threat Level:

   a. Set minimum security clearance to restrict or permit access to cardholders on specific areas on top of the restrictions imposed by the access rules.

   b. Set minimum user level to automatically log out user from the USP.

   c. Set reader mode to change how the doors are accessed (e.g. card and PIN, or card or PIN).

6. A visible notification shall be displayed in all operator CSA when a Threat Level is activated.

CC. USP Advanced Task Management

1. USP shall support an infrastructure for managing Monitoring UI tasks used for live monitoring, day to day activities, and reporting.

2. Administrators shall be able to assign tasks and lock the operator`s workspace. The user management of their workspace shall be limited by their assigned privileges.

3. Operators shall be able save their tasks as either Public Tasks or Private Tasks and in a specific partition. Public tasks shall be available to all users. Private tasks shall only be available to the City of the task.

4. Operators shall be able to share their tasks by sending them to one or more online users. Recipients shall have the option to accept the sent task.

DD. USP Reporting

1. The USP shall support report generation (database reporting) for access control, ALPR, video, and intrusion.

2. Each and every report in the system shall be a USP task, each associated with its own privilege. A user shall have access to a specific report task if he or she has the appropriate privilege.

3. The workflows to create, modify, and run a report shall be consistent for access control, ALPR, and video reports.

4. Reports shall be federated, allowing global consolidated reporting across multiple independent USP, ACS, and VMS systems.

5. Access control and ALPR reports shall support cardholder pictures and license plate pictures, respectively.

6. The USP shall support the following types of reports:

   a. Alarm reports.

   b. Video-specific reports (archive, bookmark, motion, and more).

   c. Configuration reports (cardholders, credentials, units, access rules, readers/inputs/outputs, and more).

d. Activity reports (cardholder, cardholder group, visitor, credential, door, unit, area, zone, elevator, and more).

e. ALPR-specific reports (mobile ALPR playback, hits, plate reads, reads/hits per day, reads/hits per ALPR zone, and more).

f. Health activity and health statistics reports.

g. Other types of reports, including visitor reports, audit trail reports, incident reports, and time and attendance reports.

7. Generic Reports, Custom Reports and Report Templates

a. The user shall the option of generating generic reports from an existing list, generating reports from a list of user-defined templates, or creating a new report or report template.

b. The user shall be able to customize the predefined reports and save them as new report templates. There shall be no need for an external reporting tool to create custom reports and report templates. Customization options shall include setting filters, report lengths, and timeout period. The user shall also be able to set which columns shall be visible in a report. The sorting of reported data shall be available by clicking on the appropriate column and selecting a sort order (ascending or descending).

c. All report templates shall be created within the Monitoring UI.

d. These templates can be used to generate reports on a schedule in PDF or Excel formats.

e. An unrestricted number of custom reports and templates shall be supported.

8. A reporting task layout shall consist of panes with settings (report length, filters, go and reset commands, etc.), the actual report data in column format, and a pane with display tiles. The user shall be able to drag and drop individual records in a report onto one or more display tiles to view a cardholder’s picture ID, playback a video sequence, or both.

9. The USP shall support comprehensive data filtering for most reports based on entity type, event type, event timestamp, custom fields, and more.

10. The user shall be able to click on an entity within an existing report to generate additional reports from the Monitoring UI.

11. The USP shall support the following actions on a report: print report, export report to a PDF/Microsoft Excel/CSV file, and automatically email a report based on a schedule and a list of one or more recipients.

EE. USP Zone Management

1. The USP shall support the configuration and management of zones for input point monitoring via the Zone Manager Role. A user shall be able to add, delete, or modify a zone if he or she has the appropriate privileges.

2. A zone shall monitor the status of one or more inputs points. Zone monitoring or input point monitoring shall be possible through the use of a controller and one or more input

modules. Inputs from video cameras or video encoders shall also be accessible via a zone.

3. Depending on the hardware installed, supervised inputs shall be supported. Depending on the input module used, both 3-state and 4-state supervision shall be available.

4. A schedule shall be defined for a zone, indicating when the zone will be monitored.

5. Custom Events shall provide full flexibility in creating custom events tailored to a zone. Users shall be able to associate custom events to state changes in monitored inputs.

6. The ACS shall support one or more cameras per zone. Video shall then be associated to zone state changes.

7. Input/Output (IO) Linking

   a. Zone management shall support Input/Output (IO) Linking. IO Linking shall allow one or more inputs to trigger one or more outputs.

   b. IO Linking shall be available in offline mode when communication between the server and hardware is not available.

   c. Custom Output Behaviors shall provide full flexibility in creating a variety of complex output signal patterns: simple pulses, periodic pulses, variable duty-cycle pulses, and state changes.

   d. Through the “trigger an output” action, the ACS shall support the triggering of outputs with custom output behaviors.

FF. USP User And User Group Security, Partitions, and Privileges Management

1. The USP shall support the configuration and management of users and user groups. A user shall be able to add, delete, or modify a user or user group if he or she has the appropriate privileges.

2. The USP shall support user authentication with claims-based authentication using external providers. External providers shall include:

   a. ADFS (Active Directory Federation Services)

3. Common access rights and privileges shared by multiple users shall be defined as User Groups. Individual group members shall inherit the rights and privileges from their parent user groups. User group nesting shall be allowed.

4. User privileges shall be extensive in the USP. All configurable entities for the USP, including access control/video/ALPR, shall have associated privileges.

5. Specific entities, such as cardholders, cardholder groups, and credentials shall include a more granular set of privileges, such as the right to access custom fields and change the activation or profile status of an entity.

6. Partitions

   a. The USP shall limit what users can view in the configuration database via security partitions (database segments). The administrator, who has all rights and privileges, shall be allowed to segment a system into multiple security partitions.

   b. All entities that are part of the USP can be assigned to one or more partitions.

   c. A user who is given access to a specific partition shall only be able to view entities (components) within the partition to which he or she has been assigned. Access is given by assigning the user as an accepted user to view the entities that are members of a particular partition.

   d. A user or user group can be assigned administrator rights over the partition.

7. It shall be possible to specify user and user group privileges on a per partition basis.

8. Advanced logon options shall be available such as dual logon and more.

9. It shall be possible to specify an inactive period for the Monitoring UI after which time the application shall automatically lock, while still preserving access to currently displayed camera feeds.

GG. USP Event/Action Management

1. The USP shall support the configuration and management of events for video and ALPR. A user shall be able to add, delete, or modify an action tied to an event if he has the appropriate privileges.

2. The USP shall receive all incoming events from one or more ACS and/or VMS. The USP shall take the appropriate actions based on user-define event/action relationships.

3. The USP shall receive and log the following events:

   a. System-wide events.

   b. Application events (clients and servers).

   c. Area, camera, door, elevator, and ALPR events (reads and hits).

   d. Cardholder and credential events.

   e. Unit events.

   f. Zone events.

   g. Alarm events.

   h. First Person In and Last Person Out events and antipassback events.

   i. Intrusion events.

   j. Asset management events.

4. The USP shall allow the creation of custom events.

5. The USP shall have the capability to execute an action in response to an access control, video, and ALPR event.

6. The USP shall allow a schedule to be associated with an action. The action shall be executed only if it is an appropriate action for the current time period.

HH. USP Schedules and Scheduled Tasks

1. Schedules

a. The USP shall support the configuration and management of complex schedules. A user shall be able to add, delete, or modify a schedule if he or she has the appropriate privileges.

b. The USP shall provide full flexibility and granularity in creating a schedule. The user shall be able to define a schedule in 1-minute or 15-minute increments.

c. Daily, weekly, ordinal, and specific schedules shall be supported.

2. Scheduled Tasks

a. The USP shall support scheduled tasks for access control, video, and ALPR.

b. Scheduled tasks shall be executed on a user-defined schedule at a specific day and time. Recurring or periodic scheduled tasks shall also be supported.

c. Scheduled tasks shall support all standard actions available within the USP, such as sending an email or emailing a report.

II. USP Macros and Custom Scripts

1. The USP shall enable users to automate and extend the functionalities of the system through the use of macros or custom scripts for access control, video, and ALPR.

2. Custom macros shall be created with the USP Software Development Kit (SDK).

3. A macro shall be executed either automatically or manually.

4. In the Monitoring UI, a macro shall be launched through hot actions.

JJ. USP Dynamic Graphical Maps (DGM)

1. The USP shall support mapping functionality for access control, video surveillance, intrusion detection, ALPR, and external applications.

2. The USP shall provide a map centric interface with the ability to command and control all the UPS capabilities from a full screen map interface.

3. It shall be possible to span the map over all screens of the USP client station. In the scenario where the map is spanned over all the screens of the USP client station it shall be possible to navigate the map including pan and zoom, and the map’s moves shall be synchronized between all screens. Spanning the map over multiple screen must provide the same command and control capabilities than in a single screen display.

4. The DGM shall support the following file format and protocol for importing map background:

    a. PDF

    b. JPG

    c. PNG

    d. Web Map Service (WMS) defined by the Open Geospatial Consortium (OGC)

    e. BeNomad

5. The DGM shall provide the following online map providers for use as map background and provide the ability to manage their service license if they require one:

    a. Google Map, aerial, terrain (Licensed)

    b. Bing Map, aerial, satellite, hybrid (Licensed)

    c. OpenStreet Map aerial

    d. OVI hybrid

6. It shall be possible to configure a mixed set of maps made of GIS, online providers and private imported files and link them together.

7. The DGM shall provide the ability to display all native entities of the UPS including:

    a. Cameras, fix, and PTZ

    b. Doors

    c. Camera sequences

    d. Areas

    e. Intrusion areas

    f. Intrusion zones

    g. License Plate Recognition cameras

    h. Digital inputs

    i. Digital outputs

    j. Intercoms

    k. Alarms

    l. Macros

    m. Police Car Patrollers

8. The DGM shall provide the ability to draw and display information over the map in the form of:

    a. Vectoriel shapes: line, rectangles, polygones, ellipse

    b. Pictures

    c. Text

9. The DGM shall provide the ability to display layer of information in Keyhole Markup Language (KML) format.

10. The DGM shall provide the ability to the operator to manage layers of entities displayed over the map, being able to turn them on and off and changing the superposition order.

11. The DGM shall offer built-in map data backup and restore for both map background and layers of entities.

12. The DGM shall offer failover capabilities.

13. The DGM shall scale up to several thousands of entities on a single map and hundreds of maps.

14. The DGM shall provide a means to update a map background without affecting the map object configuration.

15. The DGM shall offer a user friendly graphical map designer to configure the maps.

16. The DGM shall provide a user friendly and intuitive navigation that includes:

    a. The ability to create hierarchies of maps to facilitate navigation within and between various sites and buildings.

    b. The ability to define favorites for recurrent position recall.

    c. The possibility to create links between maps. The map links shall allow the link from one map to multiple maps representing the floors of a building.

    d. A common user experience regarding navigation into the map for both GIS and private maps. *(Specifier, Plan Manager Advanced required for GIS)*

    e. A history log of positions.

17. It shall be possible to monitor the state of entities on the map. It shall be possible to customize the icons of any entities represented on the map.

18. The DGM shall offer the ability to optionally set a graphical display notification of the motion detection.

19. The DGM shall offer a smart selection tool to access the video. By clicking the location the user wants to see, the DGM will automatically select the cameras that can see this location and move the PTZ towards that location. This smart selection tool shall take obstacles into consideration and not display cameras that cannot see the location because of a wall.

20. It shall be possible to select a location by drawing a zone of interest on the DGM, and to display all the entities that are part of that zone of interest at once.

21. The user shall be able to select and display the content of multiple USP entities on the map in popup windows.

22. It shall be possible to access live and playback video from the map.

23. It shall be possible to monitor from the DGM all entities event notifications. Users shall be able to turn notifications on and off per entity.

24. The DGM shall offer the ability to fully operate alarm monitoring. It shall be possible to:

    a. Center the map on entities related to the alarm.

    b. Visualize the Alarm notifications on the map, and access the related videos from the map.

    c. Trigger and receive alarms.

    d. Act on the alarm from the DGM, including acknowledgements, forwarding, and investigation.

    e. Visualize that an alarm occurred in an underlying linked map.

25. The DGM shall provide the following search capabilities:

    a. Search and center by entity name.

    b. From the Display of an entity in the USP, locate the entity on the map and offer the ability to select another one close-by.

26. Any update of map content by an administrator shall be immediately and dynamically pushed to all DGM users.

27. The DGM shall provide an intuitive built-in map designer for entity positioning on the map using drag and drop. Any configuration shall be graphic.

28. It shall be possible to edit and configure multiple map objects at once.

29. Various actions shall be available within maps for execution through simple and intuitive double-click, right-click, or drag-and-drop functionality. Examples of actions available through maps shall include unlocking a door and acknowledging an alarm.

30. Through the following functionality, the DGM shall allow the management of USP alarms from the map:

    a. Locate on the map entities related to the alarm.

    b. Display entities of the alarm with a specific icon, color, transparency level, and blinking rate.

    c. List, select, and locate alarms.

    d. Auto center the map on the highest priority alarm.

e. Handle the alarm from the map, including acknowledgement, forwarding and investigation.

f. All map containers, such as hotspots or map links shall reflect the alarm status of the contained entities.

31. The DGM shall offer lasso tools for:

a. Displaying entities at one location through a single action.

b. Triggering an action on all entities at one a location in a single click.

c. Editing multiple entities at one location simultaneously.

32. The DGM shall allow the display of USP entities selected from the map on a remote monitor (video wall)

33. The DGM shall provide the following search capabilities:

a. Search within the map by entity name, street name, or point of interest.

b. Drag and drop entities from the USP to the map to center their location.

34. Any updating of map content by an administrator shall be immediately and dynamically pushed to all operators displaying the map.

35. The Contractor shall provide licenses for each entity that is required to be shown on the graphical maps.

KK. USP Audit and User Activity Trails (Logs)

1. The USP shall support the generation of audit trails. Audit trails shall consist of logs of operator/administrator additions, deletions, and modifications.

2. Audit trails shall be generated as reports. They shall be able to track changes made within specific time periods. Querying on specific users, changes, affected entities, and time periods shall also be possible.

3. For entity configuration changes, the audit trail report shall include detailed information of the value before and after the changes.

4. The USP shall support the generation of user activity trails. User activity trails shall consist of logs of operator activity on the USP such as login, camera viewed, badge printing, video export, and more.

5. The ACS shall support the following actions on an audit and activity trail report: print report and export report to a PDF/ Microsoft Excel/CSV file.

LL. USP Incident Reports

1. Incident reports shall allow the security operator to create reports on incidents that occurred during a shift. Both video-related and access control-related incident reports shall be supported.

2. The operator shall be able to create standalone incident reports or incident reports tied to alarms.

3. The operator shall be able to link multiple video sequences to an incident, access them in an incident report, and change the date or time of the sequences later on.

4. It shall be possible to create a list of Incident categories, tag a category to an incident, and filter the search with the category as a parameter.

5. Incident reports shall allow the creation of a custom form on which to input information on an incident.

6. Incident reports shall allow entities, events, and alarms to be added to support at the report's conclusions.

MM. USP Third Party Integration

1. Microsoft Active Directory Integration

a. The USP shall support a direct connection to one or multiple Microsoft Active Directory server via the Active Directory Role(s). Active Directory integration shall enable the synchronization of information from the Active Directory server to the USP.

b. Active Directory integration shall permit the central management of the USP users, user groups, cardholders, and cardholder groups.

c. The USP shall be able to connect to and synchronize data from multiple Active Directory servers (up to 10).

d. The USP shall support synchronizing Active Directory Universal Groups as well as security groups belonging to other domains within the same forest.

e. The USP shall support Microsoft Active Directory encryption using LDAP SSL.

f. When enabled, Active Directory shall manage user logon to the USP client applications through the user's Windows credentials. Logging to the USP shall utilize native Active Directory password management and authentication features.

g. It shall be possible to synchronize the following USP entities and their information from Active Directory with the USP:

1) Users (username, first and last names, email address, and more).

2) User groups (user group name, description, and group email address).

3) Cardholders (first and last names, description, email, picture and more).

4) Cardholder groups (cardholder group name, description, and group email address).

5) Active Directory attributes to USP custom fields.

h. When enabled, the addition, removal, or suspension of a user's Windows account in Active Directory shall result in the creation, deletion, or disabling of the equivalent user account in the USP.

i. When enabled, the addition, removal, or suspension of a user's Windows account in Active Directory shall result in the creation, deletion, or disabling of the equivalent cardholder account in the USP.

j. Supported synchronization methods for additions, modification, and deletions of synchronized entities shall include: on first logon (users only), manual synchronization, and scheduled synchronization.

k. The USP shall support user connections across independent organizations by connecting to an external ADFS (Active Directory Federation Services) service using claims-based authentication.

2. Intrusion Detection Integration

a. The USP shall integrate with third party intrusion panels and devices via an Intrusion DDK. The Intrusion Manager Role shall manage communications with the intrusion panels. Communications with intrusion devices shall be over serial communications and/or an IP network.

b. Integration with intrusion panels shall be possible outside the release cycle of the USP. It shall be possible to add new integrations at any point in time.

c. Functionality available via the integration of intrusion devices with the USP shall include the following (where supported by the intrusion panel):

1) Arm and disarm intrusion devices (manually, on schedule, or following a USP event).

2) Activate or trigger intrusion device outputs.

3) View intrusion events and alarms.

4) Monitor the status, including arming status, of the intrusion devices.

5) Video verification of intrusion events and alarms with video panels.

6) Create USP zones using intrusion device inputs.

d. Supported intrusion panels to include:

1) Bosch G Series panels.

2) DSC Power Series panels.

3) DMP XR Series panels.

4) Honeywell Galaxy Dimension panels.

NN. Manufacturer:

a. Genetec Security Center: Synergis Pro (Design Basis)

b. Or equal.

2.4 ACS Server Hardware

A. Server Hardware

1. Spec References:

a. Access Control Server, LCD17RM

2. Minimum Features/Functions/Performance

a. The ACS Server to be compatible and approved for use with and supplied with one of the ACS Manufacturers' Operating Systems supported by the ACS Manufacturer when used as a server device, and with memory, processor and disk space scaled according to the system application requirements of this Project

b. The server shall be a rack mount standard manufactured product of a computer manufacturer regularly engaged in the production of business class servers and shall carry the manufacturer's standard product warranty, assigned to the City.

c. Server shall meet or exceed the ACS manufacturer's minimum performance and functional requirements for a ACS server at the time of beneficial occupancy.

d. Provide complete system including server, rack monitor, rack mount keyboard and mouse, or provide KVM and share peripherals with other similar rack mount devices installed under the work this Project.

3. Manufacturers:

a. Server

1) Dell

2) HP

3) Intel

4) or equal.

b. Manufacturer, Monitor:

1) Samsung series

2) Sharp

3) or equal.

c. Rack Mount Monitor Enclosure

1) Middle Atlantic RSH4A with backclamp.

2) Raxxess.

3) Custom by Contractor.

4) or equal.

d. Combination Monitor with Integral Rackmount, subject to the video response rate requirements defined above.

1) Tripplite

2) Marshall Electronics

3) Pelco

4) ToteVision

5) or equal.

2.5 Access Control Panels & related

A. Data Gathering Panels

1. Drawing References:

a. DGP (Data Gathering Panel)

2. Minimum Features/Functions/Performance:

a. General:

1) Field Panels (DGP), with enclosures, daughter cards and accessories as required to provide the functionality described in these specifications, with at least 100% expansion capability(based on greater of door or reader count) at the time of building opening

2) The Linux based intelligent controller shall provide decision making, event reporting, and database storage as a hardware platform. The intelligent controller shall provide the capability to host multiple 3rd party applications, in addition to its internal security application. Two reader interfaces shall provide control for two doors in addition to supporting up to an additional 62 doors, paired and or alternate reader configurations with peripheral interface devices are supported.

3) The controller shall communicate with the host via on-board 10BaseT/100BaseTX Ethernet port and support TLS encryption as a minimum security implementation.

4) Two physical barriers shall be controlled. Each reader port shall accommodate a readhead that utilizes OSDP, OSDP SC, Wiegand, magnetic stripe, or 2-wire RS-485 electrical signaling standards, one or two wire LED controls, and buzzer control.

5) Controller shall support, as a minimum the following open standards, BACnet, PSIA, SNMP, OSDP and OSDP SC.

6) The controller must have received 3rd party penetration testing for data integrity within 18 months of contractual award.

b. Functional

1) Primary Power: twelve to twenty four volts of direct current (12-24VDC) +/- 10%, 500mA maximum

2) Communications Ports:
   a) Host Port 0: 10/100 Ethernet
   b) Host Port 1: 10/100 Ethernet
   c) Port 2: RS-485, 2-wire
   d) Port 3: RS-485, 2-wire

3) Inputs:
   a) Eight general purpose - programmable circuit type
   b) Two dedicated: tamper and power monitor

4) Outputs: Four relays – Form-C, 5 Amp, 30 volts direct current

5) Reader Ports: Two reader ports expandable to 64
   a) Unregulated pass through or regulated 12Vdc. 180 mA maximum per port
   b) Signaling Clock and Data, Wiegand or 2-wire RS-485

6) Keypad: Multiplexed with card data

7) LED: Two-wire or one-wire bicolor support

8) Buzzer: One-wire LED mode only

9) Temperature: zero to seventy degrees Centigrade (0-70° C) operational, -55 to 85 degrees Centigrade (-55 - 85° C) storage

10) Humidity: five to ninety-five percent (5 - 95%) relative humidity, non-condensing (RHNC)

11) Standards:
   a) UL294 Recognized, CE Compliant, ROHS,
   b) FCC Part 15 Class A, NIST Certified Encryption

c. Features:

1) Connectivity: 10/100 Ethernet. Optional alternate 10/100 Ethernet

2) Door Control:
   a) Two-reader ports: Clock and Data, Wiegand, or RS-485
   b) Eight programmable inputs, four relays, diagnostic LEDs

3) Access Control:
   a) 1,500,000 Cardholder capaCity, 50,000 Transaction buffer, 255 Access Levels per cardholder, 19 digit (64-bit) user ID and 15 digit PIN numbers maximum, Activation and Deactivation dates, If/Then Macro capability, Adjustable cardholder capaCity

4) Card Formats:
   a) Eight active card formats
   b) 19 digit (64-bit) User ID and 15 digit PIN numbers maximum

c) PIV-II, CAC, TWIC card compatible

5) Card Reader Functions
a) Multiple card format support by reader
b) Paired reader support
c) Alternate reader support
d) Elevator support
e) Turnstile support
f) Biometric device support
g) Open Supervised Device Protocol (OSDP) and OSDP SC compliant
h) Occupancy count
i) Support of multi-occupancy rules
j) Anti-passback support

a) Area-based, reader-based, or time based

Nested area, hard, soft, or timed forgiveness

b) Supports host-based approval rules
c) Keypad support with programmable user commands, card input
d) Shunt relay support
e) Strike follower relay support
f) Threat level
g) Wireless locks: Aperio, Salto, SimonsVoss

d. Database Functions

1) Configurable card database

2) Supports up to nineteen (19) digital card numbers

3) Supports pin codes up to fifteen (15) digits

4) Programmable card activation and deactivation times and dates

5) Card issue code, ADA and VIP flags (up to 32 bits); PIV (75 bits); Smart Card (200 bits)

6) Up to 255 access levels per user

7) Ability to track people and objects

e. Intrusion Alarm Functions

1) Supports entry delays and exit delays

2) Area monitoring

3) Standard alarm masking

4) Provides control and alarm processing from the keypad

f. Elevator Control

1) The controller shall be able to perform elevator control, using either inputs and outputs hard-wired to the elevator control system, or, using a network

interface through the host server. Card readers may be located in the elevator lobbies or elevator cabs. Upon a valid card read, the controller shall decide which floors the person is authorized for.

g. Manufacturers

1) Mercury Security

2) Or equal.

B. Backboard mounted equipment

1. Drawing Reference(s): PS, Door Lock Power Supply

2. Function:

a. Power supply with backup battery

b. Class 1 (115VAC Input)

c. Individually fused, Power Limited, Class 2 outputs - sized to meet worst case load and runtime while maintaining system operations.

d. High density supply supports at least 8 doors per enclosure. Low density power supplies not acceptable.

e. Unless otherwise indicated support operation of ACS system for specified operational period following loss of power.

f. Battery is lead acid type of common commercial manufacture.

g. UL Listings: UL 294, UL603, UL 1069, UL1481 for application

h. Provide timer modules as required to supplement DGP control

i. Supervised fire alarm disconnect

j. Power supply and battery fully enclosed in steel NEMA enclosure with cam lock cover and conduit knockouts.

k. Thermal and short circuit protection with auto reset.

3. Manufacturers:

a. Altronix AL Series (Design Basis)

b. Security Door Controls

c. Or equal.

2.6 Card Readers

A. Card Readers

1. Spec References:

a. CR: Card Reader, Wall Mount

b. CN: Card Reader, Mullion Mount

c. CKP: Card Reader, Wall Mount with Integral Keypad

2. Dual Technology Card Readers:

a. Each reader supports both HID iCLASS 13.56 MHz Contactless Smart Card and Prox Dual Technologies.

3. Provide range of color options for selection by the City's Representative.

4. Minimum Features/Functions:

a. Typical Maximum Read Range

1) HID Prox ISO Card: 2.5 – 3.5" (6.5 - 9.0 cm)

2) HID Prox Keyfob/Tag: 1.0 – 2.25" (2.5 - 5.5 cm)

3) Microprox® Tag: 1.0 – 1.25" (2.5-3.2 cm)

4) iCLASS SE Card: 4.0 - 4.5" (10.2 - 11.4 cm)

5) iCLASS SE Key/Tag: 1.0 - 2.0" (2.5 - 5.0 cm)

b. Dimensions

1) CN: 1.9" x 6.0" x 0.9"

2) CR: 3.3" x 4.8" x 0.95"

3) CKP: 3.3" x 4.8" x 1.1"

c. Operating Temperature

1) -40º to 150º F

d. Operating Humidity

1) 5% to 95% relative humidity non-condensing

e. Transmit Frequencies

1) 125 kHz and 13.56 MHz

f. Cable Distance

1) Wiegand Interface 500ft (150 m) 22 AWg

g. Card Compatibility

1) 125 kHz Proximity
a) HID proximity cards, key fobs, and tags

b) AWID Credentials
c) EM4102 Credentials

2) 13.56 MHz contactless smart cards
a) Secure Identity Object™ (SIO®) on iCLASS Seos, iCLASS SE/SR, MIFARE DESFire EV1 and MIFARE Classic (On by Default)
b) standard iCLASS Access Control Application (order with Standard interpreter)
c) ISO14443A (MIFARE) CSN, ISO14443B CSN, ISO15693 CSN
d) Mifare and Mifare DESFire EV1 custom data models
e) FeliCa CSN, CEPAS4 CSN or CAN Manufacturer:

h. CKP: Integral keypad permits transmission of supplemental instructions to ACS DGP in combination with use of an authenticated access control card.

5. Manufacturers:

a. HID

1) CKP: HID RPK40 multiCLASS SE Reader with Keypad.

2) CR: HID RP40 multiCLASS SE Reader.

3) CN: HID RP15 multiCLASS SE Reader.

b. Or equal.

2.7 access control sensors & field devices

A. General

1. Field devices to be selected to match condition of opening and/or space to be protected. The following specifications are minimum standards; Contractor to consult with listed manufacturers and select appropriate device and mounting means for unusual construction conditions.

B. Door Tamper Alarm Switch

1. Drawing Reference: DS

2. Construction and Features

a. UL Listed

b. Hermetically sealed magnetic reed switch. Dual biased high security switch assembly deters tampering. Reed shall be potted in the contact housing with a polyurethane based compound.

c. Magnet shall be made of Alnico V.

d. Steel Door Switches

1) Contact and magnet housing shall snap-lock into a 1" dia. hole. Snap-lock insulation bushing for tight fit and maximum gap in steel.

2) Housings shall be molded of flame retardant ABS plastic. Both contact and magnet plastic housings are constructed of one piece of thick-walled ABS plastic for maximum strength.

3) Color of housings shall be off-white, grey or mahogany brown. Color to be selected by City's Representative.

4) Designed for Use in Steel Doors

5) Operates in steel door and frame at gap up to:
   a) 1" min., Steel Doors
   b) 2" Min, Wood Doors

6) Under Door Threshold switches. At all glass door assemblies with base lock plate, mount DS under door threshold. Provide necessary blocking and shimming and/or secondary magnets at recessed doors to bring magnet within specified gap.

3. Manufacturer:

a. Steel Doors, 1"

1) Sentrol 1076W.

b. Under threshold:

1) Sentrol 1921 magnet and 1055 or 1075W Switch

2) Or approved equal by Ademco.

C. Door Switch, RollUp Doors and Coiling Grills

1. Drawing Reference: DU

2. Function/Features:

a. Protects openings where door or gate travels in vertical plane.

b. Place door switches on slab at side of track or at top of frame at each end of rollup door or grill.

c. Fasten magnet to traveling door.

d. Switch connects to structure with armored cable connection.

3. Manufacturer:

a. Sentrol 1982 Magnet and 2202A or 2205 switch with Manufacturer's Supplemental Mounting Brackets and Spacers as required. At panel/sectional doors Sentrol 2300 series.

b. Ademco

c. or equal.

D. Gate Switch

1. Drawing Reference: GS

2. Function/Features:

a. Monitors status of gate protected openings.

b. Fasten magnet to traveling/moving gate with tamperproof fasteners.

c. Switch connects to conduit and backbox infrastructure with armored cable connection.

3. Manufacturer:

a. Sentrol 1982 Magnet and 2202A or 2205 switch with Manufacturer's Supplemental Mounting Brackets and Spacers as required. At panel/sectional gates, provide Sentrol 2300 series.

b. Ademco

c. or equal.

E. Hatch Switch

1. Drawing Reference: HS

2. Monitors state of roof hatches

3. Fasten magnet to hatch door.

4. Switch connects to structure at hatch opening with armored cable connection to serving junction box

5. Manufacturer:

a. Sentrol 2500 series

b. Ademco.

c. or equal.

F. Local Door Alarm, Interior

1. Drawing Reference: LA

2. Functions/Features:

a. Provide door management alarms for local and remote monitoring and annunciation of the status of the doors (door prop/door held, door intrusion/door forced or secure)

b. The LA shall be capable of operating in a stand-alone configuration or with access control systems.

c. Local sounder (field selectable 96 or 103 dBA @ 3 feet) shall be used to indicate both door prop/door held and intrusion/door forced conditions after a user selectable quiet, or access, time (0 seconds - 90 minutes) has expired. Sounder shall be incorporated into the faceplate of the LA.

d. Form C (N/O or N/C) contacts shall be available for the following outputs:

1) Door Contact Status.

2) Door Prop Alarm.

3) Intrusion & Tamper Alarm.

4) Bypass/ Key Switch Status.

5) Dry Contact Remote Alarm Reset.

e. The alarm (intrusion) contact shall change state upon the recognition of an alarm or tamper condition to alert remote monitoring equipment.

f. The unit shall remain in alarm until reset by integral key switch, remotely through a dry contact or automatically through an onboard timer (settable from 0 seconds to 5 minutes or manual).

g. An integral key switch shall be available for alarm shunt or alarm reset and be incorporated into the faceplate of the LA.

h. A Bi-Color status L.E.D. shall be incorporated into the faceplate of the LA. A remote L.E.D. output shall be provided to control a Bi-Color L.E.D. that follows the actions of the faceplate mounted L.E.D.

i. Inputs shall include a N/C Dry Contact for the door, Voltage Sense (12-24 VAC/DC) to monitor electric lock voltages and a N/O or N/C passive Shunt Input.

j. The following timers shall be user settable:

1) Auto-reset,

2) Alarm delay

3) Silent time

4) Shunt Delay.

k. The LA shall be mounted in the wall adjacent to the monitored door at PSSH.

3. Manufacturers:

a. Designed Security, Inc. Model ES4200-K4-T1 w/ Rim Cylinder Keylock K option and a tamper circuit.

1) As exterior locations, provide with manufacturer’s -007 component weatherization option.

G. Request to Exit

1. Drawing Reference: REX

2. Function:

a. Closure disarms security when approaching door from inside. Omit where base building door hardware incorporates a release button.

b. Passive infrared technology.

c. Dual “C” shaped patterns adjustable to limit protection area to areas immediately in front of and to each side of means of approach to protected doors from interior.

1) ± 14° vertically adjustable pattern.

2) Dual C shaped patterns require activation from outside ring (lobby interior) prior to activation from inner ring (adjacent door) to prevent operation of door by sliding object under door from outside of building.

3. Select device and pattern based on mounting height and architectural geometry around door.

4. Finish to be selected by City’s Representative.

5. Manufacturer:

a. Detection Systems DS-150i

b. or equal.

H. Tamper Alarm Switch

1. Select to suit application.

2. Manufacturer:

a. Sentrol.

b. Ademco.

c. Or equal.

2.8 IP NETWORK COMPATIBLE VIDEO INTERCOM SYSTEM

A. Entry Video Intercom

1. Drawing Reference: VI, VM

2. Features/Operation

a. Power Source: Power over Ethernet (802.3af).

b. Network Interface: 10 BASE-T / 100 BASE-TX Ethernet (RJ-45).

c. Network Protocols: IPv4, IPv6, TCP, UDP, SIP, HTTP, HTTPS, MJPEG, RTSP, RTP, RTCP, IGMP, MLD, SMTP, DHCP, NTP, DNS.

d. Bandwidth Usage:

1) G.711: 64Kbps x 2 per video call.

2) 64Kbps per monitor.

3) H.264: 24Kbps ~ 2,048Kbps.

e. Communication: Hands-free (VOX), push-to-talk (simplex), or handset (full-duplex).

f. Door Release: Programmable Form C dry contact, 24V AC/ DC, 500mA - use EL-12S (use RY-24L for larger contact rating, which requires 24V DC power supply) or use RY-IP44 with 4 multipurpose relays.

g. Wire Type: CAT-5e or CAT-6.

h. Distance:

1) Door Station to Network Node: 330 feet (100 meters).

2) Master Station to Network Node: 330 feet (100 meters).

i. IP Addressable Video Master Station Model IX-MV:

1) 3.5” LCD color monitor

2) Handset for privacy or hands-free VOX / PTT communication

3) Door release button

4) 6 programmable speed dial buttons for calling stations or accessing paging zones

5) Wall or desk mount

6) Connects using CAT-5e/6 cable

7) 802.3af PoE compliant

8) IP Addressable Video Door Station Model IX-DV:

9) SIP 2.0 compliant

10) 1.23 megapixel fixed color video camera

11) White LED for low light illumination

12) ONVIF Profile S compliant

13) Camera vertical adjustment +15º, 0º, or -8º (manual)

14) Slot for microSD card (not provided by Aiphone)

15) Weather and vandal resistant

16) 2 contact outputs

17) 6 trigger inputs

18) Anodized aluminum

19) 802.3af PoE compliant

20) RJ45 in/out with PoE pass through (802.3at Type 2 PoE+)

j. Manufacturer:

1) VM: Aiphone
a) Wall Mount: Model IX-MV7-W.
b) Desk Mount: IX-MV

2) VI: Aiphone Model IX-DV.

2.9 access control wiring

A. As specified in Section 28 05 13 – Conductors and Cables for Electronic Safety and Security.

PART 3 - Execution

3.1 General

A. **The Contractor shall install all system components, including City furnished equipment, and appurtenances in accordance with the manufacturer's instructions, IEEE C2 and as shown and necessary to provide a fully functional system. The contractor shall furnish necessary interconnections, services, and adjustments required for a complete and operable system as specified and shown. Control signal, communications, and data transmission line grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation**.

B. Provide mounting hardware as necessary to securely fasten ACS hardware to the supporting structure or racks.

C. Device Wiring and Communication Circuit Surge Protection

1. All inputs shall be protected against surges induced on device wiring. Outputs shall be protected against surges induced on control and device wiring installed outdoors and as shown. All communications equipment shall be protected against surges induced on any communications circuit. All cables and conductors, except fiber optics, which serve as communications circuits from security console to field equipment, and between field equipment, shall have surge protection circuits installed at each end.

D. Installation

1. The contractor shall install the system in accordance with the standards for safety, NFPA 70, UL 681, UL 1037 and UL 1076, and the appropriate installation manual for each equipment type. Components within the system shall be configured with appropriate service points to pinpoint system trouble in less than 20 minutes.

2. Flexible cords or cord connections shall not be used to supply power to any components of the system, except where specifically noted. All other electrical work shall be as specified in Division 26 and as shown.

3. All circuit boards are to be mounted on "Stand-Offs". Circuit boards may not be affixed with double sided tape.

4. No components of the security system are to be mounted on the interior door of the DGP enclosure. Where additional space is required, Contractor to place a supplemental NEMA enclosure adjacent to the DGP sized as required to accommodate the additional components.

5. Perimeter Wireway: Refer to the requirements of Section 28 05 28 - Pathway for Electronic safety and Security regarding the requirement to wrap the backboard at electronic security system installation locations with steel wireway/gutter and terminal cabinets as necessary to fully enclose wiring and components associated with electronic security systems installation.

6. Enclosure Penetrations

7. Enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in a manner that does not damage the cable. Locate penetrations to enclosures to ensure they will not interfere with components inside enclosure such as batteries, circuit boards, locking mechanisms etc.

8. Cold Galvanizing

9. Field welds and/or brazing on factory galvanized boxes, enclosures, conduits, etc., shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

E. Card Readers

1. Contractor to coordinate detail construction work in vicinity of card readers with work of other trades to ensure that specified read range of card readers is not compromised by the presence of large metal objects in the immediate vicinity of reader

2. Securely fasten card reader to structure to prevent its movement during repeated usage.

3. Unless otherwise indicated, card readers to be mounted to the nearest side of the door housing the door handle.

4. Unless otherwise indicated, card readers should be mounted to flush mount backboxes. Mounting card readers on surface mounted boxes is unacceptable except where such installations are specifically called for in the plans.

5. Contractor to further ensure that power supplies used with the readers meet or exceed card reader manufacturer minimum requirements for current and voltage stability.

6. Exterior card reader installations must be equipped with the appropriate weather protection.

3.2 Programming

A. Initial Systems Programming

1. Contractor to meet with City's Representative to confirm functional requirements for surveillance systems defined in Part 1 of this Section, including but not limited to the following:

a. Access Classification Tiers. Establish Tiers and Classes of Doors and the levels of protection to required at each including:

1) Monitoring to be provided at each Alarm point.

2) Always on (24 hour response).

3) On when the system is Master Armed.

4) Only on when the system is Perimeter Armed.

5) Displays / Does Not Display at the Access Control Panel when the point is activated.

6) Provides / Does Not Provide entry warning tone.

7) Sounds / Does Not Sound audible alarm indication.

8) Point is bypassable / not bypassable.

9) Alarm Verification with programmable verification time.

10) Summary Relay activation by Point.

11) Provides / Does Not Provide "watch point" capability.

12) Review with the City the means to be used to transition from one condition to another.
a) Example. During Pre-Game conditions, Audience entry doors are secured and alarmed. Operation from the interior or force entry from exterior to generator alarm. At the transition from Pre-Game to Game condition, Audience entry doors are released for free operation and alarming is suppressed until transition to Post Game.

13) Threat Level
a) Programming should incorporate altered conditions of operations at each opening for each Event Condition based on Threat Level established and selected by Command Center operators.

b. Calendar. System Operations as a function of day-of-the-week and hour-of-the-day and differential access permitted based on these changes, particularly for No Scheduled Event Condition.

1) Access limitations and device functions that are dependent on the time or access or the event.

c. Alarm System response to events

1) Normal access (validated).

2) System fault

3) Unauthorized access

4) Unauthorized access detected by multiple monitoring points.

d. Pass codes according to the authorities and functions defined by the City's Representative.

e. In addition to standard door operation arming and alarming as described in Part 1 of this Specification Section, initial system programming to include the following features and functions:

1) Arming Zones – at least the following:
   a) Classrooms
   b) Training Offices
   c) OEM Offices
   d) EOC

f. Document the Initial Programming Requirements and Submit in accordance with Section 28 05 00 - Common Work Results For Electronic Safety and Security.

2. At minimum, include allowance of post-opening programming time in the following quantities.

a. In addition to providing the programming necessary to meet the functional requirements defined in Part 1 of this Section, Contractor to provide systems customization programming time as defined below in the following quantities:

1) 100 hours.

b. Programming time is time spent by a trained systems programming developing the specific sequence of alarm events and response for this Project.

c. Programming time does not include installation of or correcting deficient installation of system components, coordination with the contractors, training the programmer in the programming of the system software or meeting with the the City's Representative(s) to establish the functional requirements of the security system.

d. Programming time not used in initial systems configuration shall be available to the City for supplemental post-opening programming. Contractor to provide such post opening programming in a minimum of 4 hour blocks.

e. Contractor to provide City's Representative with daily timesheets of programming time spent in support of this Project on request"

f. Implement System Programming as defined above.

3.3 Wiring Practice

A. Comply with requirements of Sections 27 11 16 - Communications Cabinets, Racks, Frames and Enclosures and Section 28 05 13 – Conductors and Cables for Electronic Safety and Security

B. At electric strikes and electric locks and all other monitored lines requiring same, provide end-of-line resistors, diodes or MOV's where device does not already include such components. Document where such devices have been added.

3.4 INTRUSION DETECTION FIELD DEVICE INSTALLATION

A. Motion Detectors

1. Orient device and place manufacturers device masking to eliminate potential sources of false motion or IR alarms including motion and/or vehicle headlights through windows, sunlight and sun reflections, HVAC diffusers, and heating/cooling appliances. Test and adjust as required over at least 2 weeks of operation following the latest of the following:

a. occupancy by the City,

b. commissioning of building systems,

c. removal of construction barriers and/or

d. installation of permanent window coverings.

B. Glass Break Detectors

1. Orient to maximize system sensitivity to glass breakage along indicated area for protection. Select variable spectral sensitivity of device to match construction of glass installed in area of protection. Adjust as necessary to eliminate false alarms.

C. Duress Alarms

1. General: Conform with UL 636.

2. Casework and Furniture Duress Alarms:

a. Provide at points within the protected area as indicated.

b. Alarms shall be capable of being secretly activated by the foot or hand of an average adult in both standing and seated positions.

c. Alarms shall not be visible or audible from the sensor.

d. Mock up proposed mounting location with for review by the City's Representative. Following acceptance by City's Representative, fasten securely in place with a mechanical, not adhesive, means.

e. Protect and secure signal cable where it extends under surface of desktop using surface raceway mechanically fastened to underside of desk. Where the cable extends through furniture accessible to end users or the action of drawers or doors, protect with split loom tubing fastened mechanically to the surface of the furniture. Adhesive fastening in lieu of mechanical fastening will not be accepted.

f. Route cable to grommeted cover plate at nearest accessible wall providing transition of cabling to concealed in-wall/raceway wire pathway.

D. Tamper Switches

1. Enclosures, cabinets, housings, boxes, raceways, and fittings with hinged doors or removable covers which contain circuits of the intrusion detection system and associated power supplies shall be provided with cover having corrosion-resistant tamper switches. Arrange tamper switches to initiate an alarm signal when the door or cover is moved as little as 6 mm 1/4 inch from the normally closed position. Mechanically mount tamper switches to maximize defeat time when enclosure covers are opened or removed. Minimum amount of time required to depress or defeat the tamper switch after opening or removing the cover shall be one second. Enclosure and tamper switch shall prevent direct line of sight to internal components and prevent switch or circuit tampering. Conceal mounting hardware so switch cannot be observed from enclosure exterior. Covers of junction boxes provided to facilitate initial installation of the system need not be provided with tamper switches if covers contain no splices or connections. Tamper switches on doors which must be opened to make normal maintenance adjustments to the system and to service power supplies shall be the push/pull-set, automatic-reset type.

2. Tamper switches shall be:

a. Inaccessible until switch is activated;

b. Under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating;

c. Spring-loaded and held in the closed position by the door, or cover protected;

d. Wired to break the circuit when the door or cover is disturbed;

3.5 System Startup

A. Satisfaction of the requirements below does not relieve the Contractor of responsibility for incorrect installations, defective equipment items, or collateral damage as a result of Contractor work/equipment. The Contractor shall not apply power to the system until after:

1. System equipment items have been set up in accordance with manufacturer's instructions.

2. A visual inspection of the system has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.

3. System wiring has been tested and verified as correctly connected.

4. System grounding and transient protection systems have been verified as properly installed.

5. Power supplies to be connected to the system have been verified as the correct voltage, phasing, and frequency.

3.6 Systems Performance Demonstration and Adjusting Procedures

A. Demonstrate functionality of each installed device. Refer to the requirements of Section 28 05 00 - Common Work Results for Electronic Safety and Security.

3.7 Labeling

A. Conform with the requirements of Section 27 05 53 – Identification for Communications Systems.

3.8 Warranty

A. Warranty

1. The ACS shall be warranted by the contractor for one (1) year from the date of Substantial Completion.

B. Maintenance and Service

1. The contractor shall provide all services required and equipment necessary to maintain the entire ACS in an operational state as specified for a period of one (1) year after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled adjustments or other nonscheduled work.

C. Description of Work

1. The adjustment and repair of ACS includes computer equipment, contractor provided programming, software updates, signal transmission equipment, access control equipment, facility interfaces, and support equipment. Provide the manufacturers required adjustments, re-programming of deficient contractor programmed functions and other work as necessary.

D. Personnel

1. Service personnel shall be qualified to accomplish all work promptly and satisfactorily. Provide proof that Service personnel have successfully completed the enterprise level of both hardware and software training offered by the system manufacturer. The City's Representative shall be advised in writing of the name of the designated service representative and of any change in personnel.

E. Inspections

1. The contractor shall perform two inspections at six (6) month intervals or more often if required by the manufacturers. This work shall be performed during regular working hours, Monday through Friday, excluding Federal holidays. These inspections shall include:

2. Visual checks and operational tests of the central processor, local processors, monitors, keyboards, system printers, peripheral equipment, ACS equipment, power supplies, and electrical and mechanical controls.

3. Clean system equipment, including interior and exterior surfaces.

4. Perform diagnostics on all equipment.

5. Check and calibrate each ACS device.

6. Run system software and correct diagnosed problems.

7. Resolve previous outstanding problems.

F. Warranty Service

1. The City’s Representative shall initiate service calls when the ACS is not functioning properly. Qualified personnel shall be available to provide service to the complete ACS.

2. The City's Representative shall be furnished with the telephone number where the contractor’s service supervisor can be reached at all times.

3. Service personnel shall be at the site within four (4) hours after receiving a request for service.

4. The ACS shall be restored to proper operating condition after one (1) calendar day.

5. Materials installed during warranty service to match or exceed specification of products originally installed for the specified function.

END OF SECTION

SECTION 28 1619

INTRUSION DETECTION

PART 1 - GENERAL

1.1 SUMMARY

A. SCOPE
1. Section includes (but is not necessarily limited to) provision of field devices for intrusion detection system, including but not limited to:
a. Intrusion Detection. Installs field devices.
1) Includes
a) Door position switches
b) Motion Detector

1.2 RELATED WORK IN OTHER SECTIONS

A. Section 27 05 33 - Conduits and Backboxes for Communications Systems
1. Rough-in for devices installed by the work of this Section.

PART 2 - PRODUCTS

2.1 GENERAL

A. Include full range of interior point protection sensors, volumetric (space) protection sensors, exterior fence sensors, and duress alarms. Select device to suit project conditions per manufacturers recommendations.

2.2 ALARM SENSORS & FIELD DEVICES

A. Door Position Switch
1. Drawing Reference: DS
2. Construction and Features
a. UL Listed
b. Double Pole, Double Throw (DPDT) electrical configuration.
c. Hermetically sealed magnetic reed switch. Dual biased high security switch assembly deters tampering. Reed shall be potted in the contact housing with a polyurethane based compound.
d. Magnet shall be made of Alnico V.
e. Steel Door Switches
1) Contact and magnet housing shall snap-lock into a 3/4" or 1" dia. hole. Snap-lock insulation bushing for tight fit and maximum gap in steel.
2) Housings shall be molded of flame retardant ABS plastic. Both contact and magnet plastic housings are constructed of one piece of thick-walled ABS plastic for maximum strength.
3) Color of housings shall be off-white, grey or mahogany brown. Color to be selected by Architect.
4) Designed for Use in Steel Doors
5) Operates in steel door and frame at gap up to:
a) 3/8" min. - 3/4" Doors
b) ½" min. - 1" Doors

6) Under Door Threshold switches. At all glass door assemblies with base lock plate, mount DS under door threshold. Provide necessary blocking and shimming and/or secondary magnets at recessed doors to bring magnet within specified gap.

f. Leads:
1) Black: Common
2) White: Closed Loop
3) Red: Open Loop

3. Manufacturer:
a. Steel Doors, 3/4"
1) GE/Sentrol 1076D switch with 1921C magnet.
2) Or equal by Ademco.
b. Steel Doors, 1"
1) Sentrol 1076D switch with 1921C magnet.
2) Or equal by Ademco.
c. Under threshold:
1) Sentrol 1921 magnet and 1055 or 1075WSwitch
2) Or equal by Ademco.

B. Motion Detector
1. Drawing Reference(s): MD, MDC
2. Functions/Features/Construction:
a. Dual detection device detects change in background heat levels associated with passage of an intruder through passive infrared technology (PIR) and microwave reflection. Both detectors need to activate to signal an alarm conditions.
b. Immune to rodent motion.
c. Pulse Count: Installer-selectable, 1- or 2-event
d. Detectable Walk Rate: 2-4 steps within field-of-view
e. Indicators: Red LED with enable/disable feature
f. Alarm Relay: Form C
g. Operating Temp: At least 32º to 120ºF
h. Operating Humidity: At least up to 95% RH (max.), non-condensing
i. Dimensions: Not larger than 5"x5"
j. K-Band Microwave
k. Where exterior device installation shown, devices to suitable for outdoor use under Project conditions
l. Corridor and Aisles Conditions, MDC
1) Select device and configure device lens(es) and masks to monitor area nominally 20 degrees wide from point that device is installed to architectural barrier opposite or cross-aisle opposite of the device, unless otherwise indicated.
m. Ceiling Mount Applications
1) Ceiling Mount Design. 360° field-of-view, mounting height from 8' to 16', install as recessed mount, unless otherwise noted.
n. Coverage - At least 25' diameter
o. Listings/Approvals
1) UL Listed
2) FCC Certified
3. Manufacturers - coordinate selected device with ceiling height and manufacturers instructions:
a. MD, Ceiling Interior
1) Ademco DT 7360
2) Rokonet Lunar DT
3) Bosch

4) Sentrol
5) or equal

b. MDC, select and submit for each condition.
1) Rokonet iWISE DT with ACT
2) Ademco
3) Bosch
4) Sentrol
5) or equal

c. MD, Exterior Conditions
1) Rokonet iWiseDT QUAD with ACT and optional ceiling swivel
2) Ademco
3) Bosch
4) or equal

C. Glassbreak Detectors, Recessed
1. Manufacturer:
a. Rokonet Vitron Plus.
b. GE Sentrol
c. Bosch
d. Ademco
e. Or approved equal

D. Glassbreak Detectors, Surface
1. Manufacturer:
a. Rokonet Vitron Plus.
b. GE Sentrol
c. Bosch
d. Ademco
e. Or approved equal
2. Intrusion Alarm Sounder
a. Drawing Reference: IAS
b. Function:
1) Low profile, electronic piezo, compact multi-tone sounder
2) Selectable 32 different tones
3) White ABS housing
4) Operates on 9–28VDC
5) Produces 82-100 dBa @ 10' (92-110 dBa @ 1m) with 20 dBa of adjustment
6) IP54 enclosure (IP65 with optional deep base)
7) Panel or wall mount
c. Manufacturer:
1) Federal Signal LP4-09-028
2) Or equal

2.3 POWER SUPPLIES

A. Power Supply, Backboard Mounted
1. Drawing Reference(s): POWER SUPPLY
2. Backboard mounted equipment
3. Function:
a. Power supply with backup battery
b. Class 1 (115VAC Input)
c. Individually fused, Power Limited, Class 2 outputs - sized to meet worst case load and runtime while maintaining system operations.

d. Unless otherwise indicated support operations of field devices and doors for at least 10 minutes following loss of power.
e. Provide timer modules as required to supplement ACAS operations.
f. Battery is lead acid type of common commercial manufacture.
g. UL Listings: UL 294, UL603, UL 1069, UL1481 for application
h. Power supply and battery fully enclosed in steel NEMA enclosure with cam lock cover and conduit knockouts.
i. Thermal and short circuit protection with auto reset.

4. Manufacturers:
   a. Altronix
   b. Dynalock
   c. Locknetics
   d. RCI
   e. Securitron
   f. Security Door Controls
   g. or equal

2.4 INTRUSION DETECTION SYSTEM

A. Intrusion Detection Panel/ Digital Alarm Communicator and Access Control System (DACS)
   1. Drawing Reference: Intrusion Detection Panel, Burglar Panel
   2. Features/Functions/Construction
      a. 246 hardwired, addressable or wireless points with flexible configuration options.
      b. Conettix IP□based communication options provide high□speed, secure alarm transport and control through connection of wired and/or cellular network interfaces.
      c. Up to 32 programmable areas, each supporting perimeter and interior points with touch screen, ATM style, or LED keypads.
      d. Compatibility with touch-screen color LCD, vacuum fluorescent, ATM style LCD or LED style Alarm Command Centers
      e. Program all system functions local or remote using Remote Programming Software (RPS) or by using basic programming through the keypad.
      f. Integrated real time clock, calendar, test timer and programmable scheduling capability for relay control and automatic execution of system functions based on a time / event.
      g. Provide 1.4 amps of auxiliary power and 2 amps of alarm power, both rated at 12 VDC.
      h. Supervision of up to 16 keypads (up to 32 unsupervised keypads can be used).
      i. The system supports up to 1000 users, each can have a passcode, an access token and a wireless keyfob. User passcodes contain three to six digits. Passcodes can be assigned to one of 14 customized authority levels in each area, and can be restricted to operate only during certain times.
   3. Manufacturer:
      a. Bosch Security Systems, Inc. D9412GV4 Control Panel with the following:
         1) D1255 Alpha Keypad. Provide quantity of Keypads shown on plans.
         2) D8103 Universal Enclosure
         3) Conettix B426 Ethernet Communication Module
         4) B208 Octo-input Module
         5) B308 Octo-output Module
         6) B520 Auxiliary Power Supply Module
         7) D8129 Octo□relay Module
         8) D9127 Series POPIT Modules
         9) D8125 POPEX Point Expander
         10) D8128D OctoPOPIT Eight□point Expander

PART 3 - EXECUTION

3.1 MANUFACTURER INSTRUCTIONS

A. Conform to manufacturer instructions and the requirements of this specification section, whichever is more restrictive.

B. Conform to UL 681, UL 1037, and UL 1076, and the appropriate installation manual for each equipment type. Components within the system shall be configured with appropriate "service points" to pinpoint system trouble in less than 20 minutes.

C. Wiring and device mounting, except for type DU, shall be fully concealed or flush in mounting surface. No devices shall be surface mounted unless specifically called for.

D. For devices requiring access and operation by building occupants, install in accordance with the U.S. Department of Justice, Americans with Disabilities Act (ADA) and the State of California Access Compliance Manual.

3.2 LABELING

A. Conform with the requirements of Section 27 05 53 – Identification for Communications Systems.

3.3 SYSTEMS PERFORMANCE TESTING AND ADJUSTING PROCEDURES

A. Demonstrate functionality of each installed device is consistent with the read range, sensitivity and immunity to false alarms as specified by the device manufacturer. In the absence of an intrusion detection panel installed by Others, demonstrate using a VOM applied at the TB15 terminal block in the presence of the Agency's Representative.

B. Test shall ensure that the requisite degree of intrusion detection is provided.
   1. Initially, test each sensor and subsystem component individually.
   2. When the function of each component within a particular subsystem such as each sensor within a particular zone is verified, certify that subsystem of the entire ACAS as satisfactorily meeting required specifications. Test each subsystem similarly until each detection zone has been certified.
   3. When subsystem certification is complete, test entire integrated system to ensure that subsystem elements are compatible and function as a complete system. Integrated system test shall be accomplished in linear fashion, end-to-end, and shall verify that each simulated intrusion performed within each detection zone produces an appropriate alarm or signal.
   4. Integrated system test shall also verify that alarm is correctly annunciated at the terminal block associated with the field devices,
   5. Log the results obtained for each device, sign log and submit for review prior to request for Demonstration of Functionality.
   6. Provide for approval, not later than 30 days prior to formal inspection and test, a detailed operational test plan of how each component, subsystem, and entire ACAS will be tested.
   7. When tests are complete and corrections made, submit a signed and dated certificate with a request for formal inspection and tests.

3.4 DEMONSTRATION OF FUNCTIONALITY

A. The Agency's Representative will witness formal tests after receipt of written certification that preliminary tests have been completed and that system is ready for final inspection. Manufacturer's technical representatives shall be present for the final inspection and test. Repeat preliminary tests and functional and operational tests, conducted as requested by the Agency's Representative. Correct defects and conduct additional tests to demonstrate that system conforms to contract specifications.

B. Motion Detection
1. Demonstrate that each device detects an intruder moving through the specified coverage pattern.

C. Window, Hatch and Door Position Switches
1. Demonstrate functionality of each device when door, hatch or window door, hatch or window operated and opened not more than 3/8".

3.5 WARRANTY, MAINTENANCE AND SERVICE

A. Warranty
1. The IDS sensors shall be warranted by the contractor for one (1) year from the date of final system acceptance.
2. Maintenance and Service
a. The contractor shall provide all services required and equipment necessary to maintain the IDS remote sensors in an operational state as specified for a period of one (1) year after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled adjustments or other nonscheduled work.
3. Description of Work
a. The adjustment and repair of IDS remote sensors includes signal transmission equipment, facility interfaces, and support equipment. Responsibility shall be limited to contractor installed equipment. Provide the manufacturers required adjustments and other work as necessary.

B. Personnel
1. Service personnel shall be qualified to accomplish all work promptly and satisfactorily. Provide proof that Service personnel have successfully completed the appropriate level of hardware training offered by the system manufacturer. The Agency shall be advised in writing of the name of the designated service representative and of any change in personnel.

C. Inspections
1. The contractor shall perform two inspections at six (6) month intervals or more often if required by the manufacturers. This work shall be performed during regular working hours, Monday through Friday, excluding Federal holidays. These inspections shall include:
2. Visual checks and operational tests of the remote sensorts, power supplies, and electrical and mechanical controls.
3. Clean system equipment, including interior and exterior surfaces.
4. Perform diagnostics on all equipment.
5. Check and calibrate each IDS device.
6. Resolve previous outstanding problems.

D. Emergency Service

1. The Agency shall initiate service calls when the IDS sensors are not functioning properly. Qualified personnel shall be available to provide service to the complete IDS sensors. The Agency shall be furnished with the telephone number where the contractor's service supervisor can be reached at all times. Service personnel shall be at the site within four (4) hours after receiving a request for service. The IDS sensors shall be restored to proper operating condition after one (1) calendar day.

END OF SECTION

SECTION 28 2300

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Related Work in Other Sections:

A. Section 27 11 19 - Communications Termination Blocks and Patch Panels

1. Provides the patch panels, if not existing to support the cameras installed under the work of this project.

B. Section 27 15 00 - Communications Horizontal Cabling

1. Horizontal structured cabling to support the cameras installed under the work of this project.

C. Section 28 05 00 - Common Work Results for Electronic Safety and Security

1. Submittals required of the work of this section.

2. Miscellaneous parts and execution standards for the work of this Section.

D. Section 28 05 28

1. Provides raceway and backboxes for the work of this Section.

1.3 Related Work by Others

A. The College supplies the POE enabled Ethernet Switches and related building Ethernet networking hardware used to transmit the packets generated by the cameras installed under the work of this Project.

1.4 SCOPE

A. Work of Division 28 includes provision of a Unified Security Platform (USP), including video surveillance systems as described in this Section. Work of Section 28 23 00 includes provision of the video surveillance portion of the USP, including but not limited to:

1. Video Surveillance System.

a. Single sensor type indoor, self-illuminated TCP/IP dome cameras.

b. 180 and 360 degree view high definition Multiview indoor and outdoor, self-illuminated TCP/IP cameras.

2. Video Management System (VMS) with:

a. Camera licensing for the quantity of cameras shown on the plans plus 10% spare licensing capacity.

3. Directory Server to be installed at the College Office.

4. Provide twenty (20) web client licenses for College's staff to use.

1.5 submittals

A. Refer to the requirements of Section 28 05 00 – Common Work Results for Electronic Safety and Security.

1.6 system performance requirements

A. Video Surveillance Systems:

1. Technical Performance:

a. TCP/IP: System demonstrates full conformance with alarming, video analytics functionality, including motion detection using ONVIF Software (Open Network Video Interface Forum) Protocol.

b. IP Cameras: Meet Manufacturers performance specification.

2. Functional Performance:

a. Monitor and Display

1) Remote monitoring and reviewing of recorded images by persons using:
a) College's Local and Wide Area Network.
b) Local Area Network using College furnished network switching, and cabling provided under the work of this Project.

2) Provide images suitable for making identification of persons under lighting conditions resulting from the work of this Project and the prevailing environmental conditions at the Project site.

3. Uninterrupted Power System: For systems deriving camera power from power supplies installed under the work of this Project, sustain system operation for 2 hours following loss of power.

1.7 coordinate

A. Coordinate intended camera locations with the work of the Other Trades and the work of Section 28 05 28 – Pathways for Electronic Safety and Security to ensure field conditions do not result in obscuring the intended camera view(s).

B. Refer to Division 27 specifications to ensure that station cabling required for the work of this section.

1.8 Definitions

A. Refer additionally to Section 28 05 00 - Common Work Results for Electronic Safety and Security.

B. Abbreviations used in this Section

1. ACS – Access Control System

2. AES: Advanced Encryption Standard

3. AGC: Automatic gain control

4. ALPR – Automated License Plate Recognition

5. API: Application Programming Interface

6. Aspect ratio: A ratio of width to height in images

7. Bit Rate: The number of bits/time unit sent over a network

8. Bonjour: Enables automatic discovery of computers, devices, and services on IP networks.

9. CSA – Client Software Application

10. DGM – Dynamic Graphical Maps

11. DHCP: Dynamic Host Configuration Protocol

12. DNS: Domain Name System

13. DVS – Digital Video Server

14. EIS: Electronic Image Stabilization

15. FPS: Frames per Second

16. FTP: File Transfer Protocol

17. H.264 (Video Compression Format)

18. IEEE 802.1x: Authentication framework for network devices

19. IP: Internet Protocol

20. IR light: Infrared light

21. ISO: International Standards Organization

22. JPEG: Joint Photographic Experts Group (image format)

23. LAN: Local Area Network

24. LED: Light Emitting Diode
25. LPR: License Plate Recognition
26. Lux: A standard unit of illumination measurement
27. MBR: Maximum Bit Rate
28. MPEG: Moving Picture Experts Group
29. Multicast: Communication between a single sender and multiple receivers on a network
30. NTP: Network Time Protocol
31. NTSC: National Television System Committee – a color encoding system based on 60Hz
32. ONVIF: Global standard for the interface of IP-based physical security products
33. PACS: Physical Access Control System
34. PAL: Phase Alternating Line – a color encoding system based on 50Hz
35. PTZ: Pan/Tilt/Zoom
36. PoE: Power over Ethernet (IEEE 802.3af/at) standard for providing power over network cable
37. PPF: Pixels per foot
38. Progressive scan: An image scanning technology which scans the entire picture
39. QoS: Quality of Service
40. RAID: Redundant Array of Independent Disks
41. SDK – Software Development Kit
42. SIP: Session Initiation Protocol
43. SMA – Software Maintenance Agreement
44. SMPTE: Society of Motion Picture and Television Engineers
45. SMTP: Simple Mail Transfer Protocol
46. SNMP: Simple Network Management Protocol
47. SSL: Secure Sockets Layer
48. SSM – Server Software Module
49. SaaS: Software as a Service
50. TCP: Transmission Control Protocol

51. TLS: Transport Layer Security

52. UI: User Interface

53. UPS: Uninterruptible Power Supply

54. UPnP: Universal Plug and Play

55. USP: Unified Security Platform

56. USW: Unified Web Client

57. Unicast: Communication between a single sender and single receiver on a network

58. VBR: Variable Bit Rate

59. VMS: Video Management System

60. WDR: Wide dynamic range

1.9 Labeling and documentation

A. Label the finished installation. Label each cable at each end uniquely using a Brady or similar cable labeling system.

B. Document the camera locations on a floor plan using CAD. Indicate the head end rack location and the major wiring runs. Provide a single-line diagram of the installed system. Submit PDF copies of the as built drawing documentation. In addition submit electronic copies of the CAD files for the College's use. Submit electronic files on a media type determined by the College.

C. Prepare and provide a hard copy and an electronic copy of an O&M manual for for the completed installation. Hard copy to be provided in a three ring binder. The electronic copy to be submitted on a PDF on a media type determined by the College's Representative.

1.10 TRAINING

A. Train the College's Representatives in operation of the installed video management system. Provide a least two separate training tracks focused on the training needs of specific stakeholder groups within the College’s operation and technical staff and College’s Technical/Information Technology Support Staff.

1. For the Colleges Technical/Information Technology Support Staff and third party integrators staff provide eight hours classroom and hands-on training in VMS system functionality, IP communications protocols used and device handshaking. Review directory tree integration mechanisms and requirements for tree maintenance. Review methods for bare metal recovery of operations. Review VMS manufacturer’s approved methods for software upgrades and hardware replacement, including failed disks in the storage array.

2. For each Training session, Document the training provided using a camera and video recorder and provide a copy of the recorded training to the College for future reference and use in training new staff.

1.11 quality assurance

A. Test Equipment - provide for the purposes of quality assurance as described in Section 28 05 00 - Common Work Results for Electronic Safety and Security.

1. Network Packet Analyzer: (Fluke, Wireshark)

2. Waveform/Vector Monitor.

3. Portable High Resolution Color Picture Monitor (Marshall Electronics, ToteVision or equal).

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the College.

2.2 ACCEPTABLE MATERIALS

A. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section.

2.3 video surveillance equipment

A. General:

1. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer’s Video Surveillance System.

2. All systems and components shall have been thoroughly tested and proven in production use for at least180 days prior to the installation of this system.

3. All Video Surveillance System active systems components shall be provided with the availability of a toll free, 24-hour technical assistance program from the manufacturer, which provides immediate technical assistance to the end user at no charge. Where
* supplied systems are only supported through dealer liaison with manufacturer, and the College’s Representative needs to speak with the VMS manufacturer during Contractor troubleshooting of integration, Contractor to initiate call.

2.4 Video Management SYSTEM

A. Video Management System

1. Drawing and Spec Reference(s): VMS, Storage Server,

2. Minimum Features/Function/Construction:

a. VMS General Requirements

1) The VMS shall be based on a true open architecture that shall allow the use of non-proprietary workstation and server hardware, non-proprietary network infrastructure and non-proprietary storage.

2) The VMS shall offer a complete and scalable video surveillance solution that shall allow cameras to be added on a unit-by-unit basis.

3) The VMS must automatically switch the stream of video from a low resolution to a megapixel stream, based onthe size of the video tile, minimizing the demand on network resources.

4) The VMS shall interface with analog-to-digital video encoders and IP cameras and with digital-to-analog video decoders, hereafter referred to as digital video servers (DVS). The VMS shall support DVS from various manufacturers.

5) The VMS shall integrate DVS using the DVS native SDK or using the following industry standards to interface to the DVS:
   a) ONVIF

6) All video streams supplied from analog cameras or IP cameras shall be digitally encoded in MPEG-4, MPEG-2, MJPEG, H.264, Wavelet, or JPEG2000 compression formats and recorded simultaneously in real time.

7) All audio streams supplied from IP video servers shall be digitally encoded in g711 (u-law), g721, g723, or AAC compression formats and recorded simultaneously in real time.

8) Each camera's bit rate, frame rate, and resolution shall be set independently from other cameras in the system, and altering these settings shall not affect the recording and display settings of other cameras.

9) The VMS shall be able to use multiple CCTV keyboards to operate the entire set of cameras throughout the system, including brands of cameras from various manufacturers and including their PTZ functionalities (i.e.: Pelco keyboard controls Panasonic dome or vice-versa).

10) The VMS shall be able to retrieve and set the current position of PTZ cameras using XYZ coordinates.

11) The VMS shall support PTZ camera protocols from multiple manufacturers, including analog and IP protocols.

12) The VMS shall arbitrate the user conflict on PTZ usage based on user levels per camera.

13) The VMS shall support the following list of CCTV keyboard protocols:
   a) American Dynamics 2078 ASCII, and American Dynamics 2088 ASCII
   b) Bosch Autodome, Bosch Intuikey.
   c) DVTel.
   d) GE ImpactNet.
   e) Panasonic, Pelco ASCII, Pelco KBD-300, and Pelco P.
   f) Radionics.
   g) Samsung SSC-1000.

h) Video alarm.

14) The VMS shall support the following list of joysticks and control keyboards:
a) Axis 295.
b) Axis T8310 Video Surveillance Control Board.
c) Panasonic WV-CU950 Ethernet keyboard.
d) Any USB joystick detected as a Windows Game Controller.

15) The VMS shall allow for the configuration of a time zone for each camera connected to a DVS. For playback review, users shall have the ability to search for video based on the following options:
a) Local time of the camera.
b) Local time of the SSM.
c) Local time of user's workstation.
d) GMT Time.
e) Other time zone.

16) Audio and Video storage configuration for the SSM shall either be:
a) Internal or external IDE/SATA/SAS organized or not in a RAID configuration.
b) Internal or external SCSI/iSCSI/Fiber Channel organized or not in a RAID configuration.
c) Within the overall storage system, it shall be possible to include disks located on:

External PCs on a LAN or WAN.

Network Attached Servers (NAS) on a LAN or WAN.

Storage Area Networks (SAN).

17) The SSM shall not limit the actual storage capaCollege configured per server.

b. Cyber Security Requirements

1) The USP shall be an IP enabled solution. All communication between the SSM and CSA shall be based on standard TCP/IP protocol and shall use TLS encryption with digital certificates to secure the communication channel.

2) The USP shall support user authentication with claims-based authentication using external providers. External providers shall include:
a) ADFS (Active Directory Federation Services)

3) The USP shall limit the IP ports in use and shall provide the Administrator with the ability to configure these ports.

4) The VMS shall support only secured media stream requests, unless explicitly configured otherwise. Secured media stream requests shall be secured with strong certificate based authentication leveraging RTSPS (aka RTSP over TLS). Client authentication for media stream requests is claims-based and may use a limited lifetime security token.

5) The VMS shall offer the ability to encrypt the media stream, including video, audio, and metadata with authenticated encryption. Media stream encryption shall be done at rest and in transit and be a certificate based AES 128b bits encryption. The VMS shall:
   a) Allow encryption to be set on a per camera basis for all or some of the cameras.
   b) Provide up to 20 different certificates for different groups of CSA or users who have been granted access to decrypted streams.
   c) Not decrease the recording performance by more than 50% when encryption is enabled.
   d) Use Secure RTP (SRTP) to encrypt the payload of a media stream in transit and allow multicast and unicast of the encrypted stream.
   e) Use a random encryption key and change periodically.
   f) Allow encrypted streams to be exported.

6) The VMS shall support end to end encrypted streams with cameras supporting Secure RTP (SRTP) both in unicast and multicast from the camera.

c. Failover and Standby Requirements

1) Failover Directory
   a) The Standby Directory shall act as a replacement SSM on hot standby, ready to take over as the acting Directory in case the primary Directory fails. The failover shall occur in less than 1 minute. No action from the user shall be required.
   b) The Standby Directory shall keep its configuration database synchronized with the primary Directory.
   c) The Standby Directory shall support disaster recovery scenarios where a server can be located in another geographic area (or building) and only take over if all other Directories become offline.
   d) The Standby Directory shall support synchronization of the configuration databases using a backup and restore mechanism. The synchronization period shall be configurable from 15 minutes to 1 week.
   e) The Standby Directory shall support real-time synchronization of the configuration databases using SQL Mirroring or SQL Always On.

2) Standby Archiver. As specified elsewhere in this Section.

3) Off-the-shelf standby/failover options (excluding the VMS Archiver) shall include:
   a) Windows Clustering.

d. Archiving

1) The Archiver (role) shall use an event and timestamp database for the advanced search of audio/video archives. This database shall use Microsoft SQL.

2) The Archiver shall protect archived audio/video files and the system database against network access and non-administrative user access.

3) The Archiver shall digitally sign recorded video using 248-bit RSA public/private key cryptography.

4) The Archiver shall offer a plug and play type hardware discovery service with the following functionalities:
   a) Automatically discover DVS units as they are attached to the network.
   b) Discover DVS units on different network segments, including the Internet, and across routers with or without network address translation (NAT) capabilities.

5) The Archiver shall have the capaCollege to configure the key frame interval (I-frame) in seconds or number of frames.

6) The Archiver shall provide a pre-alarm and post-alarm recording option that can be set between one second and 5 minutes on a per camera basis.

7) The Archiver shall provide the functionality of storing of video and audio streams based on triggering events, such as:
   a) Digital motion detection.
   b) Digital input activation.
   c) Macros.
   d) Through SDK application recording.

8) The Archiver shall perform video motion detection on each individual camera based on a grid of 1320 motion detection blocks. All of the video motion detection settings are configurable on schedule. A global sensitivity threshold is available to reduce motion detection sensitivity when the video signal is noisy or when a lot of false hits are incurred. Video motion detection itself can be set into four different modes:
   a) Full Screen: All 1320 blocks on screen are activated, and a general threshold for the overall motion in the entire image can be set, and when it is reached, it can trigger recording and a motion event or a custom event.
   b) Full Screen Unit: This is the same as the Full Screen but the motion detection takes place in the DVS.
   c) Detection Zone: Six overlapping zones can be defined in the 1320 blocks on screen with each of these zones having its own threshold, and, when that threshold is reached, each one of them can trigger recording and a motion event or a custom event. Each zone triggering its own event allows for the configuration of directional motion detection events and other complex motion detection logic.
   d) Detection Zone Unit: This is the same as the Detection Zone, but the motion detection takes place in the DVS and only one zone is supported.
   e) Disabled: No motion detection is performed on this camera.

9) The Archiver shall be able to detect motion in video within 200 milliseconds and not only on key frames.

10) The Archiver shall allow for multiple recording schedules to be assigned to a single camera. Each schedule shall be created with the following parameters:
   a) Recording mode:

      a) Continuous.

On Motion/Manual.

Manual.

Disabled.

b) Recurrence pattern:

a) Once on specific days.

Specific days on a yearly basis.

Specific days on a monthly basis.

Specific days on a weekly basis.

Daily.

11) Time coverage:

a) All day.

Specific time range(s).

Daytime or nighttime based on the times of sunrise and sunset that are automatically calculated from the time of year and a geographical location. Provision shall be given to offset the calculated sunrise or sunset time by plus or minus 3 hours.

12) The Archiver shall allow each camera (video source) to be encoded multiple times in the same or different video formats (MPEG-4, MPEG-2, MJPEG, H.264, H.265, Wavelet or JPEG2000), limited only by the capabilities of each DVS.

13) Whenever multiple video streams are available from the same camera, users shall be free to use any one of them based on their assigned usage. The standard video stream usages are:
a) Live.
b) Recording.
c) Remote.
d) Low resolution.
e) High resolution.

14) The Archiver shall allow the video quality to vary according to predefined schedules. Such schedules shall have the same configuration flexibility as the recording schedules mentioned earlier. The video quality shall be based on, but not limited to, the following parameters:
a) Maximum bit rate.
b) Maximum frame rate.
c) Image quality.
d) Key frame interval.

15) The Archiver shall have the ability to dynamically boost the quality of the "recording stream" (see previous bullet) based on specific events:
a) When recording is started manually by a user.
b) When recording is triggered by a macro, an alarm or detected motion.

16) The Archiver shall have the capaCollege to communicate with the DVS using 128 bits SSL encryption.

17) The Archiver shall have the capaCollege to communicate with the DVS using HTTPS secure protocol.

18) The Archiver shall have the capaCollege to receive multicast UDP streams directly from the DVS.

19) For network topologies that restrict the DVS from sending multicast UDP streams, the Archiver shall redirect audio/video streams to active viewing clients on the network using multicast UDP.

20) The Archiver shall have the capaCollege to redirect audio/video streams to active viewing clients on the network using unicast UDP or TCP.

21) The Archiver shall empower the administrator with a full range of disk management options:
    a) The Archiver shall allow the administrator to choose which disks to use for archiving and to set a maximum quota for each.
    b) The Archiver shall allow the administrator to spread the archiving of different cameras on different disk groups (groups of disks controlled by the same controller) so that archiving could be carried out in parallel on multiple disks.
    c) The Archiver shall have the capaCollege to move video archives to the Azure Cloud. The archives will be moved after a preset number of days.

22) The Archiver shall offer the following options to clean up old archives, on a camera by camera basis:
    a) After a preset number of days.
    b) Deleting oldest archives first when disks run out of space.
    c) Stop archiving when disks are full.

23) The Archiver shall allow important video sequences to be protected against normal disk cleanup routines.

24) Users shall have the following options when protecting a video sequence:
    a) Until a specified date.
    b) For a specified number of days.
    c) Indefinitely (until the protection is explicitly removed).

25) The Archiver shall allow the administrator to put a cap on the percentage of storage space occupied by protected video.

26) The Archiver shall keep a log and compile statistics on disk space usage.
    a) The statistics shall be available by disk group or for the whole Archiver.
    b) The statistics shall show the percentage of protected video over the total used disk space.

27) The Archiver shall have the capaCollege to down-sample video streams for storage saving purposes. The down-sampling options available are the following:

a) For H.264, MPEG-4, and H.265, streams the down-sampling options are: all key frames, 1 fps, 2 sec./frame, 5 sec./frame, 10 sec./frame, 15 sec./frame, 30 sec./frame, 60 sec./frame, 120 sec./frame.
b) For MJPEG streams the down-sampling options are: 15 fps, 10 fps, 5 fps, 2 fps, 1 fps, 2 sec./frame, 5 sec./frame, 10 sec./frame, 15 sec./frame, 30 sec./frame, 60 sec./frame, 120 sec./frame.

28) The Archiver shall support DVS with edge recording capabilities and offer the following capaCollege:
a) The ability to playback the video recorded on the DVS at different speeds.
b) The ability to offload (video trickling) the video recorded on the DVS on schedule, on event, or manually to store it on the Archiver.
c) It shall be possible to filter the video that is being offloaded using one or multiple of the following filters:

a) Time interval.

Playback request.

Video analytic events.

Motion events.

Bookmarks.

Alarms.

Input pin events.

29) Unit offline events. The Archiver shall be provided with proven performance and scalability figures:
a) The Archiver's performance shall be guaranteed during the rebuild of a disk from a raid 5 disk group. The rebuild process shall not affect the recording and playback capabilities.
b) The recommended server specification from the VMS Manufacturer's Hardware Requirement shall allow Archiver to perform up to 300 cameras or 300Mbs throughput first limit reached.
c) The included high-performance archiver specification from the VMS Manufacturer's Hardware Requirement shall allow Archiver to perform:

a) Up to 500 cameras or 500Mbs throughput first limit reached with a 1Gbs NIC.

Up to 700 cameras or 1300Mbs throughput first limit reached with a 10Gbs NIC.

30) The Archiver shall provide the ability to encrypt the media stream coming from the DVS including the video, audio and metadata
a) Media encryption shall be optional and can be activated on a per DVS basis.
b) Media encryption shall be performed with AES-128.
c) Media encryption shall encrypt all video, audio and metadata at rest and in transit. Once media encryption is turned on for a DVS all

media stored or redirected by the Archiver shall be encrypted and shall require the private key to be decoded.

d) It shall be possible to export the encrypted media into a non-encrypted ASFfile.

e. Standby Archiver

1) The Standby Archiver shall act as a replacement Archiver role on hot standby, ready to take over the functions of the primary Archiver role. The failover will occur in less than 1 minute. No action from the user will be required.

2) Provide at least 1 failover server for each 10 recording servers provided under the work of this Section.

3) The Standby Archiver assigned to an Archiver role entity shall automatically provide protection for all DVS connected to that Archiver role.

4) The Standby Archiver shall protect the primary Archiver role against the following failures:
   a) Server failure (hardware or software).
   b) Storage failure, such as Archiver Role detects that it cannot read or write to any of its allocated disks.

5) It shall be possible for a single USP server to act as the standby server of multiple Archiver roles.
   a) Each Archiver role shall have priority value if multiple Archiver Roles fail at the same time on the same standby server.

6) It shall be possible for any Archiver role in the system to be designated as another's standby and vice-versa.

7) For each Archiver role it shall be possible to set up to 2 standby archiver so that if the first failover Archiver fails the failover will automatically occur to a third server.

8) The Standby Archiver shall have the ability to act as a Redundant Archiver.

9) It shall be possible to set a different retention period for the Archiver and the Redundant Archiver.

10) The Redundant Archiver shall maintain an exact copy of everything recorded by the default Archiver, i.e. audio/video archives, events, and bookmarks.

11) Redundancy shall be configured on a camera by camera basis.

12) The Redundant Archiver shall have to ability to use a multicast video stream from the DVS and shall not require an additional connection to any DVS.

f. Cloud Archiving

1) The VMS shall support the automatic transfer of video recorded on the Archiver to the cloud, based on the age of the video.

2) The Archiver shall encrypt recordings using AES-256 prior to transferring video to the cloud and maintain encryption keys local to the user's system.

3) The VMS shall support TLS encryption between the on-premises Archiver and the cloud.

4) The VMS shall allow users to search video stored in the cloud through the same functionality used when querying video that is stored locally.

5) The VMS will maintain a local cache of video downloaded from the cloud, in order to playback recordings without requiring an additional transfer.

g. VMS Media Streaming

1) The Media Router Role shall be responsible for routing video and audio streams across local and wide area networks from the source (e.g. DVS) to the destination (e.g. CSA).

2) The Media Router Role shall support multiple transport protocols, such as unicast TCP, unicast UDP, and multicast UDP.

3) The Media Router shall support IGMP (Internet Group Management Protocol) to establish multicast group memberships:
   a) IGMP v3, including SSM (Source-Specific Multicast) shall be supported.

4) The Media Router Role using Redirector Agents shall be responsible for redirecting a stream from a source IP endpoint to a destination IP endpoint.

5) The Redirector Agents shall be capable of converting a stream from and to any supported transport protocols:
   a) Multicast UDP to Unicast TCP.
   b) Multicast UDP to Unicast UDP.
   c) Unicast TCP to Multicast UDP.
   d) Unicast UDP to Multicast UDP.

6) It shall be possible to limit the number of concurrent live and playback video redirections for each Redirector Agent in order to better control the bandwidth across multiple sites.

7) It shall be possible to protect the Media Router Role against hardware or software unavailability by configuring another Media Router Role to act as a hot standby server.

8) Multiple Redirector Agents shall be used on a large VMS installation to increase the service availability and to provide automatic load balancing.

h. VMS Video Archives Transfer capabilities

1) Archive transfer shall provide the ability to:
   a) Transfer video from a server to another server in the same system.
   b) Transfer video from a federated server to another server.
   c) Transfer video from camera storage to a server.

2) It shall be possible to program video transfers either on a recurrent schedule, or to trigger them manually or upon connection.

3) It shall be possible to filter the video of interest for a transfer. The video of interest shall be defined with the following filters:
   a) All archives when the camera was offline.
   b) Alarms.
   c) Playback request from the edge.
   d) Video analytics events.
   e) Motion events.
   f) Bookmarks.
   g) Input triggers.
   h) Time range.

4) It shall be possible to define the length of video before and after the event used as a filter to determine the video of interest.

5) The USP shall offer an interface for displaying all video archive transfer requests. This interface shall display all the current, requested and scheduled video transfer requests. It shall be possible to edit, trigger, and cancel video archive transfers from this interface.

i. General Client Software Requirements

1) The Client Software Applications (CSA) shall provide the user interface for USP configuration and monitoring over any network and be accessible locally or from a remote connection.

2) The CSA shall consist of the Configuration UI for system configuration and the Monitoring UI for monitoring. The CSA shall be Windows-based and provide an easy-to-use graphical user interface (UI).

3) The CSA for monitoring shall support running in 64-bit mode.

4) The Server Administrator shall be used to configure the server database(s). It shall be web-based and accessible locally on the SSM or across the network.

5) The CSA shall seamlessly merge access control, license plate recognition (ALPR), and video functionalities within the same user application.

6) The USP shall use the latest user interface (UI) development and programming technologies such as Microsoft WPF (Windows Presentation Foundation), the XAML markup language, and the .NET software framework.

7) All applications shall provide an authentication mechanism, which verifies the validity of the user. As such, the administrator (who has all rights and privileges) can define specific access rights and privileges for each user in the system.

8) Logging on to a CSA shall be done either through locally stored USP user accounts and passwords or using the operators Windows credentials authenticated to the College’s Active Directory X.500 service.

9) When integrated with Microsoft's Active Directory, the CSA and USP shall authenticate users using their Windows credentials. As a result, the USP will benefit from Active Directory password authentication and strong security features.

10) The CSA shall support multiple languages, including but not limited to the following: English, French, Arabic, Czech, Dutch, German, Hebrew, Hungarian, Italian, Japanese, Korean, Norwegian, Persian (Farsi), Polish, Portuguese (Brazilian), Simplified and Traditional Chinese, Russian, Spanish, Swedish, Thai, Turkish and Vietnamese.

11) To enhance usability and operator efficiency, the Configuration UI and Monitoring UI shall support many of the latest UI such as:
   a) A customizable Home Page that includes favorite and recently used tasks.
   b) Task-oriented approach for administrator/operator activities where each type of activity (surveillance, visitor management, individual reports, and more) is an operator task.
   c) Consolidated and consistent workflows for video, ALPR, and access control.
   d) Single click functionality for reporting and tracking. The Monitoring UI shall support both single-click reporting for access control, ALPR, and video, as well as single-click tracking of areas, cameras, doors, zones, cardholders, elevators, ALPR entities, and more. Single-click reporting or tracking shall create a new task with the selected entities to report on or track.

12) Configuration UI and Monitoring UI Home Page and Tasks
   a) The Configuration UI and Monitoring UI shall be task-oriented.
   b) A task shall be user interface design patterns whose goal is to simplify the user interface by grouping related features from different systems such as video and access, in the same display window. Features shall be grouped together in a task based on their shared ability to help the user perform a specific task.
   c) Tasks shall be accessible via the Home Page of either the Configuration or the Surveillance CSA.
   d) Newly created tasks shall be accessible via the Configuration UI or the Monitoring UI taskbar.
   e) Similar tasks shall be grouped into the following categories:

      a) Operation: Access control management, LRP management, and more.

Investigation: Video bookmark/motion/archive reports, access control activity reports, visitor activity reports, alarm reports, ALPR activity reports, and more.

Maintenance: Access control and video configuration reports, troubleshooters, audit trails, health-related reports, and more.

   b) An operator shall be able to launch a specific task only if he or she has the appropriate privileges.
   c) The Home Page content shall be customizable through the use of privileges to hide tasks that an operator should not have access to and through a list of favorite and recently used tasks. In addition, editing a USP XML file to add new tasks on the fly shall also be possible.

13) The Contractor shall provide licensing to enable connection by up to 30 simultaneous Clients.

j. Configuration User Interface (UI)

1) General
a) The Home Page content shall be customizable through the use of privileges to hide tasks that an operator should not have access to and through a list of favorite and recently used tasks. In addition, editing a USP XML file to add new tasks on the fly shall also be possible.
b) The Configuration UI application shall allow the administrator or users with appropriate privileges to change the system configuration.
c) The configuration of all embedded ACS, VMS, and ALPR systems shall be accessible via the Configuration UI.
d) The Configuration UI shall have a home page with single-click access to various tasks.
e) The Configuration UI shall include a variety of tools such as troubleshooting utilities, import tools, and a unit discover tool, amongst many more.
f) The Configuration UI shall include a static reporting interface to:

a) View historical events based on entity activity. The user shall be able to perform such actions as printing a report and troubleshooting a specific access event from the reporting view.

View audit trails that show a history of user/administrator changes to an entity.

b) Common entities such as users, schedules, alarms and many more, can be reused by all embedded systems (ACS, VMS, and ALPR).

2) Video management system
a) The Configuration UI shall allow the administrator or users with appropriate privileges to change video configuration.
b) The Configuration UI shall provide the ability to change video quality, bandwidth, and frame rate parameters on a per camera (stream) basis for both live and recorded video.
c) The Configuration UI shall provide the ability to change video quality by a selection of predefined video quality template.
d) The Configuration UI shall provide the ability to configure brightness, contrast, and hue settings for each camera on the same DVS.
e) The Configuration UI shall provide the capability to enable audio recording on DVS units that support audio.
f) The Configuration UI shall provide the ability to change the audio parameters, serial port and I/O configuration of individual DVS units.
g) The Configuration UI shall provide the capability to rename all DVS units based on system topology and to add descriptive information to each DVS.
h) The Configuration UI shall provide the ability to set recording schedules and modes for each individual camera. The recording mode can be:

a) Continuous.

On motion and Manual.

Manual only.

Disabled.

b) The Configuration UI shall support the creation of schedules to which any of the following functional aspects can be attached:

a) Video quality (for each video stream per camera).

Recording (for each camera).

Motion detection (for each detection zone per camera).

Brightness, Contrast, and Hue (for each camera)

Camera sequence execution

b) The Configuration UI shall support the creation of unlimited recording schedules and the assigning of any camera to any schedule.
c) The Configuration UI shall detect and warn user of any conflict within assigned schedules.
d) The Configuration UI shall provide the capability to set a PTZ protocol to a specific DVS serial port and shall allow mixing domes of various manufacturers within a system.
e) User shall have the ability to configure a return to home function after a predefined time of inactivity for PTZ cameras. This period of inactivity time shall be configurable from 1 to 7200 seconds.

k. VMS Client User Interface (UI)

1) The Monitoring UI shall fulfill the role of a Unified Security Interface that is able to monitor video, ALPR, and access control events and alarms, as well as view live and recorded video.

2) The Monitoring UI shall provide a graphical user interface to control and monitor the USP over any IP network. It shall allow administrators and operators with appropriate privileges to monitor their unified security platform, run reports, and manage alarms.

3) To enhance usability and operator efficiency, the Monitoring UI shall support the following UI concepts:
a) Dynamically adaptive interface that adjusts in real-time to what the operator is doing.
b) A dynamic dashboard loaded with entity-specific widgets (e.g. door and camera widgets).
c) Use of transparent overlays that can display multiple types of data in a seamless fashion.
d) Display tile menus and quick commands.
e) Consolidated and consistent workflows.
f) Tile menus and quick commands easily accessible within every display tile of the user workspace.
g) Single click functionality for reporting and tracking. The Monitoring UI shall support both single-click reporting for access control, ALPR, and video, as well as single-click tracking of areas, cameras, doors, zones, cardholders, elevators, ALPR entities, and more. Single-click

reporting or tracking shall create a new task with the selected entities to report on or to track.

4) Monitoring UI Home Page and Tasks
   a) Similar tasks shall be grouped into the following categories:

      a) Operation: Access control/LRP/video surveillance, visitor management, mustering, access control and video alarm monitoring, and more.

Investigation: Video bookmark/motion/archive reports, access control activity reports, visitor activity reports, alarm reports, ALPR activity reports, and more.

Maintenance: Access control and video configuration reports, troubleshooters, audit trails, and more.

5) Dynamically Adaptive UI, Dashboard, and Widgets
   a) The Monitoring UI shall dynamically adapt to what the operator is doing. This shall be accomplished through the concept of widgets that are grouped in the Monitoring UI dashboard.
   b) Widgets shall be mini-applications or mini-groupings in the Monitoring UI dashboard that let the operator perform common tasks and provide them with fast access to information and actions.
   c) With a single click on an entity (e.g. door or camera) the specific widgets associated to that entity appear and other non-relevant widgets disappear dynamically (instantly). Widgets shall bring the operator information such as door status and camera stream information, as well as user actions, such as door unlock, PTZ controls, and more.
   d) Specific widgets include those for a door, camera, alarm, zone, display tile, video stream (statistics), PTZ camera, and more.

6) Operator Workflows
   a) A workflow shall be a sequence of operations an operator or administrator shall execute to complete an activity. The “flow” relates to a clearly defined timeline or sequence for executing the activity.
   b) The Monitoring UI shall be equipped with consistent workflows for the ALPR, video, and access control systems that it unifies.
   c) Generating or printing a report, setting up or acknowledging an alarm, or creating an incident report shall follow the same process (workflow) whether the operator is working with video, ALPR, or access control, or with both video and access control.

7) Each task within the Monitoring UI shall consist of one or more of the following items:
   a) Event list.
   b) Logical tree. Doors, cameras, zones, ALPR units, and elevators shall be grouped under Areas in a hierarchical fashion.
   c) Entities list of all entities being tracked.
   d) Display tiles with various patterns (1 x 1, 2 x 2, and more).
   e) Display tile menu with various commands related to cameras, doors, PTZ, and tile controls.
   f) Dashboard with widgets.

8) The Monitoring UI shall support multiple event lists and display tile patterns, including:

a) Event/alarm list layout only
b) Display tile layout only
c) Display tile and alarm/event list combination
d) ALPR map and alarm/event list combination

9) User workspace customization
   a) The user shall have full control over the user workspace through a variety of user-selectable customization options. Administrators shall also be able to limit what users and operators can modify in their workspace through privileges.
   b) Once customized, the user shall be able to save his or her workspace.
   c) The user workspace shall be accessible by a specific user from any client application on the network.
   d) Display tile patterns shall be customizable.
   e) Event or alarm lists shall span anywhere from a portion of the screen up to the entire screen and shall be resizable by the user. The length of event or alarm lists shall be user-defined. Scroll bars shall enable the user to navigate through lengthy lists of events and alarms.
   f) The Monitoring UI shall support multiple display tile patterns (e.g. 1 display tile (1x1 matrix), 16 tiles (8x8 matrix), and multiple additional variations).
   g) The Monitoring UI shall support as many monitors as the PC video adapters and Windows Operating System are capable of accepting.
   h) Additional customization options include: show/hide window panes, show/hide menus/toolbars, show/hide overlaid information on video, resize different window panes, and choice of tile display pattern on a per task basis.

10) The Monitoring UI shall provide an interface to support the following tasks and activities common to access control, ALPR, and video:
   a) Monitoring the events from a live security system (ACS and/or VMS and/or ALPR).
   b) Generating reports, including custom reports.
   c) Monitoring and acknowledging alarms.
   d) Creating and editing incidents and generating incident reports.
   e) Displaying dynamic graphical maps and floor plans as well as executing actions from dynamic graphical maps and floor plans.
   f) Management and execution of hot actions and macros.

11) The Monitoring UI shall be able to monitor the activity of the following entities in real-time: areas, ALPR entities, doors, elevators, cameras, cardholders, cardholder groups, zones (input points), and more.

12) The Monitoring UI shall include advanced video capabilities, including:
   a) Advanced live video viewing functionality.
   b) Advanced archive playing and video playback functionality.
   c) Monitoring and management of video system events and alarms.
   d) Intercom or duplex audio.
   e) Generation of video reports.
   f) Control of PTZ cameras.
   g) Creating and monitoring archive transfer requests.
   h) Display metadata overlaid on live or playback video.

13) The Monitoring UI shall leverage the Graphical Processing Unit (GPU) for video decoding.
    a) The following GPU technologies shall be supported:

        a)NVidia CUDA

Intel Quick Sync

    b) The Monitoring UI shall have the ability to decode video through the optimal simultaneous use of the GPU and Computer Processing Units (CPU).

14) The live video viewing capabilities of the Monitoring UI shall include:
    a) The ability to display all cameras attached to the USP and all cameras attached to federated systems.
    b) Support for live video monitoring on each and every display tile within a task in the user's workspace.
    c) The USP shall support uninterrupted video streaming. The CSA shall keep existing video connections active in the event that an SSM (except Archiver) becomes unavailable.
    d) The CSA shall keep existing video connections active in the event that an SSM (except Archiver) becomes unavailable.
    e) The ability to drag and drop a camera into a display tile for live viewing.
    f) The ability to drag and drop a camera into a display tile for live viewing on an analog monitor connected to an IP hardware decoder (converting an IP encoded stream into an analog video signal).
    g) The ability to drag and drop a camera from a map into a display tile for live viewing.
    h) Support for digital zoom on live camera video streams.
    i) The ability for audio communication with video units with audio input and output.
    j) The ability to control pan-tilt-zoom, iris, focus, and presets.
    k) The ability to bookmark important events for later retrieval on any archiving camera and to uniquely name each bookmark in order to facilitate future searches.
    l) The ability to start/stop recording on any camera in the system that is configured to allow manual recording by clicking on a single button.
    m) The ability to activate or de-activate viewing of all system events as they occur.
    n) The ability to switch to instant replay of the video for any archiving camera with the simple click of button.
    o) The ability to take snapshots of live video and be able to save or print the snapshots.
    p) The ability to view the same camera multiple times in different tiles.

15) The video playback (archive playing) capabilities of the Monitoring UI shall include:
    a) Support for audio and video playback for any time span.
    b) Support for video playback on each and every display tile.
    c) The ability to instantly replay the video for any archiving camera with the simple click of a button.
    d) The ability to select between instant synch of all video streams in playback mode, allowing operators to view events from multiple angles or across several camera fields, or non-synchronous playback.

e) The ability to simultaneously view the same camera in multiple tiles at different time intervals.
f) The ability to control playback with:

a) Pause.

Lock Speed.

Forward and Reverse Playback at: 1x, 2x, 4x, 6x, 8x, 10x, 20x, 40x, 100x.

Forward and Reverse Playback frame by frame.

Slow Forward and Reverse Playback at: 1/8x, 1/4x, 1/3x, 1/2x.

Loop playback between two time markers.

b) The ability to display a single timeline or one timeline for each selected video stream, which would allow the operator to navigate through the video sequence by simply clicking on any point in the timeline.
c) The ability to display the level of motion at any point on a timeline.
d) The ability to clearly display bookmarked events on the timeline(s).
e) The ability to query archived video using various search criteria, including, but not limited to, time, date, camera, and area.
f) The tool necessary for searching video and associated audio based on user-defined events or motion parameters.
g) The ability to define an area of the video field in which to search for motion as well as define the amount of motion that will trigger search results. The Monitoring UI shall then retrieve all archived video streams that contain motion that meets the search parameters. There shall be a graphical timeline on which the time of each search hit shall be indicated.
h) The ability to browse through a list of all bookmarks created on the system and select any bookmarked event for viewing.
i) The ability to add bookmarks to previously archived video for easier searching and retrieval.
j) Support for digital zoom on playback video streams.
k) Still image export to PNG, JPEG, GIF, and BMP format with Date and Time stamp, and Camera Name on the image (snapshot).
l) Tools for exporting video and a self-contained video player on various media such as USB keys. This video player shall be easy to use without training and shall still support reviewing video metadata, such as bookmark, or navigating the video with functions like panoramic camera view dewarping.
m) Tools for exporting video sequences in standard video formats, such as ASF.
n) The ability to encrypt exported video files.
o) The ability for an operator to load previously exported video files from their computer or network.
p) The ability for queries to be saved upon closing the CSA and reappear when the application is reopened.
q) The ability to dynamically block, on demand, video stream dynamically to lower level users to prevent access, for a specific time, to live and recorded video.

r) A tool building and exporting a set of videos into a single container. This tool shall allow the operator to build sequences of video to create a storyboard and allow the export of synchronous cameras.
s) The ability to store the video export and still image export at a pre-defined storage location.
t) An interface with the ability to list, search, and manipulate previously generated video exports.
u) The ability to export sequences of video in open standards including ASF and MP4

16) The Monitoring UI shall provide an interface to support the following ALPR tasks and capabilities:
a) Monitoring and management of ALPR events and alarms.
b) Viewing of license plate picture(s) and context images.
c) Viewing of license plate data (e.g. license plate reads)
d) Verification of ALPR data against live and recorded video.

17) Entity Monitoring
a) The USP shall permit the user to select multiple entities to monitor from the Monitoring UI by adding the entities one by one to the tracking list.
b) The Monitoring UI shall provide the option to filter which events shall be displayed in the display tile layout and/or event list layout.
c) It shall be possible to lock a Monitoring UI display tile so that it only tracks the activity of a specific entity (e.g. specific door or camera).
d) The user shall be able to drag and drop an event from an event list (or an alarm from an alarm list) onto a display tile to view a license plate read, cardholder picture ID, badge ID, or live/archived video, among other options.
e) Event, alarm, monitoring/tracking, and report lists shall contain cardholder pictures where applicable.
f) The user shall be permitted to start or pause the viewing of events within each display tile.

18) Display Tile Packing and Unpacking
a) The Monitoring UI shall support single-click unpacking and packing for ALPR hits, ALPR reads, areas, doors, zones, camera sequences, and alarms.
b) The packing and unpacking of entities shall allow operators to quickly obtain additional information and camera views of a specific entity.
c) The unpacking of an entity shall display associated entities. For example, unpacking a door with multiple associated cameras shall display all cameras associated with that door. Unpacking shall reconfigure the display tiles to be able to display all associated entities. For example, unpacking a door (or a zone or alarm) that is currently in a 1 x 1 tile configuration and that has 3 cameras tied to it will create a 1 x 3 display tile arrangement for viewing all associated entities.
d) Packing will return the display to the original tile pattern.

19) Visual Tracking
a) The Monitoring UI shall support the ability to manually track a moving target with the single click of a button.
b) The ability to switch from one camera view to an adjacent camera shall be done within a single display tile.

c) Switching between camera streams shall be accomplished by simply clicking on a semi-transparent shape or overlay.
d) Visual tracking shall be available with both live and recorded video.

l. Server Administrator User Interface Requirements

1) The Server Administrator shall be used to configure the SSM and the Directory Role (main configuration) and its database(s), to apply the license, and more.

2) The Server Administrator shall be a web-based application. Through the Server Administrator, it shall be possible to access the SSM across the network or locally on the server.

3) Access to the Server Administrator shall be protected via login name, password, and encrypted communications.

4) The Server Administrator shall allow the administrator (user) to perform the following functions:
a) Manage the system license.
b) Configure the database(s) and database server for the Directory Role,
c) Activate/Deactivate the Directory Role.
d) Manually back up the Directory Role database(s) and/or restore the server database(s), as well as configure scheduled backups of the databases.
e) Define the client-to-server communications security settings.
f) Configure the network communications hardware, including connection addresses and ports.
g) Configure system SMTP settings (mail server and port).
h) Configure event and alarm history storage options.

m. Unified Web Client (UWC) General Requirements

1) The UPS shall support a unified web client (UWC) for access control and video.

2) The UWC shall be a truly thin client with no download required other than an internet web browser or standard web browser plugins.

3) The UWC shall be platform independent and run within Microsoft Internet Explorer, Firefox, Safari, and Google Chrome.

4) Web pages for the web client shall be managed and pushed by the Mobile Server. Microsoft IIS or any other web hosting service shall not be required given that all the web pages shall be hosted by the Mobile Server.

5) Video Stream shall be redirected to the Web Client with no stream transformation or re-encoding for all streams in H264, H265, and Mpeg4 ISO.

6) The Contractor shall licensing to support access by up to 30 of simultaneous Web Clients.

7) Functionalities:

a) Login using name and password or Active Directory support shall be available.
b) Encrypted communications for all transactions.
c) Print reports and export to CSV file.
d) Customer logo customization shall be available for multi-tenant and hosted services applications.
e) Video

a) Live and playback video at 320 x 240, 640 x 480 or 1280 x 1024 @ 15 fps.

Video export.

1, 4, 6 or 9 tiles.

Basic PTZ Controls (Pan/Tilt, Zoom, go to presets, start pattern).

Start / Stop recording.

Sample web page for customers to see how to view video for their own development.

Add bookmarks.

b) Alarms

a) Alarm report.

n. Smartphone and Tablet App General Requirements

1) The USP shall support mobile apps for various off-the-shelf smartphones and tablets. The mobile apps shall communicate with the Mobile Server of the USP over any WiFi or mobile network connection.

2) Mobile apps shall communicate with the UPS via a Mobile Server (same as the Unified Web Client or UWC). Communication between the mobile device and the Mobile Server shall support optional encryption.

3) Supported device manufacturers shall include (refer to Mobile App specifications for latest compatibility list):
a) Apple iPod Touch, iPhone, and iPad.
b) Android-compatible smartphones and tablets.
c) Windows and Windows Phone 8.1.

4) It shall be possible to download the mobile apps from the Central application store (Apple iTunes App Store, Google Play, Windows Store).

5) Functionalities
a) Live monitoring and command and control of the USP.
b) Receive alarm push notifications from the Apple Push Notification Server or from the Google Android push server.
c) Alarm management (view and acknowledge alarms, video tied to alarms).
d) View USP hierarchy and search for entities.
e) Stream video from the mobile device using the built-in camera.
f) Video

a) View live and playback video at 320 x 240, 640 x 480 or 1280 x 1024 @ 15 fps.

Monitor camera status.

View up to 6 video feeds.

Control PTZ functionality of a camera, including access to PTZ presets.

Save snapshots locally on the device.

View video tied to access control events, and alarms.

o. Health Monitor

1) The USP shall monitor the health of the system, log health-related events, and calculate statistics.

2) USP services, roles, agents, units, and client apps will trigger health events.

3) The USP shall populate the Windows Event Log with health events related to USP roles, services, and client apps.

4) A dedicated role, the Health Monitoring Role, shall perform the following actions:
   a) Monitor the health of the entire system and log events.
   b) Calculate statistics within a specified time frame (hours, days, months).
   c) Calculates availability for clients, servers and video/access/ALPR units.

5) A Health Monitoring task and Health History reporting task shall be available for live and historical reporting.

6) Health events shall be accessible via the SDK (can be used to create SNMP traps).

p. USP General Requirements

1) The Unified Security Platform (USP) shall be a professional class IP-enabled security and safety software solution.

2) The USP shall support the seamless unification of IP access control system (ACS), IP video management system (VMS), and IP automatic license plate recognition system (ALPR) under a single platform. The USP user interface (UI) applications shall present a unified security interface for the management, configuration, monitoring, and reporting of embedded ACS, VMS, and ALPR systems and associated edge devices.

3) Functionalities available with the USP shall include:
   a) Configuration of embedded systems, such as ACS, ALPR, and VMS systems.
   b) Live event monitoring.
   c) Live video monitoring and playback of archived video.

d) Alarm management.
e) Reporting, including creating custom report templates and incident reports.
f) Microsoft Active Directory integration for synchronizing USP user accounts and ACS cardholder accounts.
g) Intrusion device and panel integration (live monitoring, reporting, and arming/disarming).
h) Dynamic graphical map viewing.

4) The USP shall be deployed in one or more of the following types of installations:
a) Unified access, ALPR, video platform, and any combination thereof.
b) Standalone access control, ALPR, or video platform.
c) Unified access and video platform that federates multiple remote ACS and VMS.
d) Standalone video platform that federates multiple independent remote VMS.
e) Standalone access control that federates multiple independent remote ACS.

5) Licensing
a) A single central license shall be applied centrally on the configuration server.
b) There shall be no requirement to apply a license at every server computer or client workstation.
c) Based on selected options, one or more embedded systems shall be enabled or disabled.

6) Hardware and Software Requirements
a) The USP and embedded systems (video, license plate recognition, and access control) shall be designed to run on a standard PC-based platform loaded with a Windows operating system. The preferred operating system shall be coordinated with the College following the manufacturer supported operating systems.
b) The core client/server software shall be built in its entirety using the Microsoft .NET software framework and the C# (C-Sharp) programming language.
c) The USP database server(s) shall be built on Microsoft's SQL Server. The preferred SQL version shall be coordinated with the College and compatible with the USP.
d) The USP shall be compatible with virtual environments, including VMware and Microsoft Hyper-V.
e) The USP shall use the latest user interface (UI) development and programming technologies such as Microsoft WPF (Windows Presentation Foundation), the XAML markup language, and .NET software framework.

q. USP Architecture

1) The USP shall be based on a client/server model. The USP shall consist of a standard Server Software Module (SSM) and Client Software Applications (CSA).

2) The USP shall be an IP enabled solution. All communication between the SSM and CSA shall be based on standard TCP/IP protocol and shall use

TLS encryption with digital certificates to secure the communication channel.

3) The SSM shall be a Windows service that can be configured to start when the operating system is booted and run in the background. The SSM shall automatically launch at computer startup, regardless of whether or not a user is logged on the machine.

4) Users shall be able to deploy the SSM on a single server or across several servers for a distributed architecture. The USP shall not be restricted in the number of SSM deployed.

5) The USP shall protect against potential database server failure and continue to run through standard off-the-shelf solutions.

6) The USP shall support up to one thousand instances of CSA connected at the same time. An unrestricted number of CSA can be installed at any time.

7) The USP shall support an unrestricted number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.

8) The USP shall support uninterrupted video streaming. The CSA shall keep existing video connections active in the event that an SSM (except Archiver) becomes unavailable.

9) Roles-Based Architecture
   a) The USP shall consist of a role-based architecture, with each SSM hosting one or more roles.
   b) Each role shall execute a specific set of tasks related to either core system, automatic license plate recognition (ALPR), video (VMS), or access control (ACS) functionalities, among many others. Installation shall be streamlined through the ability of the USP to allow administrators to:

      a) Deploy one or several SSM across the network prior to activating roles.

Activate and deactivate roles as needed on each and every SSM.

Centralize role configuration and management.

Support remote configuration.

Move roles over from one SSM to another.

   b) Each role, where needed, shall have its own database to store events and role-specific configuration information.
   c) Roles without databases, such as The Federation feature, Active Directory, and Global Cardholder Management, shall support near real-time standby without any third party failover software being required.
   d) Directory Role

a) The Directory Role shall manage the central database that contains all the system information and component configuration of the USP.

The Directory Role shall authenticate users and give access to the USP based on predefined user access rights or privileges, and security partition settings.

The Directory Role shall support the configuration/management of the following components common to the ACS, ALPR, and VMS sub-systems:

Security Partitions, users and user groups.

Areas.

Zones, input/output (IO) linking rules, and custom output behavior.

Alarms. Schedules, and scheduled tasks.

Custom events.

Macros or custom scripts.

The Directory Role shall support the configuration/management of the following components specific to VMS:

Video servers and their peripherals (e.g. audio, IOs, and serial ports).

PTZ.

Camera sequences.

Recording and archiving schedules.

The Directory Role shall support the configuration/management of the following components specific to ACS:

Door controllers, and input and output (IO) modules.

Doors, Elevators, and Access rules.

Cardholders and cardholder groups, credentials, and badge templates.

The Directory Role shall support the configuration/management of the following components specific to ALPR:

ALPR units and cameras.

Hotlists, permit lists, and overtime rules.

b) The Video Archiver Role shall be responsible for managing cameras and encoders under its control and archiving
c) The Media Router Role shall be responsible for routing video and audio streams across local and wide area networks from the source (e.g. DVS) to the destination (e.g. CSA).
d) The Access Manager Role shall be responsible for synchronizing access control hardware units under its control, such as door

controllers and IO modules. This role shall also be responsible for validating and logging all access activities and events when the door controllers and IO modules are online.

e) The Automatic License Plate Recognition (ALPR) Role shall be responsible for synchronizing fixed ALPR units (cameras) and mobile ALPR applications under its control. The ALPR Role shall also be responsible for logging all ALPR activities and events.

f) The Zone Manager Role shall be responsible for managing all software zones (collection of inputs) and logging associated zone events. Zones shall consist of inputs from both access control and video devices.

g) The Health Monitoring Role shall be responsible for monitoring and logging health events and warnings from the various client applications, roles, and services that are part of the USP. This role shall also be responsible for logging events within the Windows Event Log and for generating reports on health statistics and health history.

h) Additional Roles

a) The Active Directory Role shall be responsible for synchronizing user accounts and cardholder accounts with a Microsoft Active Directory server.

The Intrusion Manager Role shall be responsible for managing third party intrusion devices such as alarm panels and perimeter detection devices. This role shall also be responsible for logging all intrusion events in a database.

10) Server Monitoring Service (Watchdog)

a) The USP shall include a Server Monitoring Service that continuously monitors the state of the Server Software Module (SSM) service.

b) The Server Monitoring Service shall be a Windows service that automatically launches at system startup, regardless of whether or not a user is logged into his account.

c) The Server Monitoring Service shall be installed on all PCs/servers running an SSM. In the event of a malfunction or failure, the Server Monitoring Service shall restart the failed service. As a last resort, the Server Monitoring Service shall reboot the PC/server should it be unable to restart the service.

r. USP Threat Levels

1) The USP shall support Threat Levels to dynamically change the system behavior to respond to critical events.

2) Threat Levels shall be activated and deactivated by the CSA operator with the right privilege.

3) Threat Levels shall be set on an area or on the entire system thru a common single interface for video and access control.

4) Threat Levels shall affect the system behavior by executing any action available in the USP such as: trigger output, start recording, block camera, override recording quality, arm zone, set a door in maintenance mode, and more.

5) The following specific actions shall be available with Threat Level:

a) Set minimum security clearance to restrict or permit access to cardholders on specific areas on top of the restrictions imposed by the access rules.
b) Set minimum user level to automatically log out user from the USP.
c) Set reader mode to change how the doors are accessed (e.g. card and PIN, or card or PIN).

6) A visible notification shall be displayed in all operator CSA when a Threat Level is activated.

s. USP Remote Task

1) The USP shall provide, through a Remote Task, capabilities to remotely monitor and control the content of other workstations running the CSA (Monitoring UI) that are part of the same system.

2) The USP shall support video wall applications by connecting and controlling multiple workstations and monitors simultaneously.

3) The Remote Task shall be a graphical interface showing a replication of the remote workstation running the CSA (Monitoring UI).

4) The Remote Task shall allow the connection to other workstations using a low bandwidth mode to receive only snapshots of video viewed remotely.

5) The Remote Task shall allow the connection to other workstations using a spy mode to remain invisible to the remotely connected workstation.

6) The functionality provided by the remote monitoring and control capability shall include:
a) Remote monitoring and control of the monitoring and alarm monitoring tasks.
b) Ability to remotely switch cameras, doors and zones into display tiles.
c) Ability to remotely control live and playback video.
d) Ability to remotely change the tile pattern.
e) Ability to remotely create and delete tasks.
f) Ability to remotely start/stop task cycling.
g) Ability to remotely go into full screen mode.
h) Ability to remotely save and reload the workspace.

t. USP Advanced Task Management

1) USP shall support an infrastructure for managing Monitoring UI tasks used for live monitoring, day to day activities, and reporting.

2) Administrators shall be able to assign tasks and lock the operator`s workspace. The user management of their workspace shall be limited by their assigned privileges.

3) Operators shall be able save their tasks as either Public Tasks or Private Tasks and in a specific partition. Public tasks shall be available to all users. Private tasks shall only be available to the College of the task.

4) Operators shall be able to share their tasks by sending them to one or more online users. Recipients shall have the option to accept the sent task.

u. USP Reporting

1) The USP shall support report generation (database reporting) for access control, ALPR, video, and intrusion.

2) Each and every report in the system shall be a USP task, each associated with its own privilege. A user shall have access to a specific report task if he or she has the appropriate privilege.

3) The workflows to create, modify, and run a report shall be consistent for access control, ALPR, and video reports.

4) Reports shall be federated, allowing global consolidated reporting across multiple independent USP, ACS, and VMS systems.

5) Access control and ALPR reports shall support cardholder pictures and license plate pictures, respectively.

6) The USP shall support the following types of reports:
   a) Alarm reports.
   b) Video-specific reports (archive, bookmark, motion, and more).
   c) Configuration reports (cardholders, credentials, units, access rules, readers/inputs/outputs, and more).
   d) Activity reports (cardholder, cardholder group, visitor, credential, door, unit, area, zone, elevator, and more).
   e) ALPR-specific reports (mobile ALPR playback, hits, plate reads, reads/hits per day, reads/hits per ALPR zone, and more).
   f) Health activity and health statistics reports.
   g) Other types of reports, including visitor reports, audit trail reports, incident reports, and time and attendance reports.

7) Generic Reports, Custom Reports and Report Templates
   a) The user shall the option of generating generic reports from an existing list, generating reports from a list of user-defined templates, or creating a new report or report template.
   b) The user shall be able to customize the predefined reports and save them as new report templates. There shall be no need for an external reporting tool to create custom reports and report templates. Customization options shall include setting filters, report lengths, and timeout period. The user shall also be able to set which columns shall be visible in a report. The sorting of reported data shall be available by clicking on the appropriate column and selecting a sort order (ascending or descending).
   c) All report templates shall be created within the Monitoring UI.
   d) These templates can be used to generate reports on a schedule in PDF or Excel formats.
   e) An unrestricted number of custom reports and templates shall be supported.

8) A reporting task layout shall consist of panes with settings (report length, filters, go and reset commands, etc.), the actual report data in column format, and a pane with display tiles. The user shall be able to drag and drop individual records in a report onto one or more display tiles to view a cardholder’s picture ID, playback a video sequence, or both.

9) The USP shall support comprehensive data filtering for most reports based on entity type, event type, event timestamp, custom fields, and more.

10) The user shall be able to click on an entity within an existing report to generate additional reports from the Monitoring UI.

11) The USP shall support the following actions on a report: print report, export report to a PDF/Microsoft Excel/CSV file, and automatically email a report based on a schedule and a list of one or more recipients.

v. USP User and User Group Security, Partitions, and Privileges Management

1) The USP shall support the configuration and management of users and user groups. A user shall be able to add, delete, or modify a user or user group if he or she has the appropriate privileges.

2) The USP shall support user authentication with claims-based authentication using external providers. External providers shall include:
   a) ADFS (Active Directory Federation Services)

3) Common access rights and privileges shared by multiple users shall be defined as User Groups. Individual group members shall inherit the rights and privileges from their parent user groups. User group nesting shall be allowed.

4) User privileges shall be extensive in the USP. All configurable entities for the USP, including access control/video/ALPR, shall have associated privileges.

5) Specific entities, such as cardholders, cardholder groups, and credentials shall include a more granular set of privileges, such as the right to access custom fields and change the activation or profile status of an entity.

6) Partitions
   a) The USP shall limit what users can view in the configuration database via security partitions (database segments). The administrator, who has all rights and privileges, shall be allowed to segment a system into multiple security partitions.
   b) All entities that are part of the USP can be assigned to one or more partitions.
   c) A user who is given access to a specific partition shall only be able to view entities (components) within the partition to which he or she has been assigned. Access is given by assigning the user as an accepted user to view the entities that are members of a particular partition.
   d) A user or user group can be assigned administrator rights over the partition.

7) It shall be possible to specify user and user group privileges on a per partition basis.

8) Advanced logon options shall be available such as dual logon and more.

9) It shall be possible to specify an inactive period for the Monitoring UI after which time the application shall automatically lock, while still preserving access to currently displayed camera feeds.

w. USP Event/Action Management

1) The USP shall support the configuration and management of events for video and ALPR. A user shall be able to add, delete, or modify an action tied to an event if he has the appropriate privileges.

2) The USP shall receive all incoming events from one or more ACS and/or VMS. The USP shall take the appropriate actions based on user-define event/action relationships.

3) The USP shall receive and log the following events:
   a) System-wide events.
   b) Application events (clients and servers).
   c) Area, camera, door, elevator, and ALPR events (reads and hits).
   d) Unit events.
   e) Zone events.
   f) Alarm events.

4) The USP shall allow the creation of custom events.

5) The USP shall have the capability to execute an action in response to an access control, video, and ALPR event. The USP shall support the following list of actions, without being limited to:
   a) Add bookmark
   b) Block and unblock video
   c) Display a camera on an analog monitor
   d) Display an entity in the CSA
   e) Email a report
   f) Email a snapshot
   g) Export report
   h) Go home
   i) Go to preset
   j) Override recording quality
   k) Play a sound
   l) Reboot unit
   m) Run a macro
   n) Run a pattern
   o) Send a message
   p) Send an email
   q) Set threat level
   r) Start/Stop applying video protection
   s) Start/Stop recording
   t) Start/Stop transfer
   u) Trigger alarm

x. Trigger output

1) The USP shall allow a schedule to be associated with an action. The action shall be executed only if it is an appropriate action for the current time period.

y. USP Schedules and Scheduled Tasks

1) Schedules
   a) The USP shall support the configuration and management of complex schedules. A user shall be able to add, delete, or modify a schedule if he or she has the appropriate privileges.
   b) The USP shall provide full flexibility and granularity in creating a schedule. The user shall be able to define a schedule in 1-minute or 15-minute increments.
   c) Daily, weekly, ordinal, and specific schedules shall be supported.

2) Scheduled Tasks
   a) The USP shall support scheduled tasks for video, and ALPR.
   b) Scheduled tasks shall be executed on a user-defined schedule at a specific day and time. Recurring or periodic scheduled tasks shall also be supported.
   c) Scheduled tasks shall support all standard actions available within the USP, such as sending an email or emailing a report.

z. USP Macros and Custom Scripts

1) The USP shall enable users to automate and extend the functionalities of the system through the use of macros or custom scripts for access control, video, and ALPR.

2) Custom macros shall be created with the USP Software Development Kit (SDK).

3) A macro shall be executed either automatically or manually.

4) In the Monitoring UI, a macro shall be launched through hot actions.

aa. USP Dynamic Graphical Maps (DGM)

1) The USP shall support mapping functionality for access control, video surveillance, intrusion detection, ALPR, and external applications.

2) The USP shall provide a map centric interface with the ability to command and control all the UPS capabilities from a full screen map interface.

3) It shall be possible to span the map over all screens of the USP client station. In the scenario where the map is spanned over all the screens of the USP client station it shall be possible to navigate the map including pan and zoom, and the map's moves shall be synchronized between all screens. Spanning the map over multiple screen must provide the same command and control capabilities than in a single screen display,

4) The DGM shall support the following file format and protocol for importing map background:
   a) PDF
   b) JPG
   c) PNG
   d) Web Map Service (WMS) defined by the Open Geospatial Consortium (OGC)
   e) BeNomad

5) It shall be possible to configure a mixed set of maps made of GIS, online providers and private imported files and link them together.

6) The DGM shall provide the ability to display all native entities of the UPS including:
   a) Cameras, fix, and PTZ
   b) Doors
   c) Camera sequences
   d) Areas
   e) Intrusion areas
   f) Intrusion zones
   g) License Plate Recognition cameras
   h) Digital inputs
   i) Digital outputs
   j) Intercoms
   k) Alarms
   l) Macros
   m) Police Car Patrollers

7) The DGM shall provide the ability to draw and display information over the map in the form of:
   a) Vectoriel shapes: line, rectangles, polygones, ellipse
   b) Pictures
   c) Text

8) The DGM shall provide the ability to the operator to manage layers of entities display over the map, being able to turn them on and off and changing the superposition order.

9) The DGM shall offer built-in map data backup and restore for both map background and layers of entities.

10) The DGM shall scale up to several thousands of entities on a single map and hundreds of maps.

11) The DGM shall provide a means to update a map background without affecting the map object configuration.

12) The DGM shall offer a user friendly graphical map designer to configure the maps.

13) The DGM shall provide a user friendly and intuitive navigation that includes:
   a) The ability to create hierarchies of maps to facilitate navigation within and between various sites and buildings.
   b) The ability to define favorites for recurrent position recall.
   c) The possibility to create links between maps. The map links shall allow the link from one map to multiple maps representing the floors of a building.
   d) A history log of positions.

14) It shall be possible to monitor the state of entities on the map. It shall be possible to customize the icons of any entities represented on the map.

15) The DGM shall display the actual video Field of View of camera. It shall be possible to configure the FOV of a camera by entering the specification of

the camera installation or graphically by moving the boundaries of the Field of View.

16) For PTZ cameras offering position feedback capability, the DGM shall:
    a) Dynamically represent the accurate Field of View of the camera.
    b) Allow the user to act on the PTZ by moving its field of view.

17) The DGM shall offer the ability to optionally set a graphical display notification of the motion detection.

18) The DGM shall offer a smart selection tool to access the video simply by clicking the location the user wants to see, the DGM will automatically select the cameras that can see this location and move the PTZ towards that location. This smart selection tool shall take into consideration the obstacle and not display cameras that cannot see the location because of a wall.

19) It shall be possible to select a location by drawing a zone of interest on the DGM and display all the entities that are part of that zone of interest at once.

20) The user shall be able to select and display the content of multiple USP entities on the map in popup windows.

21) It shall be possible to access live and playback video from the map.

22) It shall be possible to monitor from the DGM all entities event notification. User shall be able to turn on and off the notification per entity.

23) The DGM shall offer the ability to fully operate alarm monitoring. It shall be possible to:
    a) Center the map on entities related to the alarm.
    b) Visualize the Alarms notification on the map access the related video from the map.
    c) Trigger and receive alarms.
    d) Act on the alarm from the DGM, including acknowledgements, forwarding, and investigation.
    e) Visualize that an alarm occurred in an underlying linked map.

24) The DGM shall provide the following search capabilities:
    a) Search and center by entity name.
    b) From the Display of an entity in the USP locate the entity on the map and offer the ability to select another one close-by.

25) Any update of map content by an administrator shall be immediately and dynamically pushed to all DGM users.

bb. USP Audit and User Activity Trails (Logs)

1) The USP shall support the generation of audit trails. Audit trails shall consist of logs of operator/administrator additions, deletions, and modifications.

2) Audit trails shall be generated as reports. They shall be able to track changes made within specific time periods. Querying on specific users, changes, affected entities, and time periods shall also be possible.

3) For entity configuration changes, the audit trail report shall include detailed information of the value before and after the changes.

4) The USP shall support the generation of user activity trails. User activity trails shall consist of logs of operator activity on the USP such as login, camera viewed, badge printing, video export, and more.

5) The ACS shall support the following actions on an audit and activity trail report: print report and export report to a PDF/ Microsoft Excel/CSV file.

cc. USP Incident Reports

1) Incident reports shall allow the security operator to create reports on incidents that occurred during a shift. Both video-related and access control-related incident reports shall be supported.

2) The operator shall be able to create standalone incident reports or incident reports tied to alarms.

3) The operator shall be able to link multiple video sequences to an incident, access them in an incident report, and change the date or time of the sequences later on.

4) It shall be possible to create a list of Incident categories, tag a category to an incident, and filter the search with the category as a parameter.

5) Incident reports shall allow the creation of a custom form on which to input information on an incident.

6) Incident reports shall allow entities, events, and alarms to be added to support at the report's conclusions.

dd. USP Third Party Integration

1) Microsoft Active Directory Integration
   a) The USP shall support a direct connection to one or multiple Microsoft Active Directory server via the Active Directory Role(s). Active Directory integration shall enable the synchronization of information from the Active Directory server to the USP.
   b) Active Directory integration shall permit the central management of the USP users, user groups, cardholders, and cardholder groups.
   c) The USP shall be able to connect to and synchronize data from multiple Active Directory servers (up to 10).
   d) The USP shall support synchronizing Active Directory Universal Groups as well as security groups belonging to other domains within the same forest.
   e) The USP shall support Microsoft Active Directory encryption using LDAP SSL.
   f) When enabled, Active Directory shall manage user logon to the USP client applications through the user's Windows credentials. Logging to the USP shall utilize native Active Directory password management and authentication features.
   g) It shall be possible to synchronize the following USP entities and their information from Active Directory with the USP:

a) Users (username, first and last names, email address, and more).

User groups (user group name, description, and group email address).

Active Directory attributes to USP custom fields.

b) When enabled, the addition, removal, or suspension of a user's Windows account in Active Directory shall result in the creation, deletion, or disabling of the equivalent user account in the USP.
c) Supported synchronization methods for additions, modification, and deletions of synchronized entities shall include: on first logon (users only), manual synchronization, and scheduled synchronization.
d) The USP shall support user connections across independent organizations by connecting to an external ADFS (Active Directory Federation Services) service using claims-based authentication.

ee. USP Software Development Kit (SDK)

1) A USP SDK shall be available to support custom development for the platform.

2) The SDK shall include functionalities specific to the embedded automatic license plate recognition (ALPR), access control (ACS), and video (VMS) systems.

3) Integration with external applications and databases shall be possible with the SDK.

4) The SDK shall enable end-users to develop new functionality (user interface, standalone applications or services) to link the USP to third party business systems and applications, such as Badging Systems, Human Resources Management Systems (HRMS), and Enterprise Resource Planning (ERP) systems.

5) The SDK shall be based on the .NET framework.

6) The SDK shall support dynamic or transactional updates to the USP configuration. It shall also support change notification of USP entity configuration.

7) The SDK shall provide an extensive list of programming functions to view and/or configure core entities such as: users and user groups, alarms, custom events, and schedules, and more.

8) The SDK shall provide an extensive list of programming functions to view and configure ACS and VMS.

9) The SDK shall provide an extensive list of programming functions to view and configure most ACS entities such as: cardholders, cardholder groups, visitors, credentials, access rules (modify only), and custom fields.

10) The SDK shall be able to receive real time events from the following USP entities: users and user groups, areas, zones, cameras, video units, doors, door controllers (units), elevators, cardholders, cardholder groups, and credentials.

11) The SDK shall be able to query the history of events for areas, cameras, zones, alarms, cardholders, credentials, visitors, doors, query license plate read events, license plate hit events, generate a license plate hits report, generate a license plate reads report.

12) The SDK shall support the following alarm functions: view alarms in real time, acknowledge alarms, change priority, and change recipient.

ff. VMS must have these Certifications:

1) CSPN Certification from ANSSI

2) UL 2900-2-3 Level 3 Cyber Security Readiness Certification

3) ISO/IEW 27001 Standard

4) FBI CJIS Compliance for cloud services

5) Microsoft Gold Certification

6) DHS Safety Act Certification

3. Video Management Data Storage Server

a. EIA 19" Rack Mount chassis, including all necessary mounting rails and hardware to mount in DIN (square hole) 4 post racks as provided under the work of Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures.

b. Each server not less than 2RU high.

c. The server shall have the minimum capacities as required by the VMS manufacturer including:

1) CPU's: As required by the VMS Manufacturer.

2) RAM: As required by the VMS Manufacturer.

3) Operating System: As required by the VMS Manufacturer.

4) USB or PS/2 style mouse port

5) USB or PS/2 style keyboard port

6) Dual 10/100/Gigabit/10Gigabit Ethernet Adapters

7) Display Adapter (at least 1024 x 768 resolution @ 65,536 colors)

8) If server cannot boot from iSCSI Raid Array, provide a boot disk hard drive, at least 1T SATA or SAS.

d. Quantity of servers: As required and recommended by the VMS manufacturer for the quantity equal to 1.3 times the number of cameras provided under the work of this Project.

e. Features/Functions/Performance - iSCSI Raid Arrays

1) Total Capacity: As required to capture full-motion video at highest resolution of specified cameras stored without overwriting for at least 30 days continuous operation, assuming:
   a) 1.3 times the camera count initially provided with the Project.
   b) 3.5 megapixel recording resolution per camera or greater as required to match supplied cameras.
   c) H.264 compression
   d) 40% activity (motion present 40% of period)
   e) 15 frame per second motion recording

2) Minimum RAID Architecture:
   a) As required by the VMS Manufacturer.

3) Minimum Construction and Performance
   a) As required by the VMS Manufacturer.

4) Rack mountable, EIA 19", including all necessary mounting rails and hardware to mount in square hole) 4 post racks with DIN (square) openings

5) Not larger than 6 RU.

4. Manufacturers, VMS System:

a. Genetec Security Center Omnicast Professional with Video Storage SubSystem meeting Genetec Hardware Prequalification. Provide with Microsoft Active Directory integration. Provide configured with Failover Directory, Standby Archiver modules. Provide auxiliary software modules as necessary to provide the full functionality required in this specification, including motion detection alarm reporting to and receipt of alarm state from intrusion detection alarm panel supplied under the work of Section 28 13 00.

b. Or equal.

5. Manufacturers, Servers

a. As pre-qualified by the VMS Manufacturer.

b. BCDVIDEO

c. HP

d. Dell

e. Or equal.

6. Manufacturers, iSCSI Array: Quantity - As required to meet storage requirement.

a. As pre-qualified by the VMS Manufacturer.

b. NetApp Inc.

c. Isilon Systems

d. Dell

e. HP

f. pivot

b. Or equal.

7. Manufacturers, Hard Drives for iSCSI Array

a. Seagate

b. Western Digital

c. Or equal.

8. Rack Mount Monitor, Keyboard and 19” Diplay

a. Drawing Reference: 19RMMKVMK

b. Minimum Features, Functions, Performance, Construction

1) Combines an 8-port KVM switch, 19” LCD screen, full keyboard and touchpad in a 1U rack-mountable drawer assembly.

2) Mounts into 19”-wide rack, 26”-38” deep.

3) Control up to 8 servers from a single, easily accessible console.

4) Includes eight cables that support computers with either PS/2 or USB connections

5) Flip-up/fold-down screen keeps the console from blocking access to rack equipment when not in use:

6) 19” monitor supports video resolutions up to 1280 x 1024

7) DDC emulation allows optimal output to the LCD

8) Multi-Level Password Security

9) Enhances security by limiting access to an administrator and up to 4 local users

10) Two-level log-out allows for manual log-out or automatic log-out after a user-defined period of time has passed.

c. Manufacturers:

1) Tripplite B020-U08-19-K

2) APC

3) Or equal.

2.5 Cameras and Related

A. IP Surveillance Indoor and Outdoor Dome Camera, 4K Dome network camera:

1. Drawing References:

a. Interior Cameras, Circle with 1 in center and one arrowhead, subscript CI

b. Exterior Cameras, Circle with 1 in center and one arrowhead, subscript CE

2. The dome network camera shall meet or exceed the following design specifications:

a. The camera shall operate on an open source; Linux-based platform, and including a built-in web server.

b. The camera shall be equipped with an IR-sensitive progressive scan megapixel sensor.

c. The camera shall provide a removable IR-cut filter, providing day/night functionality.

d. The camera shall be equipped with a varifocal lens with P-iris.

e. The camera shall provide local video storage utilizing a microSD/microSDHC/microSDXC memory card expansion.

f. The camera shall be manufactured with an IP52-rated, IK08 impact-resistant, polycarbonate casing.

g. The camera shall provide a manual 3-axis (pan/tilt/rotation) positioning to allow adjustment for optimum camera rotation and placement.

h. The camera shall provide options for clear and smoked lower dome.

3. The dome network camera shall meet or exceed the following performance specifications:

a. Illumination

1) The camera shall meet or exceed the following illumination specifications:
a) 0.19 lux F1.7 (color)
b) 0.04 lux F1.7 (B/W)
c) 0 lux with IR illumination on

b. Resolution

1) The camera shall be designed to provide video streams in (3840x2160) at up to 30 frames per second (60Hz mode) or 25 frames per second (50Hz mode) using H.264 or Motion JPEG.

2) The camera shall provide up to 8 individually cropped out view areas.

3) The camera shall support video resolutions including:
a) 3840x2160

b) 1920x1080 (HDTV 1080p)
c) 1280x720 (HDTV 720p)

4. The camera shall provide both landscape format (4:3 and 16:9 aspect ratio) as well as corridor format (3:4 and 9:16 aspect ratio).

5. Encoding

   a. The camera shall support the following video encoding algorithms:

      1) Motion JPEG encoding in a selectable range from 1 up to 25/30 frames per second in all resolutions.

      2) Baseline Profile H.264 encoding with motion estimation in up to 25/30 frames per second.

      3) Main Profile H.264 encoding with motion estimation and context-adaptive binary arithmetic coding (CABAC) in up to 25/30 frames per second.

      4) Support High Profile H.264 encoding with motion estimation up to 25/30 frames per second.

      5) Support H.264 with automatic scene adaptive bitrate control in up to 25/30 frames per second.

6. The camera shall provide independently configured simultaneous H.264 and Motion JPEG streams.

7. The camera shall in H.264 support Variable Bit Rate (VBR) for video quality adapted to scene content. To protect the network from unexpected bit rate speaks the camera shall support Constant Bit Rate (CBR) or Maximum Bit Rate (MBR).

8. The camera shall provide configurable compression levels.

9. Support standard baseline profile H.264 with motion estimation.

10. Support motion estimation in H.264/MPEG-4 Part 10/AVC.

11. The camera shall for its H.264 implementation support scene adaptive bitrate control with automatic dynamic ROI to reduce bitrate in unprioritized regions in order to lowering bandwidth and storage requirements.

12. Transmission

    a. The camera shall allow for video to be transported over:

       1) HTTP (Unicast)

       2) HTTPS (Unicast)

       3) RTP (Unicast & Multicast)

       4) RTP over RTSP (Unicast)

5) RTP over RTSP over HTTP (Unicast)

b. The camera shall support Quality of Service (QoS) to be able to prioritize traffic.

13. Image

a. The camera shall incorporate Automatic and Manual White Balance.

b. The camera shall incorporate an electronic shutter operating in the range of 1/62500 s to 2 s.

c. The camera shall incorporate Wide Dynamic Range - Forensic Capture functionality providing up to120 dB dynamic range.

d. The camera shall support manually defined values for:

1) Color level

2) Brightness

3) Sharpness

4) Contrast

e. The camera shall incorporate a function for optimization of low light behavior.

f. The camera shall allow for rotation of the image in steps of 90º.

14. Audio

a. The camera shall support two-way audio connectivity via portcast technology with an accessory audio and I/O interface device.

15. IR Illumination

a. The camera shall be equipped with built-in IR LEDs

1) The IR LEDs shall have a range of up to 30 m (100 ft)

2) The IR LEDs shall emit light with a wavelength of 850 nm

16. User Interface

a. Web server

1) The camera shall contain a built-in web server making video and configuration available to multiple clients in a standard operating system and browser environment using HTTP, without the need for additional software.

2) Optional components downloaded from the camera for specific tasks, e.g. Active X, shall be signed by an organization providing digital trust services, such as Verisign, Inc.

b. Language Specification

1) The camera shall provide a function for altering the language of the user interface, and shall include support for at least 10 different languages.

c. IP addresses

1) The camera shall support both fixed IP addresses and dynamically assigned IP addresses provided by a Dynamic Host Control Protocol (DHCP) server.

2) The camera shall allow for automatic detection of the camera based on UPnP and Bonjour when using a PC with an operating system supporting this feature.

3) The camera shall provide support for both IPv4 and IPv6.

17. Protocol

a. The camera shall incorporate support for at least IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, TCP, ICMP, SNMPv1/v2c/v3 (MIB-II), RTSP, RTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, UPnP, ARP, DNS, DynDNS, SOCKS, SSH, NTP, CIFS/SMB, Bonjour

b. The SMTP implementation shall include support for SMTP authentication.

18. Text overlay

a. The camera shall:

1) Provide embedded on-screen text with support for date & time, and a customer-specific text, camera name, of at least 45 ASCII characters.

2) Provide the ability to apply privacy masks to the image.

3) Allow for the overlay of a graphical image, such as a logotype, into the image.

19. Security

a. The camera shall support the use of HTTPS and SSL/TLS, providing the ability to upload signed certificates to encrypt and secure authentication and communication of both administration data and video streams.

b. The camera shall provide centralized certificate management, with both pre-installed CA certificates and the ability to upload additional CA certificates. The certificates shall be signed by an organization providing digital trust services.

c. The camera shall support IEEE 802.1X authentication.

d. The camera shall provide support for restricting access to pre-defined IP addresses only, so-called IP address filtering.

e. The camera shall restrict access to the built-in web server by usernames and passwords at three different levels.

f. Enhanced security features

1) The use of signed firmware validates the firmware's integrity before accepting to install it.

20. API support

a. The camera shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications.

b. The camera shall conform to ONVIF profile G as defined by the ONVIF Organization.

c. The camera shall conform to ONVIF profile S as defined by the ONVIF Organization.

d. The camera shall conform to ONVIF profile T as defined by the ONVIF Organization.

1) For ONVIF profile specifications, see www.onvif.org/

21. Embedded applications

a. The camera shall provide a platform allowing the upload of third party applications into the camera.

22. Installation and maintenance

a. The camera shall be supplied with Windows-based management software which allows the assignment of IP addresses, upgrade of firmware and backup of the cameras' configuration.

23. The camera shall support the use of SNMP-based management tools according to SNMP v1, 2c & 3 / MIB-II.

24. The camera shall allow updates of the software (firmware) over the network, using FTP or HTTP.

25. The camera shall provide the ability to apply a rectangle of customer-defined number of pixels to the image, which can be used as a pixel counter identifying the size of objects in number of pixels.

26. The camera shall accept external time synchronization from an NTP (Network Time Protocol) server.

27. The camera shall store all customer-specific settings in a non-volatile memory that shall not be lost during power cuts or soft reset.

28. The camera shall provide Remote zoom and Remote focus functionality.

29. Access log

a. The camera shall provide a log file, containing information about the 250 latest connections and access attempts since the unit's latest restart. The file shall include information about the connecting IP addresses and the time of connecting.

b. Provide a connection list of all currently connected viewers. The file shall include information about connecting IP address, time of connecting and the type of stream accessed.

30. Camera diagnostics

a. The camera shall be equipped with LEDs, capable of providing visible status information. LEDs shall indicate the camera's operational status and provide information about power, communication with receiver, the network status and the camera status.

b. The camera shall be monitored by a Watchdog functionality, which shall automatically re-initiate processes or restart the unit if a malfunction is detected.

c. The camera shall send a notification when the unit has re-booted and all services are initialized.

31. Hardware interfaces

a. Network interface

1) The camera shall be equipped with one 10BASE-T/100BASE-TX PoE Fast Ethernet-port, using a standard RJ45 connector and shall support auto negotiation of network speed (100 MBit/s and 10 MBit/s) and transfer mode (full and half duplex).

b. Inputs/Outputs

1) The camera shall provide I/O connectivity via portcast technology with an accessory audio and I/O interface device.

32. Enclosure

a. The camera shall:

1) Be manufactured with an IP52-rated, IK08 impact-resistant, polycarbonate casing.

2) Be fitted with a dehumidifying membrane.

3) Provide encapsulated electronics and captive screws.

33. Power

a. Power over Ethernet IEEE 802.3af/802.3at Type 1 Class 3

1) Max: 11.5 W

2) Typical: 8.6 W

34. Environmental

35. The camera shall:

a. Operate in a temperature range of 0 °C to 50 °C (32 °F to 122 °F).

b. Operate in a humidity range of 10–85% RH (non-condensing).

c. Be stored in a humidity range of 5-95% RH (non-condensing).

36. Manufacturer:

a. Interior Camera, Fixed

1) Axis Communications P3228-LV (Design Basis)
a) Provide the following mounts, as scheduled
a. Axis T94K01D Pendant Kit including weather shield.
b. Axis T91 Mounts

37. Exterior Camera, Fixed

a. Axis Communications P3228-LVE (Design Basis)

1) Provide the following mounts, as scheduled
a) Axis T94T01D Pendant Kit
b) Axis T91 Mounts

B. IP Surveillance Interior/Exterior Dome Camera, Three Camera Sensors minimum, Fixed, 180° Combined Horizontal Angle:

1. Drawing References:

a. Interior Cameras, Circle with 3 in center and three arrowheads, subscript CI

b. Exterior Cameras, Circle with 3 in center and three arrowheads, subscript CE

2. The fixed dome multi-sensor network camera shall meet or exceed the following design specifications:

a. Image sensor 4 x 1/2.9” progressive scan RGB CMOS

b. Lens

1) Fixed 3.2 mm, F2.0

2) Horizontal field of view: 180°

3) Vertical field of view: 90°

4) M12 mount

c. Day and night Automatically removable infrared-cut filter

d. Minimum illumination

1) Color: 0.17 lux, F2.0

2) B/W: 0.05 lux, F2.0

e. Shutter time 1/33500 to 1/10 s

f. Camera angle adjustment

1) Pan ±180°

2) Tilt 0°, 35°, 45°, 55°

3) Roll ±10°

g. Video compression

1) H.264 (MPEG-4 Part 10/AVC) Baseline, Main and High Profiles

2) Motion JPEG

h. Resolution 8192x1728 (14.2 MP) to 608x128

i. Frame rate

1) 8.3 MP (client dewarp): up to 25/30 fps (50/60 Hz)

2) 7.5 MP (dewarped): up to 12.5/15 fps (50/60 Hz)

j. Video streaming

1) 2 individually configurable streams in H.264 and Motion JPEG

2) Controllable frame rate and bandwidth

3) VBR/MBR H.264

k. Image settings

1) Saturation, contrast, brightness, sharpness, Forensic WDR: up to 120 dB depending on scene, white balance, day/night threshold, exposure mode, compression, dynamic text and image overlay, exposure control, noise reduction, fine tuning of behavior at low light, polygon privacy masks

l. Security

1) Password protection, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, digest authentication, user access log, centralized certificate management

m. Supported protocols

1) IPv6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, SFTP, CIFS/SMB, SMTP, Bonjour, UPnP®, SNMP v1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH, LLDP

n. Application Programming Interface

1) Open API for software integration

2) ONVIF® Profile S and ONVIF® Profile G, specification at onvif.org

o. Analytics Included

1) video motion detection, active tampering alarm

2) Supported

3) perimeter defender, motion guard, fence guard, loitering guard

4) Support for installation of third-party applications.

p. Event triggers Analytics, edge storage events, shock detection

q. Event actions

1) Day/night mode, overlay text, video recording to edge storage, pre- and post-alarm video buffering, send SNMP trap

2) File upload: FTP, SFTP, HTTP, HTTPS network share, email

3) Notification: email, HTTP, HTTPS TCP

r. Data streaming Event data

s. Built-in installation aids Pixel counter, Leveling guide

t. Casing

1) IP66-/IP67- and NEMA 4X-rated, IK10-rated impact-resistant casing with polycarbonate hard coated clear dome, aluminum base and dehumidifying membrane

2) Color: white NCS S 1002-B

3) For repainting instructions of skin cover or casing and impact on warranty, contact your distributor partner.

u. Mounting

1) Mounting bracket with junction box holes (double-gang, single-gang, 4” square, and 4” octagon)

2) ¾” (M25) conduit side entries

v. Sustainability PVC free

w. Memory 1024 MB RAM, 512 MB Flash

x. Power

1) Power over Ethernet (PoE) IEEE 802.3af/802.3at Type 1 Class 3

2) Typical 7 W, max 12.9 W

y. Connectors RJ45 10BASE-T/100BASE-TX/1000BASE-T PoE

z. Storage

1) Support for microSD/microSDHC/microSDXC card

2) Support for SD card encryption

3) Support for recording to network-attached storage (NAS)

aa. Operating conditions

1) -30 °C to 50 °C (-22 °F to 122 °F)

2) Maximum temperature (intermittent): 60 °C (140 °F)

3) Humidity 10–100% RH (condensing)

3. Manufacturer:

a. Axis Communications P3819-PVE (Design Basis)

1) Provide the following mounts, as required:

a) Axis T94A01D Pendant Kit

Axis T91B61 Wall Mount

Axis T91B51 Ceiling Mount

Axis T94A02F Ceiling Bracket

Axis T91A64 Corner Bracket

Axis T91B50 Telescopic Ceiling Mount

b. Or equal.

C. IP Surveillance Interior/Exterior Dome Camera, Four Camera Sensors, Fixed, 360° Combined Horizontal Angle:

1. Drawing References:

a. Interior Cameras, Circle with 4 in center and four arrowheads, subscript CI

b. Exterior Cameras, Circle with 4 in center and four arrowheads, subscript CE

2. The panoramic network camera shall meet or exceed the following design specifications:

a. Image sensor 4 x 1/2.8” progressive scan RGB CMOS

b. Lens

1) Varifocal, 3–6 mm, F1.8–2.6

2) 4x1080p capture mode:

3) Horizontal field of view: 96°–49°

4) Vertical field of view: 53°–27°

5) Diagonal field of view: 113°–55°

6) Motorized focus, motorized zoom

c. Day and night — Automatically removable infrared-cut filter

d. Minimum illumination — Color: 0.17 lux

e. Shutter time

1) 1/32500 s to 2 s with 50 Hz

2) 1/32500 s to 2 s with 60 Hz

f. Camera angle adjustment — Pan ±90°, tilt 5–65°, rotation 5–95°, twist ±20°

g. Video compression

1) H.264 (MPEG-4 Part 10/AVC) Baseline, Main and High Profiles

2) Motion JPEG

h. Resolution — 4 x 1920x1080 (4 x HDTV 1080p) to 160x90

i. Frame rate — Up to 25/30 fps (50/60 Hz)

j. Video streaming

1) Multiple, individually configurable streams in H.264 and Motion JPEG

2) Controllable frame rate and bandwidth

3) VBR/MBR H.264

k. Image settings

1) Saturation, contrast, brightness, sharpness, Forensic WDR, white balance, exposure control, exposure zone, fine tuning of behavior at low light, rotation: 0°, 90°, 180°, 270° including corridor format, dynamic text and image overlay, Polygon privacy mask, compression

l. IP address — One IP address for all channels

m. Security

1) Password protection, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, digest authentication, user access log, centralized certificate management

n. Supported protocols

1) IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnP, SNMP v1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, SFTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH

o. Application Programming Interface

1) Open API for software integration

2) ONVIF® Profile S and ONVIF® Profile G, specification at onvif.org

p. Analytics Included

1) Video motion detection, active tampering alarm supported

2) Perimeter defender, cross line detection, motion guard, fence guard, and loitering guard, store optimization suite, loss prevention suite

3) Support for installation of third-party applications.

q. Event triggers

1) Detectors, hardware, input signal, storage, system, time, analytics, edge storage events

r. Event actions

1) Day/night vision mode, overlay text, record video, send images, send notification, send SNMP trap, send video clip, status LED

2) File upload: FTP, HTTP, HTTPS, network share, SFTP and email

3) Notification: email, HTTP, HTTPS, TCP and SNMP trap

s. Data streaming Event data

t. Built-in installation aids Pixel counter, focus assistant, remote focus, remote zoom

u. Casing

1) IP66-, IP67-, NEMA 4X-rated, IK09 impact-resistant, aluminium and plastic casing with polycarbonate hard-coated dome, sunshield (PC/ASA)

2) Color: white NCS S 1002-B

v. Mounting

1) Mounting bracket with junction box holes (double gang box, single gang box, 4” octagon junction box and 4” square junction box)

2) ½” (M20) conduit side entry

3) ¾” (M25) conduit adapter included

w. Sustainability PVC free

x. Memory 1024 MB RAM, 512 MB Flash

y. Power

1) Power over Ethernet (PoE) IEEE 802.3at Type 2 Class 4

2) IR illumination on: class 4, typical 11.1 W, max 17.0 W

3) IR illumination off: class 3, typical 8.6 W, max 11.0 W

z. Connectors RJ45 10BASE-T/100BASE-TX PoE

aa. IR illumination

1) Four individually controllable IR with power-efficient, long-life 850 nm IR LEDs

2) Range of reach 15 m (49.2 ft) or more depending on the scene

bb. Storage

1) Support for microSD/microSDHC/microSDXC card

2) Dual SD cards

3) Support for SD card encryption

4) Support for recording to network-attached storage (NAS)

cc. Operating conditions

1) -30 °C to 50 °C (-22 °F to 112 °F)

2) Humidity 10–100% RH (condensing)

3. Manufacturer:

a. Axis Communications P3719-PLE (Design Basis)

1) Provide the following mounts, as required:

2) Axis T94M02D Pendant Kit

3) Axis T91D61 Wall Mount

4) Axis T91B51, T91B63 Ceiling Mount

5) Axis T91B50 Telescopic Ceiling Mount

b. Or equal.

2.6 Power Supplies

A. Computer Grade Uninterruptible Power System, UL Listed

1. Drawing Reference: 2 KVA UPS

2. Features/Functions/Performance:

a. Provide continuous, no-break power with sine wave output.

b. Size to carry connected load.

c. Provide Transient Over-Voltage (TOV) Surge Suppression; comply with ANSI/IEEE C62.41-1980, Category A and Category B.

d. Provide complete isolation from Line.

e. Provide output voltage regulation to ANSI C84.1 for computing equipment.

f. SNMP manageable and status reporting to College's Management console. Provide Ethernet network interface on UPS.

g. Provide output KVA, switch-mode power supply rated, not less than 150% of connected load indicated.

h. Rack Mounted - at full height racks, provide rack mounted equipment.

3. Acceptable:

a. APC Smart-UPS X 2000VA Rack/Tower LCD 100-127V

b. Equal by Tripp Lite.

c. Or Equal.

PART 3 - EXECUTION

3.1 Programming and Installation

A. Initial Systems Programming

1. Meet with College’s Representative to establish functional requirements for surveillance systems, including but not limited to the following:

a. Camera Views

1) Define in conjunction with the College's representatives the minimum field of view to be provided at each fixed cameras. Contractor to review the target for each camera at the Initial Systems Programming Meeting with the College's Representative and adjust the target view areas, and where required, the mounting location to provide the view currently required by the College's Representative. Where the mounting location requires adjustment, Contractor to coordinate related changes required with College's Representative.

2. Document and submit in accordance with the requirements of Section 28 05 00.

3. Provide initial systems programming in accordance with the preceding.

B. Installation

1. General

a. Conform to the manufacturer's recommendations and instructions regarding:

1) camera mounting and adjustment.

2) power and video cable sizing for length of indicated run.

2. Camera Installation

a. Locate the cameras in accordance with the plans and as required to provide the target images noted on the plans, except where modified through the pre-construction meeting described above.

b. Do not place cameras where they will be subject to ready access or tampering from persons in public access areas of the sites.

1) Bring to the College's Representative attention through an RFI any proposed location that does not require a ladder or similar means of access from the public space.

2) Obtain College's Representative's resolution of the RFI prior to proceeding with the installation.

c. Secure cameras to structure so that they cannot be readily removed, including with use tools or by force.

1) Cameras are to be mounted to flush mounted backboxes at fed through rear of camera body, except where surface mounting is explicitly called for.

2) Where surface mounting is indicated, use knock-outs on side of camera housing to connect to conduit. Install backbox containing required structured cabling biscuit box at remote location hidden from view and secure cover with tamperproof fasteners.

3) Select fastening means appropriate to the mounting surface and its underlying framing system and fasten securely to the structure and not to lightweight surface materials. Removal of cameras following successful fastening shall require use of tamper fastener tooling or application of destructive force. College's Representative reserves the right to request

remounting of any camera not found to meet this standard at no additional cost.

d. Where mounting to pipe mount indicated/or required by field conditions, select materials to maintain stability of camera image under environmental conditions associated with installation location, including wind load and potential for impact.

e. At exterior cameras, seal openings as directed by the manufacturer’s instructions.

f. Apply manufacturer's recommended anti-graffiti coating to camera housings and domes.

g. Provide cameras with lensing as required to cover area of coverage indicated on the plans.

h. Adjust auto-iris systems at night to gain maximum depth of field under low light conditions.

i. Using a precision display portable video monitor and/or laptop, adjust each camera's angle and field of view as directed by the College’s Representative.

3.2 System Startup

A. The Contractor shall not apply power to the CCTV system until the following items have been completed:

1. CCTV system equipment items have been set up in accordance with manufacturer's instructions.

2. A visual inspection of the CCTV system has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.

3. System wiring has been tested and verified as correctly connected as indicated.

4. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.

5. Power supplies to be connected to the CCTV system have been verified as the correct voltage, phasing, and frequency as indicated.

B. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work/equipment.

3.3 Systems Performance Testing and Adjusting Procedures

A. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The College’s Representative will witness all performance verification and endurance testing. Written permission shall be obtained from the College’s Representative before proceeding with the next phase of testing. Original copies of all data produced during performance verification and endurance testing shall be turned over to the College’s Representative at the conclusion of each phase of testing prior to College’s Representative approval of the test.

B. Contractor's Field Testing.

1. The Contractor shall calibrate and test all equipment, verify system operation, place the integrated system in service, and test the integrated system. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the College's Representative that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure. In addition, the Contractor shall make a master video tape recording to a USB stick showing typical day and night views of each camera in the system and shall deliver the USB stick with the report. Note any objects in the field of view that might produce highlights that could cause camera blinding. Note any objects in the field of view or anomalies in the terrain which may cause blind spots. Note if a camera cannot be aimed to cover the zone and exclude the rising or setting sun from the picture. Note night assessment capabilities and whether lights or vehicle headlights cause blooming or picture degradation. If any of the above conditions or other conditions exist that cause picture degradation or interfere with the camera field of view, the Contractor shall inform the College's Representative. The field testing shall as a minimum include:

a. Verification that the video transmission system and any signal or control cabling have been installed, tested, and approved as specified.

b. When the system includes remote control/monitoring stations or remote switch panels, verification that the remote devices are functional, communicate with the security center, and perform all functions as specified.

c. Verification that all cameras are aimed and focused properly. The Contractor shall conduct a walk test of the area covered by each camera to verify the field of view.

d. Verification that cameras facing the direction of rising or setting sun are aimed sufficiently below the horizon so that the camera does not view the sun directly.

e. When dome camera mounts are used in the system, verify that all preset positions are correct and that the dome also operates correctly in a manual control mode.

2. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the College's Representative that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

C. Performance Verification Test

1. The Contractor shall demonstrate that the completed CCTV system complies with the contract requirements. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The performance verification test, as specified, shall not be started until receipt by the Contractor of written permission from the College's Representative, based on the Contractor's written report. This shall include certification of successful completion of Contractor Field Testing as specified in paragraph "Contractor's Field Testing," and upon successful completion of training as specified. If the CCTV system is being installed in conjunction with an ESS, the CCTV performance verification test shall be run simultaneously with the ESS performance verification test. The College's Representative may terminate testing at any time when the system fails to perform as specified. Upon successful completion of the

performance verification test, the Contractor shall deliver test reports and other documentation as specified to the College's Representative prior to commencing the endurance test.

2. Testing

a. Picture Monitors:

1) Using indicated video test source, verify linearity and adjust as required.

b. Camera Operation: Demonstrate that each camera:

1) Produces images in conformance with specifications and as defined in the initial systems programming requirements.

2) Includes date/time/camera number identification.

c. Uninterrupted Power Systems: Disconnect normal power service. Demonstrate that the system remains in full operation for the specified time.

3.4 Labeling

A. Conform with the requirements of Section 27 05 53 – Identification for Communications Systems and for field devices, use the device label assigned per the requirements of Section 28 05 00 - Common Work Results for Electronic Safety and Security.

3.5 Warranty

A. Warranty

1. The VMS shall be warranted by the contractor for one (1) year from the date of Substantial Completion.

B. Maintenance and Service

1. The contractor shall provide all services required and equipment necessary to maintain the entire VMS in an operational state as specified for a period of one (1) year after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled adjustments or other nonscheduled work.

C. Description of Work

1. The adjustment and repair of VMS includes computer equipment, contractor provided programming, software updates, signal transmission equipment, access control equipment, facility interfaces, and support equipment. Provide the manufacturers required adjustments, re-programming of deficient contractor programmed functions and other work as necessary.

D. Personnel

1. Service personnel shall be qualified to accomplish all work promptly and satisfactorily. Provide proof that Service personnel have successfully completed the professional level of both hardware and software training offered by the system manufacturer. The

College's Representative shall be advised in writing of the name of the designated service representative and of any change in personnel.

E. Inspections

1. The contractor shall perform two inspections at six (6) month intervals or more often if required by the manufacturers. This work shall be performed during regular working hours, Monday through Friday, excluding Federal holidays. These inspections shall include:

2. Visual checks and operational tests of the central processor, local processors, monitors, keyboards, system printers, peripheral equipment, VMS equipment, power supplies, and electrical and mechanical controls.

3. Clean system equipment, including interior and exterior surfaces.

4. Perform diagnostics on all equipment.

5. Check and calibrate each VMS device.

6. Run system software and correct diagnosed problems.

7. Resolve previous outstanding problems.

F. Warranty Service

1. The College’s Representative shall initiate service calls when the VMS is not functioning properly. Qualified personnel shall be available to provide service to the complete VMS.

2. The College's Representative shall be furnished with the telephone number where the contractor’s service supervisor can be reached at all times.

3. Service personnel shall be at the site within four (4) hours after receiving a request for service.

4. The VMS shall be restored to proper operating condition after one (1) calendar day.

5. Materials installed during warranty service to match or exceed specification of products originally installed for the specified function.

END OF SECTION

SECTION 31 2100

UTILITY TRENCHING AND BACKFILL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping, underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc., and associated structures.

B. Provide labor, material, equipment, and services necessary to complete the backfilling and compacting as necessary for this project. Section includes, but is not limited to:
1. Select Backfill Material
2. Aggregate Base
3. Detectable Tape
4. Trench Excavation
5. Pipe Bedding
6. Trench Backfill
7. Trench Surfacing

C. This section excludes drainage fill material and placement around subdrains. See Section 33 46 00 – Subdrainage.

1.2 RELATED SECTIONS

A. Section 31 1000 – Site Clearing

B. Section 31 2000 – Earthwork Moving

C. Section 31 2319 - Dewatering

D. Section 33 1000 – Water System

E. Section 33 3000 – Sanitary Sewer System

F. Section 33 4100 – Storm Utility Drainage Piping

G. Section 33 4600 – Subdrainage

1.3 RELATED DOCUMENTS

A. Geotechnical Report: [Insert Report Title, Company, and Report Date].

B. ASTM
1. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
2. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Applications.

C. California Administrative Code, Title 24, Part 2 - Basic Building Regulations, Chapter 24, Excavations, Foundations, and Retaining Walls.

D. Caltrans Standard Specifications, 2015
   1. Section 19, Earthwork
   2. Section 26, Aggregate Bases
   3. Section 68, Subsurface Drains
   4. Section 96, Geosynthetics

E. CAL/OSHA, Title 8

1.4 DEFINITIONS

A. AC: Asphalt Concrete

B. ASTM: American Society for Testing and Materials

C. Base: The layer placed between the subgrade and surface pavement in a paving system.

D. Bedding: Material from bottom of trench to bottom of pipe

E. CDF: Controlled Density Fill

F. DIP: Ductile Iron Pipe

G. Engineered Fill:
   1. Soil or soil-rock material approved by the Kensington Fire Protection District and transported to the site by the Contractor in order to raise grades or to backfill excavations.
   2. Contractor shall provide sufficient tests, and a written statement that all materials brought onto the project site comply with specification requirements.

H. Excavation: Consists of the removal of material encountered to subgrade elevations

I. Initial Backfill: Material from bottom of pipe to 12 inches above top of pipe

J. PCC: Portland Cement Concrete

K. RCP: Reinforced Concrete Pipe

L. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.

M. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of ½ the outside diameter measured from the top or bottom of the pipe.

N. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base.

O. Subsequent Backfill: Material from 12 inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.

P. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
   1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans or authorized by the Geotechnical Engineer.
   2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.

Q. Utility Structures:
   1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
   2. Sanitary sewer manholes, vaults, etc.
   3. Water vaults, etc.

1.5 SUBMITTALS

A. Test Reports: Submit the following report for import material directly to the Kensington Fire Protection District from the Contractor's testing services:
   1. Compaction test reports for aggregate base.

B. Samples:
   1. If required by the Geotechnical Engineer, provide 20-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material. Do not import materials to Project without written approval of the Geotechnical Engineer and the Kensington Fire Protection District.
   2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer and the Kensington Fire Protection District.

1.6 QUALITY ASSURANCE

A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.

B. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19, Earthwork.

C. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

D. Soil Testing:
   1. Contractor to engage a geotechnical testing agency, to include compaction testing and for quality control testing during fill operations.
   2. Test results will be submitted to the Kensington Fire Protection District.

1.7 PROJECT CONDITIONS

A. Promptly notify the Kensington Fire Protection District of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Kensington Fire Protection District verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless

Contractor has notified the Kensington Fire Protection District in writing of differing conditions prior to contractor starting work on affected items.

B. Barricade open excavations and post with warning lights.
   1. Operate warning lights and barricades as required.
   2. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout, and other hazards.
   3. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.

D. Provide dust and noise control.

E. Environmental Requirements:
   1. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.
   2. Protect existing streams, ditches and storm drain inlets during work on this project.

F. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.

G. Transport all excess soils materials by legally approved methods to disposal areas.
   1. Coordinate with the Engineer.
   2. Any additional fill requirements shall be the responsibility of the Contractor.

1.8 EXISTING UTILITIES

A. Locate existing underground utilities in the areas of work. For utilities that are to remain in place, provide adequate means of protection during excavation operations.
   1. Locating of existing underground utilities shall include but not be limited to pot-holing prior to the start of construction.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Kensington Fire Protection District and/or utility agency immediately for directions.
   1. Cooperate with the Kensington Fire Protection District and public and private utility companies in keeping their respective services and facilities in operation.
   2. Repair damaged utilities to the satisfaction of the agency with jurisdiction.

C. Do not interrupt existing utilities serving facilities occupied and used by the Kensington Fire Protection District or others, except when permitted in writing by the Kensington Fire Protection District and then only after acceptable temporary utility services have been provided.

PART 2 - PRODUCTS

2.1 GENERAL

A. Import materials will be subject to approval of the Geotechnical Engineer.

B. For approval of imported fill material, notify the Kensington Fire Protection District at least 7 days in advance of intention to import material.

2.2 PIPE BEDDING AND INITIAL BACKFILL

A. ASTM D2321, Class IA, IB or II.
1. Clean and free of clay, silt or organic matter.

B. Permeable Material: In accordance with Section 68-2.02F of Caltrans Standard Specifications, Class 1, Type A or Class 2.

C. Class 2 Aggregate Base: In accordance with Section 26 of Caltrans Standard Specifications, ¾ inch maximum.

D. Sand: In accordance with Section 19-3.02F of Caltrans Standard Specifications.

2.3 SELECT BACKFILL

A. Select backfill material shall be gravel, free of clay or organic matter and shall conform to the following gradation:

Sieve Size	Percentage Passing
1 inch	100
¾ inch	90 – 100
No. 4	35 – 60
No. 200	2 - 9

B. For gas pipe and fuel piping select backfill shall be clean, graded building sand conforming to the following gradation:

Sieve Size	Percentage Passing
No. 4	100
No. 200	0 -5

2.4 WARNING TAPE

A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.
1. Warning Tape Color Codes
a. Red: Electric
b. Yellow: Gas, Oil; Dangerous Materials
c. Orange: Telephone and Other Communications
d. Blue: Water Systems

e. Green: Sewer Systems
f. White: Steam Systems
g. Gray: Compressed Air

2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.
3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.5 DETECTION WIRE FOR NON-METALLIC PIPING

A. Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

2.6 SUBSEQUENT BACKFILL

A. Conform to on-site or imported structural backfill.

2.7 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)

A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8 inch top size. The 3/8 inch aggregate shall not comprise more than 30% of the total aggregate content.

B. Cement: Conform to the standards as set forth in ASTM C150, Type II Cement.

C. Fly Ash: Conform to the standards as set forth in ASTM C618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.

D. Air Entraining Agent: Conform to the standards as set forth in ASTM C260.

E. Aggregates need not meet the standards as set forth in ASTM C33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.

F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.

G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the

placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.

H. Mix design shall meet the Geotechnical Engineer's approval.

2.8 CONCRETE STRUCTURE BEDDING AND BACKFILL

A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill, or other material approved by the Geotechnical Engineer.

B. Poured-in-Place Structures:
1. Bedding: Bedding shall meet the approval of the Geotechnical Engineer. In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
2. Side Backfill: On-site or imported structural fill.

2.9 GEOSYNTHETICS

A. Filter Fabric:
1. Filter Fabric: Section 96-1.02 of Caltrans Standard Specifications.
2. Mirafi 140N, Mirafi Inc., or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with the recommendations of the Geotechnical Engineer.

B. Protect existing trees to remain. No grading is permitted under the drip line of protected trees.

C. Excavations for appurtenant structures, such as, but not limited to, manholes, transition structures, junction structure, vaults, valve boxes, catch basins, thrust blocks, and boring pits, shall be deemed to be in the category of trench excavation.

D. Unless otherwise indicated in the Plans, all excavation for pipelines shall be open cut.

E. Prior to commencement of work, become thoroughly familiar with site conditions.

F. In the event discrepancies are found, immediately notify the Kensington Fire Protection District in writing, indicating the nature and extent of differing conditions.

G. Backfill excavations as promptly as work permits.

H. Do not place engineered fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the Kensington Fire Protection District.

I. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

J. In excavations, use satisfactory excavated or borrow material.

K. Under grassed areas, use satisfactory excavated or borrow material.

3.2 SITE PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, which are to remain, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the Kensington Fire Protection District.

3.3 EXISTING UTILITIES

A. Identity the location of existing utilities.
1. Prior to trenching, the Contractor shall excavate at locations specifically indicated on the Plans, if any, and where new lines cross other utilities of uncertain depth and determine the elevation of the utility in question to ensure that the new line will clear the potential obstruction.
2. The Contractor shall contact Underground Service Alert (USA) at 1-800-227-2600 for assistance in locating existing utilities.
3. If, after the excavation, a crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the Kensington Fire Protection District to clear the utility.

B. Protect all existing utilities to remain in operation.

C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at Contractor's risk.

D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
1. Use hand or light equipment for excavating immediately adjacent to known utilities or for excavations exposing a utility or buried structure.
2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
4. Report damage of utility line or subsurface structures immediately to the Owner.

E. Backfill trenches resulting from utility removal in lifts of 8 inches maximum.

3.4 TRENCH EXCAVATION

A. General
1. Excavation shall include removal of all water and materials that interfere with construction. The Contractor shall remove any water which may be encountered in the trench by pumping or other methods during the pipe laying, bedding and backfill operations. Material shall be sufficiently dry to permit approved jointing.
2. Excavation shall include the construction and maintenance of bridges required for vehicular and pedestrian traffic, support for adjoining utilities.
3. The Contractor shall be responsible to safely direct vehicular and pedestrian traffic through or around his/her work area at all times.

4. The Contractor shall relocate, reconstruct, replace or repair, at his/her own expense, all improvements which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor.

B. Existing Paving and Concrete:
   1. Existing pavement over trench shall be sawcut, removed, and hauled away from the job. Existing pavement shall be neatly sawcut along the limits of excavations.
   2. Existing concrete over the trench shall be sawcut to a full depth in straight lines, at a minimum distance of 12 inches beyond the edge of the trench, either parallel to the curb or a right angles to the alignment of the sidewalk.
   3. Boards or other suitable material shall be placed under equipment outrigging to prevent damage to paved surfaces.

C. Trench Width:
   1. The maximum allowable trench widths at the top of the all pipe materials outside diameter of barrel pipe plus 18 inches. shall be as follows:
      a. The maximum trench width shall be inclusive of all shoring.
      b. If the maximum trench width is exceeded, the State's representative may direct the Contractor to encase or cradle the pipe in concrete at no additional charge.
   2. For pipes 3 inch diameter and larger, the free working space on each side of the pipe barrel shall not be less than 6 inches.

D. Excavation Width at Springline of Pipe:
   1. Up to a nominal pipe diameter of 24 inches: Minimum of twice the outside pipe diameter, or as otherwise allowed or required by the Geotechnical Engineer.
   2. Nominal pipe diameter of 30 inches through 36 inches: Minimum of the outside pipe diameter plus 2 feet, or as otherwise allowed or required by the Geotechnical Engineer.
   3. Nominal pipe diameter of 42 inches through 60 inches: Minimum of the outside pipe diameter plus 3 feet, or as otherwise allowed or required by the Geotechnical Engineer.

E. Open Trench:
   1. The maximum length of open trench shall be 300 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench shall be left open at the end of the day.
   2. Provisions for trench crossings and free access shall be made at all street crossings, driveways, water gate valves, and fire hydrants.
   3. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.
   4. Excavation Depth for Bedding: Minimum of 6 inches below bottom of pipe or as otherwise allowed or required by the Geotechnical Engineer, except that bedding is not required for nominal pipe diameters of 2 inches or less.
   5. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.
   6. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
   7. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

F. Excavated Material:
   1. All excavated material not required for backfill shall be immediately removed and properly disposed of in a legal manner by the Contractor.
   2. Material excavated in streets and roadways shall be laid alongside the trench no closer than 2 feet from the trench edge and kept trimmed to minimize inconvenience to public traffic.
   3. Provisions shall be made whereby all storm and wastewater can flow uninterrupted in gutters or drainage channels.

3.5 CONTROL OF WATER AND DEWATERING

A. Contractor attention is directed to Section 31 23 19, Dewatering.

B. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage to the satisfaction of the Geotechnical Engineer and the Owner until backfilling is completed.

C. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.

D. Obtain the Geotechnical Engineer's approval for proposed control of water and dewatering methods.

E. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.

F. Maintain dewatering system in place until dewatering is no longer required.

3.6 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Geotechnical Engineer, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.7 PIPE BEDDING

A. Obtain approval of bedding material from the Geotechnical Engineer.

B. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of bedding material will not be permitted.

C. Stabilization of Trench Bottom: When the trench bottom is unstable due to wet or spongy foundation, trench bottom shall be stabilized with gravel or crushed rock. The State's inspector will determine the suitability of the trench bottom and the amount of gravel or crushed rock needed to stabilize a soft foundation. Soft material shall be removed and replaced with gravel or crushed rock as necessary.

D. Placement of Bedding Material: The trench bottom shall be cleaned to remove all loose native material prior to placing select backfill material. Sufficient select backfill material shall be placed in trench and tamped to bring trench bottom up to grade of the bottom of pipe. The relative compaction of tamped material shall be not less than 90 percent. It is the intention of these requirements to provide uniform bearing under the full length of pipe to a minimum width of 60 percent of the external diameter.

3.8 BACKFILLING

A. Initial Backfill:
1. Obtain approval of backfill material from Geotechnical Engineer.
2. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12 inches above the top of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of initial backfill material will not be permitted.

B. Pipe Detection: In trenches containing pressurized plastic pipes, tracer wire shall be placed directly above the pipe and shall be connected to all valves, existing exposed tracer wires, and other appurtenances as appropriate.

C. Installation of Tracer Wire:
1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.

4. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

D. Installation of Warning Tape
1. Install tape approximately 1 foot above and along the centerline of the pipe.
2. Where tape is not continuous lap tape ends a minimum of 2 feet.

E. Subsequent Backfill:
1. Above the level of initial backfill, the trench shall be backfilled with non-expansive native material from trench excavation or with imported select backfill material (Contractor's option). Subsequent backfill shall be free of vegetable matter, stones or lumps exceeding 3 inches in greatest dimension, and other unsatisfactory material.
2. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, except that the upper 36 inches in areas subject to vehicular traffic shall be compacted to at least 95% relative compaction, unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of subsequent backfill material will not be permitted.

F. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe. Jetting of trench backfill is not permitted.

G. Utility backfill shall be inspected and tested by the Geotechnical Engineer during placement. Cooperate with the Geotechnical Engineer and provide working space for such tests in operations. Backfill not compacted in accordance with these specifications shall be re-compacted or removed as necessary and replaced to meet the specified requirements, to the satisfaction of the Geotechnical Engineer and the Owner prior to proceeding with the Project.

H. Compaction testing shall be in accordance with California Test Method ASTM D1556 or D1557.

3.9 CLEANUP

A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.

END OF SECTION

SECTION 31 2319

DEWATERING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, and equipment necessary to dewater trench and structure excavations, in accordance with the requirements of the Contract Documents. The Contractor shall secure all necessary permits to complete the requirements of this section. The Contractor shall refer to 31 2100, Utility Trenching and Backfill for other dewatering requirements.

1.2 RELATED SECTIONS

A. Section 31 2100, Utility Trenching and Backfill

1.3 CONTRACTOR SUBMITTALS

A. Prior to commencement of excavation, the Contractor shall submit a detailed plan and operation schedule for dewatering of excavations. The Contractor may be required to demonstrate the system proposed and to verify that adequate equipment, personnel and materials are provided to dewater the excavations at all locations and times. The Contractor's dewatering plan is subject to review by the Owner’s Representative.

1.4 QUALITY CONTROL

A. It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

B. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.

C. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals (at least weekly) to detect any settlement which may develop. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely on the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

D. It is the Contractor’s responsibility to obtain all necessary local, state, and federal permits, permissions, and approvals for the selected discharge location.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Dewatering, where required, may include the use of well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, and other means. Standby pump equipment shall be maintained on the jobsite.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Contractor shall provide all equipment necessary for dewatering. It shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all time, competent workmen for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation during power failure.

B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level. Dewatering shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this section or other requirements.

C. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

E. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with drain rock at no cost to the Kensington Fire Protection District. Drain rock layer shall be approved Class II Permeable Material.

F. The Contractor shall maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation, construction, backfilling, and up to acceptance.

G. Flotation shall be prevented by the Contractor by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.

H. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sand packed and/or other means shall be used to prevent pumping of fine sands or silts from the subsurface. A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation. If well points or wells are used, a permit from the County shall be obtained by the Contractor. Wells, well points and piezometers shall be installed and removed or abandoned in accordance with County requirements.

I. Dewatering wells, well points, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level at least two feet below the bottom of excavations before the excavation work begins at each location. Water shall be removed and excluded until backfilling is complete and all field soils testing have been completed.

J. Dewatering Design Criteria: The Contractor shall design its dewatering systems to meet the following minimum requirements:
   1. Provide stable excavation walls and bottom in accordance with California and Federal OSHA requirements.
   2. Provide reasonably dry base of excavation.
   3. Prevent boiling of the excavation bottom.
   4. Filter native soil and prevent loss of soil through piping action.
   5. Preserve the undisturbed bearing capacity of subgrade soils at the bottom of the excavation.
   6. Draw down the groundwater level below and beyond the excavation bottom and sidewalls where shoring is not designed to resist hydrostatic pressures.

K. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent floatation or movement of structures, pipelines and sewers.

L. Discharge of removed groundwater shall be in accordance with the Contractor's SWPPP and State and Federal regulations. Water removed from excavations shall be discharged to a sedimentation tank(s). Groundwater shall be tested for contaminants prior to discharge. All discharges shall be approved by the local and State jurisdiction.

M. It is the Contractor’s responsibility to obtain all necessary local, state, and federal permits, permissions, and approvals for the selected discharge location.

N. Discharge of groundwater removed by the dewatering system may be allowed to the Sanitation District wastewater collection system. Groundwater must meet specific quality and quantity requirements before discharge to the sewer is allowed. The Contractor shall coordinate with the Sanitation District and obtain approval for discharge to the sewer. If the Contractor elects to discharge elsewhere, it is the Contractor's responsibility to obtain all necessary local, state, and federal permits, permissions, and approvals for the selected discharge location.

O. Dewatering of trenches and other excavation shall be considered as incidental to the construction of the Work and all costs thereof shall be included in the various contract prices of the Bid Forms, unless a separate bid item has been established for dewatering.

END OF SECTION

SECTION 32 1100

PAVEMENT BASE COURSE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate subbase

B. Aggregate base

C. Cement treated base

D. Lime stabilization

1.2 RELATED SECTIONS

A. Section 01 5050, Erosion Control

1.3 RELATED DOCUMENTS

A. Geotechnical Report: Report on Kensington Public Safety Building 217 Arlington Avenue Kensington, California by Haley & Aldrich, Inc. for MARJANG Architecture, dated December 2021.

B. ASTM:
1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
2. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
3. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
4. E548, Guide for General Criteria Used for Evaluating Laboratory Competence

C. Caltrans Standard Specifications, 2015
1. Section 24, Stabilized Soils
2. Section 25, Aggregate Subbases
3. Section 26, Aggregate Bases
4. Section 27, Cement Treated Bases

1.4 DEFINITIONS

A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.

B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material ¾ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.

C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.

D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.

1.5 SUBMITTALS

A. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.6 QUALITY ASSURANCE

A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.

B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.

C. Perform installation of base materials under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of the Geotechnical Engineer, shall be removed and replaced at no cost to the Kensington Fire Protection District. Notify the Geotechnical Engineer at least 24 hours prior to commencement of base material installation and at least 48 hours prior to testing.

D. Do not mix or place cement treated base when the temperature is below is below 36 degrees F or when the ground is frozen.

E. Finish surface of material to be stabilized prior to lime treatment shall be in accordance with Caltrans Standard Specification Section 24, Stabilized Soils.

F. Finish surface of the stabilized material after lime treatment shall be in accordance with Caltrans Standard Specifications Section 24, Stabilized Soils.

G. Finish surface of cement treated base shall be in accordance with Caltrans Standard Specification Section 27, Cement Treated Bases.

H. Do not project the finish surface of aggregate subbase above the design subgrade.

I. Finish grade tolerance at completion of base installation: +0.05 feet

1.7 PROJECT CONDITIONS

A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the Kensington Fire Protection District.

C. Provide dust and noise control.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE

A. Material: Class 2, ¾ inch maximum in accordance with Caltrans Standard Specification Section 26, Aggregate Bases.

PART 3 - EXECUTION

3.1 GENERAL

A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

3.2 WET WEATHER CONDITIONS

A. Do not place or compact subgrade if above optimum moisture content.

B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.3 AGGREGATE SUBBASE

A. Spreading and Compacting: In accordance with Caltrans Standard Specification Section 25-1.03D, Spreading and 25-1.03E, Compacting.

3.4 AGGREGATE BASE

A. Watering, Spreading and Compacting: In accordance with Caltrans Standard Specification Section 26-1.03D, Spreading and 26-1.03E, Compacting.

3.5 DISPOSAL

A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Kensington Fire Protection District.

END OF SECTION

SECTION 32 1216
ASPHALT PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hot Mix Asphalt

B. Tack coat

C. Hot Mix Asphalt paving

D. Hot Mix Asphalt overlay

E. Speed bumps

F. Asphalt curbs

G. Pavement grinding

H. Adjusting manholes, valves, monument covers and other structures to grade

1.2 RELATED SECTIONS

A. Section 32 1100, Pavement Base Course

1.3 RELATED DOCUMENTS

A. Geotechnical Report: Report on Kensington Public Safety Building 217 Arlington Avenue Kensington, California by Haley & Aldrich, Inc. for MARJANG Architecture, dated December 2021.

B. ASTM
1. D979: Standard Practice for Sampling Bituminous Paving Mixtures
2. D1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
3. D2041: Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
4. D2726: Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
5. D2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
6. D3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

C. Caltrans Standard Specifications, 2015
1. Section 20: Landscape
2. Section 39: Asphalt Concrete
3. Section 88: Engineering Fabrics
4. Section 92: Asphalt Binder
5. Section 94: Asphaltic Emulsions

6. Section 96: Geosynthetics

1.4 DEFINITIONS

A. ASTM: American Society for Testing Materials.

B. Caltrans: State of California, Department of Transportation

1.5 QUALITY ASSURANCE

A. Testing Agency: Owner's Representative will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Thickness of hot mix asphalt: In-place compacted thickness of asphalt courses will be determined according to ASTM D3549.

D. Surface Smoothness: Finished surface of each asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D979.
   1. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement may be determined by testing core samples according to ASTM D1188 or ASTM D2726.
      a. One core sample may be taken for every 1000 square yard or less of installed pavement, but in no case will fewer than 3 cores be taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

1.6 SUBMITTALS

A. Job-Mix Designs: Certificates signed by manufacturers certifying that each hot mix asphalt mix complies with requirements.

B. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Tack Coat: Minimum surface temperature of 60 F at application.
   2. Asphalt Base Course: Minimum surface temperature of 40 F and rising at application.
   3. Asphalt Surface Course: Minimum surface temperature of 60 F at application.
   4. Reinforcing Fabric: Air temperature is 50 F and rising and pavement temperature is 40 F and rising.

PART 2 - PRODUCTS

2.1 HOT MIX ASPHALT

A. Type A In accordance with Caltrans Standard Specifications Section 39-2, Hot Mix Asphalt.

B. Hot Mix Asphalt Materials:
   1. Asphalt Binder: Grade PG 64-10 in accordance with Caltrans Standard Specification Section 92, Asphalt Binders.
   2. Tack Coat: Grade SS1 in accordance with Caltrans Standard Specification Section 94, Asphaltic Emulsions.

C. Aggregates: 1-inch max gradation for virgin aggregate and recycled asphalt pavement (RAP) in accordance with to Caltrans Standard Specification Section 39-2.02, Type A Hot Mix Asphalt.

D. Soil Sterilant: In accordance with Caltrans Standard Specifications Section 20-5.03, Inert Ground Covers and Mulches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Areas to receive new foundation improvements, floor slabs, and pavements should be excavated as necessary to reach design subgrade elevation but should not extend below the base of adjacent foundations.

B. Surfaces exposed by excavation should be scarified to a depth of about 8 inches, moisture-conditioned to above the optimum moisture content, and compacted to at least 90 percent relative compaction.

C. In pavement areas that will receive vehicular traffic, the upper 8 inches of the soil subgrade and aggregate base should be compacted to at least 95 percent relative compaction to achieve a firm, unyielding subgrade.

D. The soil subgrade should be kept moist until it is covered by the concrete slab-on-grade or aggregate base.

E. Shale bedrock subgrade, if encountered, is exempt from scarification and recompaction.

F. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

G. Notify Kensington Fire Protection District in writing of any unsatisfactory conditions. Do not begin paving until these conditions have been satisfactorily corrected.

3.2 PAVEMENT GRINDING

A. Clean existing paving surface of loose or deleterious material immediately before pavement grinding.

B. Grind conforms as indicated.

3.3 SOIL STERILANT

A. Furnish and apply to areas per manufacturer's specifications.

3.4 SURFACE PREPARATION FOR AGGREGATE BASE MATERIALS

A. General: Immediately before placing asphalt materials remove loose and deleterious material from substrate surfaces and ensure that prepared subgrade is ready to receive paving in accordance with Caltrans Standard Specification Section 39-2.01C(3)(b) and in accordance with Section 32 11 00, Pavement Base Course.

B. Tack Coat: Apply uniformly and at specified rates between HMA layers, to vertical surfaces of curbs, gutters and construction joints, and to existing pavement, including planed surfaces, in accordance with Caltrans Standard Specification Section 39-2.01C(3)(f).
   1. Allow tack coat to cure undisturbed before paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 SURFACE PREPARATION FOR PAVEMENT AT HOT MIX ASPHALT OVERLAYS

A. Pavement Irregularities: Level with hot mix asphalt, Type A, ½ inch max aggregate.

B. Pavement Cracks:
   1. Less than ¼ inch wide: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion.
   2. Wider than ¼ inch: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion and skin patch.

C. Clean surface of all material, such as leaves, dirt, sand, gravel, water and vegetation prior to applying binder of paving asphalt to existing surface.

3.6 GEOSYNTHETIC PAVEMENT INTERLAYER

A. Place geosynthetic pavement interlayer in accordance with Caltrans Standard Specification Section 39-2.01C(3)g.

3.7 HOT MIX ASPHALT SPREADING AND COMPACTING EQUIPMENT

A. Provide spreading and compacting equipment in accordance with Caltrans Standard Specification Section 39-2.01C(2).

3.8 HOT MIX ASPHALT PLACEMENT

A. Place, spread and compact hot mix asphalt to required grade, cross section, and thickness in accordance with Caltrans Standard Specification Sections 39-2.01C(2), 39-2.01C(3), and 39-2.01C(8).

B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.9 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections in accordance with Caltrans Standard Specification Sections 39-2.01C(4)
   1. Construct joints free of depressions with same texture and smoothness as other sections of asphalt course.
   2. Clean contact surfaces and apply tack coat.
   3. Offset longitudinal joints in successive courses a minimum of 6 inches.
   4. Offset transverse joints in successive courses a minimum of 24 inches.
   5. Compact joints as soon as hot mix asphalt will bear roller weight without excessive displacement.

3.10 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact in accordance with Caltrans Standard Specification Sections 39-2.01C(2).

B. Compaction Requirements: Average Density to be 92 percent of reference maximum theoretical density according to ASTM D2041, but not less than 90 percent nor greater than 96 percent.

C. Finish Rolling: Finish roll paved surfaces to remove roller marks while asphalt is still warm.

D. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

E. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh asphalt. Compact by rolling to specified density and surface smoothness.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 HOT MIX ASPHALT CURBS AND DIKES

A. Construction: Place over compacted surfaces in accordance with Caltrans Standard Specification Section 39-2.01C(9). Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.

B. Shape: Place hot mix asphalt to curb cross section indicated.

3.12 SPEED BUMPS

A. Construct speed bumps over compacted pavement surfaces in accordance with Caltrans Standard Specification Section 39-2. Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.

B. Place asphalt concrete by hand using a template/screed designed to result in speed bump cross-section indicated after compaction.

C. Compact speed bumps with 8-ton static roller.

3.13 ADJUSTING MANHOLES, VALVES, MONUMENT COVERS AND OTHER STRUCTURES TO GRADE

A. Remove pavement, using vertical cuts, as needed to remove frame and provide for concrete collar. Do not damage adjacent pavement.
   1. Circular Covers: Cut circle with radius 6 inches larger than cover and concentric with cover.
   2. Rectangular Covers: Cut rectangle 6 inches larger than cover on all sides.

B. Install grade rings or blocking as needed to raise cover to finish grade.

C. Pour concrete collar:
   1. Bottom of Collar: Top of existing collar or 6 inches below top of proposed collar, whichever is at a higher elevation.
   2. Top of Collar: Bottom of existing asphalt pavement.
   3. Apply tack coat to all exposed surfaces.
   4. Fill excavation with hot mix asphalt and, while still hot, compact flush with adjacent surface.

3.14 INSTALLATION TOLERANCES

A. Hot Mix Asphalt Pavement:
   1. Course thickness and surface smoothness shall be in accordance with Caltrans Standard Specification Section 39-2.01A(4)(i)(iii)
   2. Total Thickness: Not less than indicated.

B. Trench Patch:
   1. Compacted surface: Within 0.01 foot of adjacent pavement.
   2. Do not create ponding.

C. Adjust Covers:
   1. Compacted surface: Up to 0.01 foot higher, and no lower, than adjacent pavement.
   2. Do not create ponding.

END OF SECTION

SECTION 32 1313
CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.

B. Form construction and use in placing portland cement concrete pavement.

C. Joints for portland cement concrete pavement.

D. Finishing portland cement concrete pavement.

E. Curing and protecting portland cement concrete pavement.

1.2 RELATED SECTIONS

A. 32 1100, Pavement Base Course

B. 32 1318, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. Geotechnical Report: Report on Kensington Public Safety Building 217 Arlington Avenue Kensington, California by Haley & Aldrich, Inc. for MARJANG Architecture, dated December 2021.

B. AASHTO Standard Specifications
   1. T132: Standard Method of Test for Tensile Strength of Hydraulic Cement Mortars

C. ASTM Standards
   1. D36: Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
   2. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   3. A706: Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
   4. A775: Standard Specification for Epoxy Coated Steel Reinforcing Bars.
   5. A934: Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
   6. A996: Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
   7. C94: Standard Specification for Ready-Mixed Concrete
   8. C603: Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants
   9. C639: Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
   10. C661: Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer

11. C679: ASTM C679-15 Standard Test Method for Tack-Free Time of Elastomeric Sealants
12. C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
13. C793: Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
14. C881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
15. D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
16. D1640: Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
17. D2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
18. D2835: Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
19. D3963: Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
20. D6690: Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

D. Caltrans Standard Specifications, 2015
   1. Section 10, General
   2. Section 40, Concrete Pavement
   3. Section 52, Reinforcement
   4. Section 95, Epoxy

E. Caltrans Standard Plans:
   1. Plan P1: Jointed Plan Concrete Pavement – New Construction
   2. Plan P10: Concrete Pavement Dowel Bar Details

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing and Materials

C. Caltrans: State of California, Department of Transportation

1.5 QUALITY ASSURANCE

A. Testing Agency: Owner's Representative will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

D. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

1.6 SUBMITTALS

A. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.

B. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
1. Cementitious materials and aggregates
2. Steel reinforcement and reinforcement accessories
3. Admixtures
4. Curing compound
5. Applied finish material
6. Bonding agent of adhesive
7. Joint filler
8. Joint Sealant
9. Tie Bars
10. Epoxy
11. Backer Rods

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

A. In accordance with Section 32 1318, Cement and Concrete for Exterior Improvements.

2.2 BASE MATERIAL

A. In accordance with Section 32 1100, Pavement Base Course.

2.3 TIE BARS

A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A615, Grade 40 or 60

B. Epoxy-coat in accordance with Caltrans Standard Specification Section 52-2.02, Epoxy-Coated Reinforcement, except bars must comply with ASTM A706; ASTM A996; or ASTM A615, Grade 40 or 60.

C. Do not bend tie bars.

2.4 EPOXY

A. Bond tie bars to existing concrete with epoxy resin in accordance with Caltrans Standard Specification Section 95-1.02D, Epoxy Adhesive for Bonding Freshly Mixed Concrete to Hardened Concrete.

2.5 SILICONE JOINT SEALANT

A. Furnish low modulus silicone joint sealant in a one-part silicone formulation. Do not use acid cure sealants. Compound to be compatible with the surface to which it is applied and conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 77°± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	45 psi max.
Flow at 77° ± 1°F	ASTM C639[a]	Shall not flow from channel
Extrusion Rate at 77° ± 1°F	ASTM C603[b]	75-250 g per min.
Specific Gravity	ASTM D792 Method A	1.01 to 1.51
Durometer Hardness, at 0°F, Shore A, cured 7 days at 77° ± 1°F	ASTM C661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C793	No chalking, cracking or bond loss
Tack free at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM C679	Less than 75 minutes
Elongation, 7 day cure at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	500 percent min.
Set to Touch, at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 77° ± 1°F	AASHTO T132[c]	50 psi min.
Movement Capability and Adhesion, 100% extension at 0°F after air cured 7 days at 77° ± 1°F, and followed by 7 days in water at 77° ± 1°F	ASTM C719[d]	No adhesive or cohesive failure after 5 cycles

Notes:

a. ASTM Designation: C639 Modified (15 percent slope channel A).
b. ASTM Designation: C603, through $^{1}/_{8}$ inches opening at 50 psi.
c. Mold briquets in conformance with the requirements in AASHTO Designation: T132, sawed in half and bonded with a $^{1}/_{16}$ inches maximum thickness of sealant and tested in conformance with the requirements in AASHTO Designation: T132. Briquets shall be dried to constant mass at 212 ± 10°F.
d. Movement Capability and Adhesion: Prepare 12 inch x 1 inch x 3 inch concrete blocks in conformance with the requirements in ASTM Designation: C719. A sawed face shall be used for bond surface. Seal 2 inch of block leaving ½ inches on each end of specimen unsealed. The depth of sealant shall be $^{3}/_{8}$ inches and the width ½ inches.

B. Formulate the silicon joint sealant to cure rapidly enough to prevent flow after application on grades of up to 15 percent.

C. Furnish to the Owner's Representative a Certificate of Compliance. Accompany certificate with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. Provide the certificate and accompanying test report for each lot of silicone joint sealant prior to use on the project.

2.6 ASPHALT RUBBER JOINT SEALANT

A. Conform to the requirements of ASTM Designation: D6690 as modified herein or to the following:

1. Provide a mixture of paving asphalt and ground rubber. Ground rubber to be vulcanized or a combination of vulcanized and de-vulcanized materials ground so that 100 percent will pass a No. 08 sieve and contain not less than 22 percent ground rubber, by mass. Modifiers may be used to facilitate blending.
2. The Ring and Ball softening point shall be 135°F minimum, when tested in conformance with the requirements in ASTM D36.
3. Provide asphalt rubber sealant material capable of being melted and applied to cracks and joints at temperatures below 400°F.

B. The penetration requirements of Section 4.2 of ASTM Designation: D6690 do not apply. The required penetration at 77˚F, 5 oz, 5s, shall not exceed 120.

C. The resilience requirements of Section 4.5 of ASTM Designation: D6690 do not apply. The required resilience, when tested at 77°F, shall have a minimum of 50 percent recovery.

D. Accompany each lot of asphalt rubber joint sealant shipped to the job site, whether as specified herein or conforming to the requirements of ASTM Designation D6690, as modified herein, by a Certificate of Compliance, storage and heating instructions and precautionary instructions for use.

E. Heat and place in conformance with the manufacturer's written instructions and the details shown on the Plans. Provide manufacturer's instructions to the Owner's Representative. Do not place when the pavement surface temperature is below 50 ˚F.

2.7 PREFORMED COMPRESSION JOINT SEALANT

A. Material: ASTM Designation: D2628.
1. Number of cells: 5 or 6.
2. Lubricant Adhesive: ASTM Designation D2835.
3. Install compression seals along with lubricant adhesive according to the manufacturer's recommendations. Submit manufacturer's recommendations to the Owner's Representative`.

B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of Compliance, storage instructions and precautionary instructions for use. Also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the Plans. Show evidence that the selected seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the Plans.

2.8 BACKER RODS

A. Provide backer rods that have a diameter prior to placement at least 25 percent greater than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond, adverse reaction occurs between the rod and sealant. In no case use a hot pour sealant that will melt the backer rod. Submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

2.9 SLIP RESISTIVE AGGREGATE FINISH

A. Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50

percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

PART 3 - EXECUTION

3.1 WATER SUPPLY

A. Provide water supply in accordance with Caltrans Standard Specification Section 10-6, Watering.

3.2 SUBGRADE

A. Prepare subgrade in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

3.3 SOIL STERILANT

A. Furnish and apply to areas indicated.

3.4 PLACING

A. Prepare concrete in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

3.5 SPREADING COMPACTING AND SHAPING

A. Conform to one of the following:
   1. Stationary Side Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Stationary Side-Form Construction.
   2. Slip Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Slip Form Construction.

3.6 INSTALLING TIE BARS

A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the Plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 50 feet. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.

B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:
   1. Drilling and bonding in conformance with the details shown on the Plans. Provide a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C881, Type V. Grade 3 (Non-Sagging), Class shall be as follows:

Temperature of Concrete	Required Class of Epoxy Resin
Lower than 40° F	A
40˚ F through 60˚ F	B
Above 60˚ F	C

   2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be cleaned in accordance with the epoxy manufacturer's instructions and

shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Owner's Representative, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Owner's Representative, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.

3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

3.7 JOINTS

A. Construct joints in accordance with Caltrans Standard Specification Section 40-1.03B, Joints, except that tie bars shall be as specified under Part 1, Materials.
   1. Construction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B(2), Construction Joints.
      a. Construct a construction joint at the end of each day's work, or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.
      b. If sufficient concrete has not been mixed to form a slab to match the next contraction joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall be become the property of the Contractor and shall be properly disposed of.
      c. A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of tie bars.
   2. Contraction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B (3), Contraction Joints, except that the insert method of forming joints in pavement shall not be used.

3.8 FINISHING

A. Finish concrete in accordance with Caltrans Standard Specification Section 40-1.03H, Finishing.

B. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:
   1. Uniformly spread 25 lb per 100 sq. ft of dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.

2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.

3.9 CURING

A. Cure concrete in accordance with Caltrans Standard Specification Section 40-1.03I, Curing.

3.10 SEALING JOINTS

A. Liquid Joint Sealant Installation.
1. The joint sealant detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the Plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 2 inch on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of 1/4 $\pm$ 1/32 inches and a minimum pressure of 90-psi.
4. Install backer rod as shown on the Plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 40°F or above. Install backer rod when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.
5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the Plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the Plans.
6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the Plans. Rejected joint materials or joint material whose finished surface does not conform to the

dimensions shown on the Plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.

7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

B. Preformed Compression Joint Seal Installation

1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the Plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of 1/4 $\pm$ 1/32 inches and a minimum pressure of 90 psi.

3.11 PROTECTING CONCRETE PAVEMENT

A. Protect pavement in accordance with Caltrans Standard Specification Section 40-1.03J Protecting Concrete Pavement.

END OF SECTION

SECTION 32 1318

CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Materials for portland cement concrete

B. Aggregate and aggregate grading for portland cement concrete

C. Water for portland cement concrete

D. Admixtures for portland cement concrete

E. Proportioning for portland cement concrete

F. Mixing and transporting portland cement concrete

G. Formwork for cast in place portland cement concrete

H. Embedded materials for portland cement concrete

I. Steel reinforcement for portland cement concrete

J. Placing and finishing portland cement concrete

K. Curing portland cement concrete

L. Protecting portland cement concrete

1.2 RELATED SECTIONS

A. Section 32 1216, Asphalt Paving

B. Section 32 1313, Concrete Pavement

1.3 RELATED DOCUMENTS

A. ASTM Standards
   1. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   2. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   3. C94, Standard Specification for Ready-mixed Concrete
   4. C150, Standard Specification for Portland Cement
   5. C260, Standard Specification for Air-Entraining Admixtures for Concrete
   6. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
   7. C494, Standard Specification for Chemical Admixtures for Concrete.

8. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Portland Cement
9. C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
10. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
11. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

B. Caltrans Standard Specifications, 2018
1. Section 51: Concrete Structures
2. Section 73: Concrete Curbs and Sidewalks
3. Section 90: Concrete

1.4 DEFINITIONS

A. ASTM: American Society for Testing and Materials

1.5 SUBMITTALS

A. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the Plans. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

B. Reinforcing Steel Shop-Drawings

1.6 QUALITY ASSURANCE

A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.
1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slabs on grade and other work.

B. Certifications:

1. Provide Owner's Representative at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
   a. Materials contained comply with the requirements of the Contract Documents in all respects.
   b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
   c. Statement of type and amount of any admixtures.
2. Provide Owner's Representative, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

1.7 DESIGNATION

A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.

B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT

A. General: Type II or Type V cement conforming to the requirements of ASTM C150. Contractor may substitute pozzolan for portland cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F Fly Ash meeting the requirements of ASTM C618.

B. Color: Provide a coloring equivalent to ¼ pound of lampblack per cubic yard. Add to the concrete at the central mixing plant.

2.2 AGGREGATE AND AGGREGATE GRADATION

A. General: Fine and coarse aggregates shall be ¾ inch maximum size; clean and crushed aggregate free of materials which may cause staining. Aggregates shall conform to the requirements of section 90-1.02C of the Caltrans Standard Specifications.

B. Aggregate Size and Gradation: Conform to the requirements of section 90-1.02C(4)(d) of the Caltrans Standard Specifications for 1 inch maximum combined aggregate.

2.3 WATER

A. General: Water shall be clean, free from injurious amounts of oil, alkali, organic matter, or other deleterious material, and not detrimental to concrete per ASTM C94. Water shall conform to the requirements of section 90-1.02D of the Caltrans Standard Specifications, for mixing and curing portland cement concrete and for washing aggregates.

2.4 CHEMICAL ADMIXTURES

A. Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material. Admixtures shall conform to the requirements of section 90-1.02E of the Caltrans Standard Specifications and as noted herein or on the Plans.
   1. Air-Entraining Admixture: ASTM C260/C260M
   2. Water-Reducing Admixture: ASTM C494/C494M, Type A
   3. Retarding Admixture: ASTM C494/C494M, Type B
   4. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D
   5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F
   6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G
   7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II

2.5 CLASSIFICATION OF PORTLAND CEMENT CONCRETE

A. Unless specified otherwise herein or on the Plans, portland cement concrete for the following items shall be designated as follows:
   1. Curbs, Gutters, and Sidewalks: Minor concrete.
   2. Cast in Place Concrete Pipe: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.
   3. Thrust Blocks: The concrete shall have a minimum compressive strength of 3,000 psi.
   4. Sign and Fence Footings: The concrete shall consist of a minimum of 376 pounds of portland cement per cubic yard of concrete.
   5. Water, Storm, and Sanitary Structures: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.

2.6 EXPANSION JOINT MATERIAL

A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless specified otherwise herein or on the Plans, expansion joint thickness shall be as follows:
   1. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½ inch
   2. Structures: As indicated

2.7 REINFORCEMENT AND DOWELS

A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM A615 for Grade 60

bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.

B. Slip dowels, where noted or called for on the Plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM A615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.

C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM A1064. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.

D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM A1064.

E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.8 FORMS

A. Conform to the requirements of Section 73-1.03C and Section 90-1.03B(5) of the Caltrans Standard Specifications.

B. Tolerance: Not to deviate more than ¼ inch in 10 feet in grade and alignment.

2.9 PRECAST CONCRETE STRUCTURES

A. Conform to the following Sections of Caltrans Standard Specifications:
1. 51-7, Minor Structures
2. 70-5.02, Flared End Sections

2.10 CONCRETE VEHICULAR PAVEMENT

A. General: See Section 32 1313, Concrete Pavement.

PART 3 - EXECUTION

3.1 STRUCTURAL EXCAVATION

A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.

B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density as determined by ASTM D1557.

C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site.

3.2 BRACING AND SHORING

A. Conform to California and Federal OSHA requirements.

B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Consulting Engineer for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.

D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.3 PLACING CONCRETE FORMS

A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.

B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.

C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.

D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.4 PLACING STEEL REINFORCEMENT

A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
   1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
   2. Splice locations shall be made as indicated on the plans.

B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.

C. Place reinforcing to provide the following minimum concrete cover:
1. Surfaces exposed to water: 4 inches.
2. Surfaces poured against earth: 3 inches.
3. Formed surfaces exposed to earth or weather: 2 inches.
4. Slabs, walls, not exposed to weather or earth: 1 inch.

D. Minimum spacing, center of parallel bars shall be two and one half (2 ½) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.5 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

A. Transit mix concrete in accordance with the requirements of ASTM Designation C94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by the Owner's Representative.

B. Do not hand mix concrete for use in concrete structures.

3.6 PLACING PORTLAND CEMENT CONCRETE

A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.

B. Do not place concrete until the subgrade and the forms have been approved.

C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.

D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner's Representative. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.

E. Concrete in certain locations may be pumped into place upon prior approval by the Owner's Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 PLACING ACCESSORY MATERIALS

A. Place water stops and other items required to be embedded in of portland cement concrete structures at locations shown or required in accordance with Section 51-2.04 of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans.

B. Curing Compounds:
   1. Regular Portland Cement Concrete: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 FORM REMOVAL

A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.

B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.

C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.

D. Leave edge forms in place at least 24 hours after pouring.

3.9 FIELD QUALITY CONTROL

A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.

B. No concrete shall be placed prior to approval of forms.

C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.

D. Conform the finish grade and cross section of concrete improvements to the design grades and cross sections.

E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances ACI 117 and as follows:
   1. Elevation: ¼ inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10 foot long, unleveled straightedge not to exceed 1/4 inch.
   4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
   5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
   6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
   8. Joint Spacing: 3 inches, unless otherwise indicated.
   9. Contraction Joint Depth: Plus 1/4 inch, no minus.
   10. Joint Width: Plus 1/8 inch, no minus.

3.10 RESTORATION OF EXISTING IMPROVEMENTS

A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.

B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

SECTION 32 1375

CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Portland cement concrete curbs and gutters, sidewalk, curb ramps and driveways.

1.2 RELATED SECTIONS

A. Section 32 1100, Pavement Base Course

B. Section 32 1313, Concrete Pavement

C. Section 32 1318, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. Geotechnical Report: Report on Kensington Public Safety Building 217 Arlington Avenue Kensington, California by Haley & Aldrich, Inc. for MARJANG Architecture, dated December 2021.

B. American society for Testing and Materials (ASTM)
   1. A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   2. D1751 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

C. Caltrans Standard Specifications, 2015
   1. Section 51: Concrete Structures
   2. Section 72: Slope Protection
   3. Section 73: Concrete Curbs and Sidewalks
   4. Section 90: Concrete

1.4 DEFINITIONS

A. ASTM: American Society for Testing Materials

B. ACI: American Concrete Institute

1.5 SUBMITTALS

A. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Kensington Fire Protection District. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific

gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

1.6 QUALITY ASSURANCE

A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.

B. Certifications:
   1. Provide Kensington Fire Protection District at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
      a. Materials contained comply with the requirements of the Contract Documents in all respects.
      b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
   2. Settlement of type and amount of any admixtures.
   3. Provide Kensington Fire Protection District, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

C. Conform to the applicable provisions of Sections 51, 73 and 90 of the Caltrans Standard Specification and these Technical Specifications.
   1. Conform construction of portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks) to the requirements of Section 73 of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
   2. Construct "V" ditches in accordance with Section 72-5 of the Caltrans Standard Specifications; except that finishing shall be in accordance with Standard Specification Section 73, or as otherwise required in these Technical Specifications or shown on the Plans.

1.7 DESIGNATION

A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.

B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.1 GENERAL

A. Comply with requirements of Section 32 1318, Cement and Concrete for Exterior Improvements.

2.2 PORTLAND CEMENT CONCRETE

A. Unless specified otherwise herein or on the Plans, portland cement concrete for items in this section shall be Minor Concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:
   1. Compressive Strength:
      a. Typical: 3000 psi, minimum at 28 days, unless otherwise indicated.
      b. Curbs & Gutters: 3500 psi, minimum at 28 days.
   2. Slump Limit: 8 inches minimum for concrete containing high-range water-reducing admixture (superplasticizer, limited to flatwork only); 4 inches for other concrete.
   3. Water/Cement Ratio: 0.5

2.3 CURBS AND GUTTERS FORMS

A. Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.

2.4 EXPANSION JOINT MATERIAL

A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM Designation D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

B. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
   1. Curbs, Curb Ramps, Island Paving, Driveways and Gutter Depressions: ¼ inch

2.5 REINFORCEMENT AND DOWELS

A. Comply with requirements of Section 32 1318, Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with requirements of Section 32 1318, Cement and Concrete for Exterior Improvements.

B. Form, place and finish concrete curbs, gutters, walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.

C. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12 inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6 inch deep lift of asphalt concrete after gutter form is removed.

3.2 SUBGRADE

A. Conform to Section 73-1.03B of Caltrans Standard Specifications.

3.3 SOIL STERILANT

A. Furnish and apply an oxidation granular preemergent soil sterilant to prepared subgrade or after installation of rock or aggregate base uniformly at the rate recommended by the manufacturer.

3.4 PLACING CONCRETE FORMS

A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.

B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.

C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.

D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.5 PLACING STEEL REINFORCEMENT

A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
   1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
   2. Splice locations shall be made as indicated on the plans.

B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports

and ties of such strength and density to permit walking on reinforcing without undue displacement.

C. Place reinforcing to provide the following minimum concrete cover:
1. Surfaces exposed to water: 4 inches
2. Surfaces poured against earth: 3 inches
3. Formed surfaces exposed to earth or weather: 2 inches
4. Slabs, walls, not exposed to weather or earth: 1 inch

D. Minimum spacing, center of parallel bars shall be two and one half (2 ½) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.6 PLACING PORTLAND CEMENT CONCRETE

A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.

B. Do not place concrete until the subgrade and the forms have been approved.

C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.

D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Kensington Fire Protection District. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.

E. Concrete in certain locations may be pumped into place upon prior approval by the Kensington Fire Protection District. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 EXPANSION JOINTS

A. Construct expansion joints incorporating premolded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, median/island paving, valley gutters, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch smooth slip dowels in the positions shown or noted on the detail drawings.

B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

3.8 WEAKENED PLANE JOINTS

A. Construct weakened plane joints in concrete curbs, gutters, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.

B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

C. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

3.9 FINISHING CONCRETE

A. Finish curb and gutter in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.

B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.

C. Provide a broom finish to all horizontal surfaces perpendicular to the path of travel on surfaces used by pedestrians:
1. Sloped Less than 6%: Provide a medium salt (medium broom) finish by drawing a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.
2. Surfaces Sloped Greater than 6%: Provide a slip resistant (heavy broom finish) by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.10 FORM REMOVAL

A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.

B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.

C. Leave edge forms in place at least 24 hours after pouring.

3.11 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

A. New curb or gutter is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert ½ inch diameter by 12 inch long dowels at 24 inches on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.

B. A cold joint to the existing curb is not acceptable.

3.12 FIELD QUALITY CONTROL

A. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.

B. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in Section 73 of the Caltrans Standard Specifications.

3.13 RESTORATION OF EXISTING IMPROVEMENTS

A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.

B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

SECTION 32 1400

SLURRY SEAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The Contractor shall perform all work associated with Slurry Seal as shown and as specified herein including all labor, materials, equipment supplies, and facilities associated with providing a finished product satisfying all the requirements of the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. The Contractor shall submit, at least seven (7) working days before slurry seal placement commences, a laboratory report of test results and proposed mix design covering the specific materials to be used on the project. The percentage of asphaltic emulsion proposed in the mix design shall be within the percentage range specified herein.

1.3 RELATED SECTIONS

A. Section 32 1723, Pavement Markings

1.4 RELATED DOCUMENTS

A. Caltrans Standard Specifications, 2015
   1. Section 37: Bituminous Seal

PART 2 - PRODUCTS

2.1 SLURRY SEAL

A. Slurry seal shall be Type II in accordance with Section 37-3 of the Caltrans Standard Specifications with the exceptions noted in these specifications.

2.2 AGGREGATE

A. Aggregate for Type II slurry seal shall be in accordance with Section 37-3.02A and 37-3.02B of the Caltrans Standard Specifications.

2.3 ASPHALTIC EMULSION

A. Asphaltic emulsion shall be Grade PMCQS1h, complying with Section 37-3B(3) of the Caltrans Standard Specifications.

B. The polymer within the asphalt emulsion shall be Neoprene, SBR, EVA, or SBS or approved equal. Solid polymer such as EVA, SBS, or approved equal shall be

adequately blended into the asphalt prior to the asphalt prior to emulsification. If latex such as Neoprene, SBR or similar is used, the latex shall be "co-milled" into the emulsion through the water phase during manufacturing. Each load of polymer asphaltic emulsion shall have a certificate from the asphalt emulsion manufacturing indicating that either asphalt blending or "co-milling" process is used. The certificate shall also state the percentage of the solid rubber polymer added, by weight of the asphalt, as well as the composition of the polymer. The addition of latex to the emulsion after emulsion manufacturing is prohibited.

2.4 WATER AND ADDITIVE

A. Water shall be of such quality that the asphalt will not separate from the emulsion before the slurry seal is in place in the work. If necessary for workability, a set-control agent that will not adversely affect the slurry seal may be used.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The application of Type II slurry seal shall conform to Section 37-3.03 of the Caltrans Standard Specifications with the exceptions noted in these Specifications.
   1. The slurry seal shall be placed at a rate to produce 10 to 13 pounds of aggregate per square yard for Type II slurry, as required in these Specifications. The complete mixture shall be such that the slurry seal mixture has proper workability and will permit traffic flow within two (2) hours after placement without the occurrence of bleeding, raveling, polishing, separation, or other distress within 30 days after its placement.
   2. Asphaltic emulsion shall be added at a rate of between 10 to 15 percent by weight of the dry aggregate. The extract rate will be determined by the Engineer. The quantity of asphaltic emulsion to be used in the slurry seal mixture will be determined by the design asphalt binder content, as approved by the Engineer, and the asphalt solid content of the asphaltic emulsion furnished.
   3. The Contractor shall sweep all slurry seal streets seven (7) days after the application of slurry seal with a power sweeper.

3.2 PROPORTIONAL MIXING

A. The proportional mixing of slurry seal shall conform to Section 37-3.03B and 37-3.03C of the Caltrans Standard Specifications.

B. The mixer shall thoroughly blend all materials to form a homogenous mass before leaving the mixer.

3.3 SURFACE PREPARATION

A. All existing striping and pavement markers shall also be removed prior to the application of the slurry seal. The slurry shall be applied within 72 hours after the removal of pavement striping marker.

B. The complete street surface shall be power swept from face of curb to face of curb prior to the application of slurry seal. The Contractor shall provide cleaning method necessary to remove all dirt, vegetation, and loose materials from the pavement.

C. All material gathered shall be properly disposed of by the Contractor. The Contractor shall remove all plant material growing in the street or on the interface of the asphalt surface with the lip of concrete gutter prior to placing slurry.

D. Immediately preceding the slurry seal application, the Contractor shall cover all grates, slotted manholes, and other appurtenances on the pavement that would allow the entry of slurry; cover all manhole covers, water and gas valve box covers, monuments boxes, grates and other exposed facilitates with plastic oil resistant construction paper secured by tape or adhesive. The Contractor prior to the final set of the slurry shall uncover all covered manholes, valves, grates and boxes. All uncovered items shall be clean and meet the requirement of the Project Inspector.

E. All catch basin grates and hoods adjacent to the work or within 50 feet shall be covered to prevent slurry from entering the catch basin.

3.4 SPREADER BOX

A. The slurry mixture shall be spread by means of a controlled spreader box conforming to Section 37-3.03C of the Caltrans Standard Specifications.

B. The spreader box shall be clean and free of all slurry seal and emulsion at the start of each working shift.

3.5 SAND BLOTTER

A. A sand blotter shall be spread at selected driveways, intersections, and where required by the Engineer to accommodate pedestrian or vehicular traffic until the slurry set.

3.6 APPLICATION OF SLURRY SURFACE

A. The surface shall be fogged with water directly preceding the spreader. The slurry mixture shall be of the desired consistency when deposited on the surface. Total time of mixing shall not exceed four (4) minutes. A sufficient amount of slurry shall be carried in all parts of the spreader at all times so that the complete coverage is obtained. No lumping, balling or unmixed aggregate shall be permitted. No segregation of the emulsion and aggregate fines from the coarse aggregate will be permitted. If coarse aggregate settles to the bottom of the mix, the slurry will be removed from the pavement. No excessive breaking of the emulsion will be allowed in the spread box. No streaks such as those caused by oversize aggregate will be left in the finished pavement.

B. The entire pavement, including the area around curb return shall be covered from gutter lip to gutter lip. The ends of slurry seal streets shall be a clean, straight line created by placing 15 lb felt paper with a 30 in. minimum width to create the line.

C. Longitudinal joints must correspond with lane lines. You may request other longitudinal joint patterns if they do not adversely affect the slurry seal.

D. Spread slurry seal in full lane widths. Do not overlap slurry seal between adjacent lanes more than 3 inches.

E. Use kraft paper at transverse joints and over previously placed slurry seal to prevent double placement. Remove the paper after use. Use hand tools to remove spillage.

F. No excessive buildup, or unsightly appearance shall be permitted on longitudinal or transverse joints. Burlap drags shall be used and changed daily.

G. Approved squeegees shall be used to spread slurry in non-accessible areas to the slurry mixer. Care shall be exercised in leaving no unsightly appearance from handwork.

H. Slurry application will be stopped to allow sufficient time to allow slurry to cure prior to opening streets to traffic. Protect the slurry seal from damage until it has cured.

I. All gutter spills must be cleaned immediately.

3.7 WEATHER LIMITATIONS

A. The slurry seal shall not be applied when either atmospheric or pavement temperature is 55 degrees Fahrenheit and falling but may be applied when either the atmospheric or pavement temperature is above 45 degrees Fahrenheit and rising. The slurry seal shall not be applied during periods of abnormally high relative humidity.

3.8 SLURRY REPAIR

A. In the event that the applied slurry seal surface violates the project requirements or has the following conditions:
   1. Tire or wheel marks
   2. Longitudinal ridges
   3. Picked up or raveled areas
   4. Transverse ridges or bumps
   5. Washboarding or excessively rough sand blotters

B. The slurry seal shall be repaired as follows:
   1. The slurry seal shall be removed by a "PENHALL PROFILER" or equal and a full lane width pass of slurry seal applied in full compliance with these specifications.
   2. The Engineer may omit removal of the affected slurry seal if it would not affect the repair.

3.9 STRIPING

A. Temporary striping and legends shall be placed on the newly slurry sealed streets prior to the release of streets to traffic. These materials must be submitted to the Engineer for approval prior to installation.

B. Permanent striping shall be installed after seven (7) days but no later than ten (10) days after the slurry seal is complete in accordance with Section 32 1723, Pavement Markings.

END OF SECTION

SECTION 32 1713

PARKING BUMPERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes concrete precast wheel stops.

1.2 SUBMITTALS

A. Submit product data for each type of product.

PART 2 - PRODUCTS

2.1 PARKING BUMPERS

A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 2500 psi minimum compressive strength, 5½ inches high by 7½ inches wide by 48 inches long (or length as shown on plans). Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed vertical holes through wheel stop for anchoring to substrate.
   1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
   2. Mounting Hardware: Galvanized-steel dowel, ½ inch diameter, 24-inch minimum length.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
   1. Oldcastle Precast
   2. Bertelson Precast
   3. Barco Products, or approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.

B. Install wheel stops in bed of adhesive before anchoring.

C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION

SECTION 32 1723

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of existing traffic stripes and pavement markers

B. Removal of existing signs

C. Cleaning and sweeping of streets before application of traffic stripes and pavement markings

D. Materials and application for traffic stripes and pavement markings

E. Materials and application for pavement markers

F. Traffic control signs and street name signs

G. Object markers

H. Survey monuments

1.2 RELATED SECTIONS

A. Section 32 1318, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. Caltrans Standard Specifications, 2015
   1. Section 78, Incidental Construction
   2. Section 81, Miscellaneous Traffic Control Devices
   3. Section 82, Signs and Markers
   4. Section 84, Markings

B. Caltrans Standard Plans, 2015
   1. Plan A20A through A20D: Pavement Markers and Traffic Lines, Typical Details
   2. Plan A24A and A24B: Pavement Markings Arrows
   3. Plan A24C: Pavement Markings, Symbols and Numerals
   4. Plan A24D: Pavement Markings, Words
   5. Plan A24E: Pavement Markings, Words, Limit and Yield Lines
   6. Plan A24F: Pavement Markings, Crosswalks
   7. Plan A73A: Object Markers
   8. Plan A73B: Markers
   9. Plan A73C: Delineators, Channelizers and Barricades
   10. Plan A74: Survey Monuments
   11. Plan RS1: Roadside Sign, Typical Installation Details No. 1
   12. Plan RS2: Roadside Sign, Wood Post - Typical Installation Details No. 2
   13. Plan RS3: Roadside Sign, Laminated Wood Box Post - Typical Installation Details No. 3

14. Plan RS4: Roadside Sign, Typical Installation Details No. 4

C. The State of California Traffic Manual, 2014

D. The regulations, standards, and tests of the State of California Department of Transportation Materials and Research Division, edition in effect at time of date on Plans.

E. Professional Land Surveyor's Act, Business and Professions Code §§ 8700 – 8805

1.4 SUBMITTALS

A. Submit product data for each of the following:
1. Traffic paint
2. Pavement markers and adhesives
3. Reflectorized markers and posts

1.5 QUALITY ASSURANCE

A. Deliver certificates showing conformance with this specification to the Owners Representative with each shipment of materials and equipment to the Project site.

B. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

1.6 PROJECT CONDITIONS

A. Do not apply traffic striping or pavement markings to the pavement until after approval to proceed has been given by the Owners Representative.

B. Thoroughly cure new asphalt concrete and portland cement concrete before application of stripes, markings or markers.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC STRIPES AND MARKING

A. Thermoplastic striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02B, unless noted otherwise herein or on the Plans.

B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.

C. Thermoplastic stripes and markings shall have a minimum skid friction value of BPN 35.

2.2 PAINTED STRIPES AND MARKINGS

A. Painted striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02C, unless noted otherwise herein or on the Plans.

B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.

2.3 TRAFFIC CONTROL SIGNS

A. General: Traffic control signs shall be in accordance with Caltrans Standard Specification Section 82-1, Signs and Markers.

B. Sign Panels shall be in accordance with Caltrans Standard Specification Section 82-2, Sign Panels. Conform type (regulatory or warning), size, shape and pattern to the State of California, Department of Transportation, Traffic Manual, edition in effect at the date of the Plans.

C. Posts:
1. Metal Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02B, Metal Posts.
2. Wood Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02C, Wood Posts.

D. Mounting Hardware shall be in accordance with Caltrans Standard Specification 82-3.02E, Sign Panel Fastening and Mounting Hardware, unless otherwise specified.

E. Post Foundations: Conform to Caltrans Standard Plans.

PART 3 - EXECUTION

3.1 REMOVAL OF TRAFFIC STRIPES, PAVEMENT MARKINGS AND PAVEMENT MARKERS

A. Where blast cleaning is used for the removal of painted traffic stripes and pavement markings, or for removal of objectionable material, remove the residue, including dust and water, immediately after contact with the surface being treated. Remove by a vacuum attachment operating concurrently with the blast cleaning operation.

B. Where grinding is used for the removal of thermoplastic traffic stripes and pavement markings; remove the residue by means of a vacuum attachment to the grinding machine. Do not allow the residue to flow across or be left on, the pavement.

C. Where markings are to be removed by blast cleaning or by grinding, the removed area shall be approximately rectangular so that no imprint of the removed marking remains on the pavement.

D. Waste from removal of yellow painted traffic stripe may contain lead chromate. Residue produced when yellow paint is removed may contain heavy metals in concentrations that exceed thresholds established by the California Health and Safety Code and may produce toxic fumes when heated. As such, when grinding or other methods approved by the Owner's Representative are used to remove yellow painted traffic stripes, the removed residue, including dust, shall be collected and contained immediately. The Contractor shall submit a written work plan for the removal, storage, and disposal of yellow painted traffic stripe to the Owner's Representative for approval not less than fifteen (15) days prior to the start of the removal operations. Removal operations shall not be started until the Owner's Representative has approved the work plan.

E. Contractor will be responsible for repairing any damage to the pavement during removal of pavement markers. Damage to the pavement, resulting from removal of pavement markers, shall be considered as any depression more than 1/4-inch deep.

3.2 TEMPORARY PAVEMENT MARKERS

A. If permanent pavement markers cannot be installed immediately, and the street or road is to be placed in service, install short term, temporary pavement markers on the new pavement prior to opening the street or road to traffic.

B. Place markers, at a minimum, of 24 feet on centers, or as required by the governmental agency having jurisdiction, in the appropriate colors to delineate centerlines and travel lanes on multi-lane roadways.

3.3 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Apply in conformance with the manufacturer's instructions and the applicable requirements Caltrans Standard Specification Section 84-2.03, Construction, and Caltrans Standard Plans A20A through A20D, and A24A through A24E.

3.4 PAINTED TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Apply in conformance with the manufacturer's instructions and the applicable requirements of Caltrans Standard Specification Section 84-3.03, 3.04 and 3.05 and Caltrans Standard Plans A20A through A20D, and A24A through A24F.

3.5 PAVEMENT MARKERS

A. Place in accordance with Caltrans Standard Specification Section 81-3.03, Construction.

B. Pavement recesses are not required. Markers shall be installed accurately to the line established by the Owner’s Representative. No markers shall be installed until the surface has been approved by the Owner’s Representative.

3.6 TRAFFIC CONTROL SIGNS

A. Install in accordance with Caltrans Standard Specification Sections 82-2.03 and 82-3.03, Caltrans Standard Plan RS1, the applicable requirements of the State of California Department of Transportation Maintenance Manual and the details shown on the Plans. The horizontal locations shown on Caltrans Standard Plan RS1 shall not be applicable, the horizontal location shall be as shown on the Plans.

B. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

C. After erection, damage to traffic sign faces shall be touched up or the sign replaced.

3.7 STREET NAME SIGNS

A. Install in accordance with the manufacturer’s instructions and as shown on the Plans.

B. Horizontal location shall be as shown on the Plans.

C. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

3.8 REFLECTORIZED OBJECT MARKERS.

A. Install in accordance with Caltrans Standard Specification Section 82-5.03, Construction, except that the metal marker posts shall not be driven in place without prior approval of the Owner's Representative.

B. Install at locations shown on the Plans.

3.9 STREET SURVEY MONUMENTS

A. Install Survey Monuments in accordance with Caltrans Standard Specification Section 78-2.03, Construction and Caltrans Standard Plan A74, except that the marker disk will not be furnished. Exact point in marker to be determined by an accurate survey and placed by a California Licensed Land Surveyors in accordance with the Professional Land Surveyors' Act.

3.10 PROTECTION

A. Protect the newly installed traffic stripes and pavement markings from damage until the material has cured.

B. Replace any traffic stripes or pavement markings or markers broken, misaligned or otherwise disturbed prior to opening roadway to traffic.

3.11 RESTORATION OF EXISTING IMPROVEMENTS

A. Existing signs striping or other markings removed or damaged due to the installation of new facilities shall be replaced in kind.

B. Existing landscaping or planting removed, damaged or disturbed due to the installation of traffic control signs or street name signs shall be replaced in kind.

END OF SECTION

SECTION 33 1000

WATER SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Site water distribution system for domestic and fire protection services up to 5 feet of any on-site building being served.

B. Domestic water and fire protection water transmission or distribution system within a roadway or street right-of-way.

1.2 RELATED SECTIONS

A. Section 31 2100, Utility Trenching and Backfill

1.3 RELATED DOCUMENTS

A. ASME
1. ASME A112.1.2: Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water Connect Receptors
2. ASME B1.20.1: Pipe Threads, General Purpose, Inch
3. ASME B16.1: Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
4. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings
5. ASME B16.22: Wrought Copper and Copper Alloy Solder – Joint Pressure fittings
6. ASME B16.26: Cast Copper Alloy Fittings for Flared Copper Tubes

B. ASTM
1. ASTM A536: Standard Specification for Ductile Iron Castings
2. ASTM A674: Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
3. ASTM B61: Standard Specification for Steam or Valve Bronze Castings
4. ASTM B62: Standard Specification for Composition Bronze or Ounce Metal Castings
5. ASTM B88: Standard Specification for Seamless Copper Water Tube
6. ASTM C94: Standard Specification for Ready-Mixed Concrete
7. ASTM D1785: Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
8. ASTM D2564: Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems
9. ASTM F1056: Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings

C. AWWA
1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
3. C110: Ductile-Iron and Gray-Iron Fittings
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

6. C116: Protective Fusion-Bonded Epoxy Coatings for the Interior & Exterior Surfaces for Ductile-Iron and Gray-Iron Fittings
7. C150: Thickness Design of Ductile-Iron Pipe
8. C151: Ductile-Iron Pipe, Centrifugally Cast
9. C153: Ductile-Iron Compact Fittings
10. C200: Steel Water Pipe 6 inch and larger
11. C203: Coal-Tar Protective Coatings and Linings for Steel Water Pipe
12. C205: Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 inch and Larger-Shop Applied
13. C207: Steel Pipe Flanges for Waterworks Service-Sizes 4 inch through 144 inch
14. C208: Dimensions for Fabricated Steel Water Pipe Fittings
15. C209: Cold Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings
16. C210: Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings
17. C213: Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
18. C214: Tape Coatings for Steel Water Pipelines
19. C218: Liquid Coatings for Aboveground Steel Water Pipe and Fittings
20. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
21. C500: Metal-Seated Gate Valves for Water Supply Service
22. C502: Dry-Barrel Fire Hydrants
23. C503: Wet Barrel Fire Hydrants
24. C504: Rubber Seated Butterfly Valves.
25. C507: Ball Valves, 6 inch through 60 inch.
26. C508: Swing-check Valves for Waterworks Service, 2 inch through 48 inch NPS.
27. C509: Resilient-Seated Gate Valves for Water Supply Service
28. C510: Double Check Valve Backflow Prevention Assembly
29. C511: Reduced-Pressure Principle Backflow Prevention Assembly
30. C512: Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
31. C550: Protective Interior Coatings for Valves and Hydrants
32. C600: Installation of Ductile-Iron Water Mains and Their Appurtenances
33. C606: Grooved and Shouldered Joints
34. C651: Disinfecting Water Mains
35. C800: Underground Service Line Valves and Fittings
36. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 60 inch for Water Transmission and Distribution
37. C901: Polyethylene (PE) Pressure Pipe and Tubing, ½ inch through 3 inch for Water Service
38. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch through 48 inch for Water Transmission and Distribution
39. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 65 inch, for Waterworks
40. M11: Steel Pipe - A Guide for Design and Installation
41. M23: PVC Pipe – Design and Installation
42. M41: Ductile-Iron Pipe and Fittings

D. Factory Mutual Insurance Company (FM)
1. FM 1530: Fire Department Connections

E. National Fire Protection Association (NFPA)
1. NFPA 24: Installation of Private Fire Service Mains and Their Appurtenances
2. NFPA 70: National Electric Code
3. NFPA 1963: Fire Hose Connection

F. National Sanitation Foundation (NSF)
   1. NSF 61: Drinking Water System Components-Health Effects

G. Underwriters Laboratory(UL)
   1. UL 262: Safety Gate Valves for Fire-Protection Service
   2. UL 405: Safety Fire Department Connection Devices
   3. UL 789: Indicator Posts for Fire-Protection Service

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing Materials

C. AWWA: American Waterworks Association

D. DI: Ductile iron

E. DIP: Ductile iron pipe

F. FM: Factory Mutual

G. NFPA: National Fire Protection Association

H. NSF: National Sanitation Foundation

I. PCC: Portland cement concrete

J. PE: Polyethylene

K. PVC: Polyvinyl Chloride

L. UL: Underwriters Laboratory

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. External Load: Earth load indicated by depth of cover plus AASHTO H20 live load unless indicated otherwise.

1.6 SUBMITTALS

A. Product Data: Manufacturer's literature and data, including, where applicable, sizes, pressure rating, rated capacity, listing/approval stamps, labels, or other marking on equipment made to the specified standards for materials, and settings of selected models, for the following:
   1. Piping materials and fittings
   2. Gaskets, couplings, sleeves, and assembly bolts and nuts
   3. Flexible pipe fittings
   4. Restrained pipe fittings
   5. Flexible Connectors
   6. Expansion joints
   7. Flexible expansion joints
   8. High deflection fittings/ball joints
   9. Gate valves

10. Butterfly valves
11. Check valves
12. Ball valves
13. Air release, air/ vacuum and combination air valves
14. Blow-off valves
15. Pressure reducing valves
16. Flow Regulating valves
17. Service connections and water meters
18. Valve boxes, meter boxes, frames and covers
19. Backflow preventers
20. Fire hydrants
21. Post indicator valves
22. Fire department connections
23. Thrust block concrete mix
24. Tapping sleeves and tapping valves
25. Service saddles and corporation stops
26. Identification materials and devices

B. Shop Plans and Calculations: Where an on-site fire water system is required, Contractor shall provide shop plans for Engineer and agency approval prior to construction. Coordinate with the Plans and identify any proposed modifications or deviations. Shop Plans and Calculations shall be stamped and signed by a registered Fire Protection Engineer licensed by the State of California as required.
   1. Include the following information:
      a. Design assumptions
      b. Thrust block sizing and calculations
      c. Materials to be used
      d. Available water pressure
      e. Required water pressure
   2. The review of fire system components constitutes only a portion of the review and approval required. A copy of the fire system component submittal package shall be forwarded to the local fire marshal for further review and approval.

C. Shop drawings: Include plans, elevations, details and attachments.
   1. Precast and cast in-place vaults and covers
   2. Wiring diagrams for alarm devices

D. Field test reports: Indicate and interpret test results for compliance with the Project requirements.

1.7 QUALITY ASSURANCE

A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.

B. Comply with the following requirements and standards:
   1. NSF 61: “Drinking Water System Components-Health Effects” for materials for potable water.
   2. NFPA 24: “Installation of Private Fire Service Mains and Their Appurtenances” for materials, installations, tests, flushing, and valve and hydrant supervision.
   3. NFPA 70: “National Electric Code” for electrical connections between wiring and electrically operated devices.

C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

1.8 MATERIAL DELIVERY, STORAGE AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.

C. Handling: Use slings to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. During Storage: Use precautions for valves, including fire hydrants according to the following.
   1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
   2. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

E. Do not store plastic pipe and fittings in direct sunlight.

F. Protect pipe, fittings, flanges, seals and specialties from moisture, dirt and damage.

G. Protect linings and coatings from damage.

H. Handle precast boxes, vaults and other precast structures according to manufacturer’s written instructions.

I. Protect imported bedding and backfill material from contamination by other materials.

1.9 COORDINATION

A. Coordinate connection to existing water mains with water utility supplying water.

B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution piping and fire protection piping.

PART 2 - PRODUCTS

2.1 COPPER PIPE: SIZES ¾ INCH THROUGH 2 INCH

A. Pipe and Fittings: Provide Type K soft or hard copper pipe, seamless water tube, annealed conforming to ASTM B88.

B. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18.

C. Wrought copper solder-joint pressure fittings or wrought copper alloy unions shall conform to ASME B16.22

D. Cast copper alloy flare fittings shall conform to ASME B16.26.

E. Wrought copper alloy body, hexagonal stock, metal-to-metal seating surfaces, and solder-joint threaded ends shall conform to ASME B1.20.1.

F. Compression connections shall be Mueller 110, Ford or approved equal.

G. Joints: Restrain by couplings.

2.2 PE PLASTIC PIPE: SIZES ½ INCH THROUGH 3 INCH

A. Pipe and Fittings: Provide PE3408, Pressure Class 200, DR 9 conforming to AWWA C901. PWPIPE, or approved equal.

B. Cast Copper Fittings shall conform to ASME B16.18.

C. Cast Copper Compression Fittings and connections shall be Mueller 110, Ford or approved equal.

D. Joints: Restrain with clamps or heat-fusion.

2.3 PVC PIPE: SIZES 1/8 INCH THROUGH 3 INCH

A. Pipe and Fittings: ASTM D1785, Schedule 40. [Schedule 80 and 120 are also available. Pressure ratings up to 260 psi are achievable with schedule 40]

B. Joints: Restrain with solvent cement. Do not use threaded pipe.

C. Solvent Cement: ASTM D2564.

2.4 DIP: SIZES 4 INCH THROUGH 48 INCH

A. Pipe: Pressure Class 150 pipe conforming to AWWA C151, AWWA Manual M41 and standard thickness per AWWA C150. U.S. Pipe, American Cast Iron Pipe Company, or approved equal.

B. Fittings: Provide fittings with pressure rating greater than or equal to that of the adjoining pipe.

C. Pipe and Fitting Lining: Cement Mortar, AWWA C104.

D. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.

E. Fittings
1. Standard: AWWA C110, sizes 4 inch through 48 inch.
2. Compact: AWWA C153, sizes 4 inch through 24 inch.
3. All fittings shall be fusion epoxy coated per AWWA C116.

F. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.

G. Unrestrained Joints (Rubber Gasket Joints):
1. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111.
2. Mechanical Joint: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111.

H. Restrained Joints:
1. Flanged Joint: Provide bolts, nuts, and gaskets in conformance with AWWA C115. Gaskets shall conform to the requirements specified in AWWA C111. Unless otherwise required, above ground flange assembly bolts shall be standard hex-head, cadmium plated machine bolts with American Standard Heavy, hot–pressed, cadmium plated hexagonal nuts. Buried flange nuts and bolts shall be as above except they shall be of Type 304 stainless steel.
2. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111 with “Field Lok Gasket,” sizes 4 inch through 24 inch, “TR Flex,” sizes 4 inch through 64 inch; both by U. S. Pipe, or approved equal. “Megalug” restraint harness, EBAA Iron, or approved equal.
3. Mechanical Joint: [Pressure rating of 350 psi for sizes 3 inch through 16 inch, and 250 psi for sizes 18 inch through 48 inch] Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111 with “Megalug,” sizes 3 inch through 48 inch, EBAA Iron, or approved equal.
4. Grooved and Shouldered Joints: AWWA C150, AWWA C151 and AWWA C606. 24 inch maximum size.

I. Insulating Joints:
1. Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
2. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.
3. Provide gasket of the dielectric type, full face, as recommended in AWWA C115.
4. Provide bolts and nuts as recommended in AWWA C115.

J. Couplings: [check with manufacturer for sizes and pressure rating available]
1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer’s shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. Stainless steel bolts and nuts and special coatings available for extra protection from corrosion. Smith-Blair, Inc., Dresser, or approved equal.
2. Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer’s shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. Stainless steel bolts and nuts and special coatings available for extra protection from corrosion. Smith-Blair, Inc., Dresser, or approved equal. or 2) restrained flange adapter, “Megaflange,” sizes 3 inch through 48 inch, EBAA Iron, or approved equal.

2.5 PE PIPE: SIZES 4 INCH THROUGH 64 INCH

A. Pipe and Fittings: AWWA C906

B. Joints:
   1. Thermal Butt Fusion: AWWA C906 and pipe manufacturer's recommendations
   2. Flanged joints: AWWA C906 and pipe manufacturer's recommendations

2.6 PVC PIPE: SIZES 4 INCH THROUGH 48 INCH

A. Pipe: Pressure Class 150, DR 14, spigot and gasket bell end, conforming to AWWA C900 (4 inch through 12 inch and AWWA C905 (14 inch through 48 inch)

B. Fittings: Ductile iron fittings
   1. Standard: AWWA C110, sizes 4 inch through 48 inch
   2. Compact: AWWA C153, sizes 4 inch through 24 inch
   3. All fittings shall be fusion epoxy coated per AWWA C116

C. Unrestrained Joints: Push-On Bell and Spigot Joint: AWWA C900

D. Restrained Joints:
   1. Push-On Bell and Spigot Joint: Harness assembly as manufactured by EBAA Iron, or approved equal.
   2. Plain End PVC to Ductile Iron Mechanical Joint: EBAA Iron, or approved equal.

E. Steel or Ductile Iron Couplings: [check with manufacturer for sizes and pressure rating available]
   1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. Stainless steel bolts and nuts and special coatings available for extra protection from corrosion. Smith-Blair, Inc., Dresser, or approved equal.
   2. Plain End Pipe to Ductile Iron or Steel Flanged Pipe: Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. Stainless steel bolts and nuts and special coatings available for extra protection from corrosion. Smith-Blair, Inc, Dresser or approved equal.

F. PVC Couplings: [check with manufacturer for sizes and pressure rating available]
   1. Unrestrained Plain End to Plain End Pipe: AWWA C900, as manufactured by North American Piper approved equal.
   2. Restrained Plain End to Plain End Pipe: AWWA C900, "Fluid-Tite" as manufactured by North American Pipe, or approved equal.

2.7 CEMENT MORTAR LINED AND COATED STEEL PIPE: 6 INCH AND LARGER

A. Pipe: AWWA C200 and AWWA M11

B. Special Sections and Fittings: AWWA C200, C207, C208 and AWWA M11 for all bends, tees, nozzles, closures, etc.

C. Flanges: AWWA C207. Includes blind flanges.

D. Linings and Coatings for Pipe, Special Sections and Fittings: Cement Mortar Lining and Coating: AWWA C205. [Other linings and coatings are available. Consult the following AWWA Standards and pipe manufacturers such, as Ameron, for details.
   1. Liquid Epoxy Lining and Coating: AWWA C210
   2. Fusion Bonded Epoxy Lining and Coating: AWWA C213

3. Coal-Tar Lining and Coating: AWWA C203
4. Cold-Applied Tape Coatings, Piping: AWWA C214
5. Cold-Applied Tape Coatings, Specials, Connection and Fittings: AWWA C209
6. Cold Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Buried or Submerged Steel Water Pipelines
7. Aboveground Pipe Coatings: AWWA C218]

E. Non-Restrained Joints: AWWA M11 - Rubber Gasket: Carnegie-shape rubber gasket as indicated

F. Restrained Joints: AWWA M11. Where a flanged joint, butt strap or coupling are not indicated, either restrained joint a, or b, as follows, is acceptable, but the selected joint shall be used throughout the project.
1. Rubber Gasket: Carnegie-shape rubber gasket with field welded restraint bar as indicated
2. Field Lap Welded Slip Joint: As indicated
3. Field Welded Butt Strap: As indicated
4. Flanged Joint: AWWA C207 with Type 316L stainless steel bolts and nuts as indicated

G. Joint Coating for Cement Mortar Lined and Coated Steel Pipe:
1. Field Joint Encasement: Cement mortar contained in fabric lined with closed cell polyethylene foam as indicated. Attach fabric to pipe with Type 316L stainless steel straps as indicated. Closed cell polyethylene foam encasement shall be by Industrial Specialties or approved equal.

H. Non-Restrained Flexible Couplings: AWWA C219, Smith Blair, Inc., Number 411 or approved equal, with factory applied fusion-bond epoxy coating and Type 316L stainless steel bolts and nuts.

I. Restrained Flexible Couplings: Non-restrained flexible coupling supplemented with a restraining harness as indicated and as follows:
1. Restraining harness design by Contractor’s pipe manufacturer using criteria presented in AWWA M11.
2. Space harness-lugs and tie bolts equally around the pipe.
3. Type 316L stainless steel harness tie bolts and nuts.
4. Design and dimensions of harness lugs to be modified from that shown in AWWA M11, as necessary, to provide additional height to clear the coupling.

J. Field Coating of Coupling Assemblies: Apply either of the following flexible tape and mastic or putty coating systems to the all non-restrained or restrained flexible steel couplings.
1. Denso Coating System – Denso North American, Inc.
2. Trenton Coating System – Trenton Corporation

2.8 FLEXIBLE CONNECTORS

A. Flanged Coupling Adapters for plain end pipe at fittings, valves and equipment shall be Dresser Style 127 or 128, similar models by ITT; Baker Coupling Company or approved equal. Nuts, bolts and other hardware shall be Type 304 stainless steel.

B. Mechanical Couplings shall be rated for a minimum working pressure of 150 psi. The barrel shall be a minimum 10 inches long. Couplings shall be cleaned and shop primed

with manufacturer's standard rust inhibitive primer. Mechanical couplings shall be Smith-Blair, Romac, JCM, Apac or approved equal, with stainless steel nuts, bolts, and threaded rods.

C. Flexible Coupling for Steel Pipe shall be Dresser Coupling Style 38 with EPDM gaskets, or approved equal.

2.9 EXPANSION JOINT

A. An expansion joint shall be installed at location indicated on the Plans and shall be manufactured of ductile iron conforming to the material properties of AWWA C153.

B. Separation beyond the maximum extension of the expansion joint shall be prevented without the use of external tie rods.

C. The expansion joint shall be pressure tested against its own restraint to a minimum of 250 psi.

D. All pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy, conforming to the applicable requirements of AWWA C213, and shall be tested with a 1500 volt spark test conforming to stated specification.

E. Mechanical or Flanged Joint: The expansion joint shall be Model Ex-Tend 200, 4 inch through 36 inch, as manufactured by EBAA Iron, Inc., or approved equal.

F. TR Flex Joints: TR Flex Telescoping Sleeve, 4 inch through 64 inch, U. S. Pipe.

2.10 FLEXIBLE EXPANSION JOINTS

A. Flexible expansion joints shall be installed at locations indicated on the Plans and shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and AWWA C153.

B. Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum of 250 psi. A minimum 2:1 safety factor, determined from the published pressure rating, shall apply.

C. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of 15º, and 6 inches minimum expansion. The flexible expansion fitting shall not expand or exert an axial imparting thrust under internal water pressure. The flexible expansion fitting shall not increase or decrease the internal water volume as the unit expands or contracts.

D. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61.

E. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C116

F. Polyethylene sleeves, meeting AWWA C105, shall be included for direct buried applications.

G. Flanged or mechanical Joint: Flexible expansion joint shall be Force Balanced FLEX-TEND, sizes 3 inch through 48 inch, as manufactured by EBAA Iron, or approved equal.

H. Flanged Joint: Starflex, Series 5000, Star Pipe Products, or approved equal.

I. Plain End to Plain End Pipe: “Xtra Flex,” sizes 4 inch through 24 inch, U. S. Pipe, or approved equal.

2.11 HIGH DEFLECTION FITTINGS/BALL JOINTS

A. Plain End Pipe: Xtra Flex Restrained Joint High Deflection Fittings, 4 inch through 24 inch, U. S. Pipe, or approved equal.

B. Mechanical or Flanged Joint: Flex 900, 4 inch through 12 inch, EBAA Iron, or approved equal.

2.12 GATE VALVES

A. Provide valves conforming to AWWA C500 or AWWA C509

B. Valves shall be resilient-seated, with non-rising stem, gray or ductile-iron body and bonnet, with bronze or gray or ductile-iron gate, bronze stem and square stem operating nut unless noted otherwise.

C. [Metal seated, AWWA C500, and rubber seated, AWWA C504, are also available.]

D. All bolts, nuts and washers, except operating nut, shall be stainless steel.

E. Stem operating nut to be 2 inches square and open counter-clockwise.

F. Stem extensions shall be installed to bring the stem operating nut to within 2 feet of finish grade where the depth from finish grade to the stem operating nut exceeds 4 feet.

G. Equip valves in pump stations and other interior or vault installations with hand-wheels.

H. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer’s recommendations.

I. For the domestic water system, valves shall also conform to NSF 61.

J. Service vine Valves and fittings, 2 inch and smaller shall be in accordance with AWWA C800

K. Where a post indicator is shown, provide valve with an indicator post flange.

L. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
   1. Mueller Company
   2. M&H Valve Company
   3. Crane Company, or approved equal

2.13 SWING CHECK VALVES

A. Provide swing-check type valves conforming to AWWA C508.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Mueller Company
2. M&H Valve Company
3. DeZurik/APCO
4. Watts, or approved equal

2.14 BALL VALVES

A. Provide ball valves (6 inch through 48 inch) per AWWA C507 as manufactured by Crane Company, or approved equal.

B. Provide ball valves (2 inches and smaller) conforming to AWWA C800 as manufactured by Mueller 300 Series, Ford, or approved equal.

C. Valves shall open by counterclockwise rotation of the valve stem.

D. Provide valves with ends as appropriate for the adjoining pipe.

E. Provide valve with lockable operating nut or handle as shown on the Plans.

2.15 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES

A. Air release and vacuum valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve body, and shall conform to AWWA C512. A compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve. Provide universal air-vacuum type valves, Crispin, DeZurik/APCO or approved equal.

B. Combination air valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve or double valve body, and shall conform to AWWA C512. A simple or compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
1. Crispin
2. DeZurik/APCO, or approved equal

2.16 BLOW-OFF VALVES

A. Provide valve and service size as shown in the Plans. Provide 2 inch valves at low points of the piping system, and 4 inch valves at dead-ends of the piping system, unless otherwise directed by the Engineer.

B. 2 inch blow-off shall have a 2 inch vertical female iron pipe (FIP) inlet and a 2 inch normal pressure and temperature (NPT) nozzle outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16-inch square operating nut. All working

parts shall be serviceable without excavation. Kupferle/Truflo Model TF550, or approved equal.

C. 4 inch blow-off shall have all brass principal working parts, 4 inch inlet and outlet and is self-draining and non-freezing. Valve shall open by counterclockwise rotation of a top-mounted 2-inch square operating nut. All working parts shall be serviceable without excavation.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:

E. Kupferle/ MainGuard #7600, or approved equal

2.17 PRESSURE-REDUCING VALVES

A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250 psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment.

B. Valves shall have flanged ends. Valves sized 3 inches or smaller may have screwed ends.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Cla-Val Company
2. Bermad
3. Ames Company, or approved equal

2.18 FLOW-REGULATING VALVES

A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250 psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment. Details as indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Cla-Val Company
2. Bermad
3. Ames Company, or approved equal

2.19 SERVICE CONNECTIONS AND WATER METERS

A. Service connections and water meter details and boxes as indicated.

2.20 VALVE BOXES, METER BOXES, FRAMES AND COVERS

A. Water Valve Box: Provide pre-cast concrete valve box for each buried valve. Provide box with steel or cast-iron traffic cover marked “WATER”. Christy Model G5 with G5C cover or approved equal.

B. Valve or Meter Boxes: Contractor shall verify box size required for water system appurtenances as shown in the Construction Documents. Provide a precast concrete utility box for each buried appurtenance. Provide a traffic-rated lid for H20 loading. A non-traffic rated lid may be used for boxes located in landscape areas. Christy, or approved equal.

2.21 BACKFLOW PREVENTER - REDUCED PRESSURE PRINCIPLE ASSEMBLIES (RPPA)

A. Install EBMUD approved Backflow Preventer.

B. Provide RPPA consisting of two independently operating check valves with a pressure differential relief valve located between the two check valves, two shut-off valves and four test cocks. RPPA shall be tamper-proof and conform to AWWA C511. Valve shall have an outside screw (OS) gate valve on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves for continuous-pressure application.

C. Body:
1. 2 inch and Smaller: Bronze with threaded ends
2. 2 ½ inch and Larger: Bronze, cast iron steel, or stainless steel with flanged ends

D. Interior Lining: AWWA C550, epoxy coating for cast iron or steel bodies

E. Interior Components: Corrosion-resistant materials

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Cla-Val Company
2. Ames Company
3. Febco, CMB Industries, Inc.
4. Hersey Products, Inc.
5. Watts
6. Zurn/Wilkins, or approved equal

2.22 BACKFLOW PREVENTER - DOUBLE CHECK DETECTOR ASSEMBLY (DCDA)

A. Install EBMUD approved Backflow Preventer.

B. Provide a cast-iron body DCDA consisting of mainline double check assemblies in parallel with a bypass double check and meter assembly, two shut-off valves and four test cocks. DCDA shall be tamper-proof and conform to AWWA C510. FM approved or UL listed, with outside screw and yoke (OS&Y) gate valve on inlet and outlet, and strainer on inlet. Include two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer, for continuous pressure application.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Cla-Val Company
2. Ames Company
3. Febco, CMB Industries, Inc.
4. Hersey Products, Inc.

5. Zurn/Wilkins, or approved equal

2.23 FIRE DEPARTMENT CONNECTION

A. Exposed, sidewalk or Freestanding Type Fire Department Connection: UL 405, cast brass body with threaded inlets according to NFPA 1963 and matching local fire department hose threads and threaded bottom outlet. Include lugged caps, gaskets and chains; lugged swivel connections and drop clapper for each hose-connection inlet; 18-inch-high brass sleeve; and round escutcheon plate. Number of inlets shall be as shown on the Plans. Clapper and spring check inlets shall each have a minimum capacity of 250 gpm, and be furnished with a cap and chain. Outlet shall be sized for simultaneous use of all inlets. Connection shall be branded “Building XX”.
   1. 2-Way FDC: Connection shall conform to UL 405 or FM 1530. Elkhart, Croker, or approved equal.
   2. 3-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Elkhart, Croker, Potter-Roemer or approved equal.
   3. 4-Way FDC: Connection shall conform to UL 405. Potter-Roemer, Croker, or approved equal.
   4. 6-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Croker, Potter-Roemer or approved equal.

2.24 THRUST BLOCKS

A. Use concrete conforming to ASTM C94 having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 ½ parts sand, and 5 parts gravel, having the same minimum compressive strength.

B. Provide thrust blocks or mechanical pipe restraints at all fittings and changes in angle, alignment or elevation.

C. Where depth or location of existing structures prohibit the use of standard thrust blocks, gravity blocks may be used.

2.25 TAPPING SLEEVES AND TAPPING VALVES

A. Tapping sleeves shall be epoxy coated and furnished with stainless steel washers, nuts and bolts. Mueller H-615 and H-619, Ford, or approved equal.

B. Tapping valves shall have flanged inlet, Class 125, conforming to ASME B16.1 and furnished with stainless steel washers, nuts and bolts. Tapping valves shall be constructed with a mechanical joint outlet. Mueller T-687, T-642, T-681, or approved equal.

2.26 SERVICE SADDLES AND CORPORATION STOPS

A. Service Saddles: Saddles shall conform to AWWA C800 and NSF 61.
   1. For DIP: Provide bronze or stainless-steel body, double strap type with a 200 psi, maximum working pressure. Mueller BR2 Series, Ford, or approved equal.
   2. For PVC: Provide bronze body, wide strap type. Mueller H-13000 Series, Ford, or approved equal.
   3. For PE: Per manufacturer’s recommendations.

B. Corporation Stops: Provide ground key type; bronze conforming to ASTM B61 or ASTM B62, for a working pressure of 100 psi and suitable for the working pressure of the system.
   1. Ends shall be suitable for adjoining pipe and connections, solder-joint, or flared tube compression type joint.
   2. Threaded ends shall conform to AWWA C800.
   3. Coupling nut for connection to flared copper tubing shall conform to ASME B16.26.
   4. Mueller H-15000 Series with “CC” threads and a copper flare straight connection outlet, Ford, or approved equal.

2.27 IDENTIFICATION MATERIALS AND DEVICES

A. Warning Tape: Provide warning tape consisting of metallic foil bonded to solid blue plastic film not less than 3 inches wide. Film shall be inert polyethylene plastic. Film and foil shall each not be less than 1 mil thick. The tape continuously shall have printed black-letter, not less than ¾ inch high, message reading “CAUTION: WATER MAIN BELOW”.

B. Tracer Wire for Nonmetallic Piping: Provide 12 guage, coated copper or aluminum wire not less than 0.10 inch in diameter, with blue THW, THWN, or THHN rated insulation, in sufficient length to be continuous over each separate run of nonmetallic pipe. Wire shall be tied in at all valves.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) shown on the Plans.

B. Excavation, Bedding, Backfill, and Compaction: Section 31 2100 – Utility Trenching and Backfill.

C. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer’s recommendations.

D. Pipe laying and jointing:
   1. Provide proper facilities for lowering sections of pipe into trenches.
   2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.
   3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
   4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
   5. Grade the pipeline in straight lines; avoid the formation of dips and low points.
   6. Support pipe at proper elevation and grade.
   7. Provide secure firm, uniform support. Wood support blocking will not be permitted.

8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
9. Provide anchors and supports where indicated and where necessary for fastening work into place.
10. Make proper provision for expansion and contraction of pipelines.
11. Keep trenches free of water until joints have been properly made.
12. Do not lay pipe when conditions of trench or weather prevent proper installation.
13. All fittings shall be blocked with appropriately sized thrust blocks as shown on the Plans.

E. Installation of Tracer Wire:
1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.
4. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

F. Installation of Warning Tape
1. Install tape approximately 1 foot above and along the centerline of the pipe.
2. Where tape is not continuous, lap tape ends a minimum of 2 feet.

G. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

H. Connections to Existing Lines:
1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.

I. Closure: Close open ends of pipes and appurtenance openings at the end of each day's work or when work is not in progress.

3.2 INSTALLATION OF DUCTILE-IRON PIPING

A. Install pipe and fittings in accordance with requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

B. Jointing:
1. Provide push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.

2. Provide mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of AWWA C111.
3. Provide flanged joints with the gaskets, bolts, and nuts specified for this type joint.
4. Install flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories.
5. Align bolt holes for each flanged joint.
6. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
7. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without over straining the flange.
8. Where flanged pipe and fitting have dimensions that do not allow the installation of a proper flanged joint as specified, replace it by one of proper dimensions.
9. Use setscrewed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe. Assemble in accordance with the recommendations of the setscrewed flange manufacturer.
10. Provide insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints. Bolts for insulating sleeves shall be full size for the bolt holes.
11. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

C. Exterior Protection: Completely encase buried ductile iron pipelines and underground appurtenances with polyethylene wrap. Install 8 mil linear low-density polyethylene (LLD) film or 4 mil high-density cross-laminated (HDCL) film per manufacturer's recommendations and in accordance with AWWA/ANSI C105/A21.5 and ASTM A674.

D. Pipe Anchorage: Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.3 INSTALLATION OF POLYVINYL CHLORIDE PIPING

A. Comply with the recommendations for pipe installation, joint assembly and appurtenance installation in AWWA Manual M23.

B. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.

C. Jointing:
1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the applicable requirements of AWWA C600 for joint assembly.
6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot

end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.

7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

D. Pipe Anchorage:
1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.4 INSTALLATION OF POLYETHYLENE PIPING

A. Install pipe, fittings, and appurtenances in accordance with manufacturer's recommendations.

B. Jointing:
1. Provide mechanical joints, compression fittings, or flanges as recommended by the manufacturer.
2. Jointing shall be performed using proper equipment and machinery by trained and certified personnel.
3. Joints, fittings and tools shall be clean and free of burrs, oil, and dirt.
4. Butt fusion:
a. Pipe ends shall be faced to establish clean, parallel mating surfaces.
b. Align and securely fasten the components to be joined squarely between the jaws of the joining machine.
c. Heat the ends of the pipe to the pipe manufacturer's recommended temperature interface pressure and time duration. A pyrometer or other surface temperature measuring device should be used to insure proper temperature of the heating tool. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
d. Prevent molten plastic from sticking to the heater faces. Molten plastic on the heater faces shall be removed immediately according to the tool manufacturer's instructions.
e. Bring the molten ends together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. Hold the molten joint under pressure until cooled adequately to develop strength. Refer to the manufacturer's recommendations for temperature, pressure, holding, and cooling times.
f. Remove the inside bead from the fusion process using Manufacturer's recommended procedure.
5. Socket fusion:
a. Mixing manufacturers' heating tools and depth gauges will not be allowed unless the tools conform to ASTM F1056.
b. Pipe ends shall be faced square to establish clean, parallel mating surfaces.
c. Clamp the cold ring on the pipe at the proper position using a depth gauge.
d. Heat the tool to the pipe manufacturer's recommended temperature. A pyrometer or other surface temperature measuring device should be used to insure proper temperature. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
e. Follow manufacturer's recommendations for bringing the hot tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket fitting.
f. Simultaneously remove the pipe and fitting from the tool.

g. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion.
h. Hold or block the pipe in place during cooling.

6. Electrofusion:
   a. Unless the operation is for a saddle-type electrofusion joint, pipe ends shall be faced square to establish clean, parallel mating surfaces.
   b. Clamp the pipe and fitting at the proper position in the fixture.
   c. Connect the electrofusion control box to the fitting and to the power source. Apply the electric current using manufacturer's instructions.
   d. Allow the joint to cool before removing the clamping fixtures.

3.5 INSTALLATION OF VALVES

A. Gate Valves
   1. Install gate valves conforming to AWWA C500 and UL 262 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, operation, and Maintenance of Gate Valves) to AWWA C509.
   2. Install gate valves conforming to AWWA C509 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C509.
   3. Install gate valves on PVC water mains in addition in accordance with the recommendations for appurtenance installation in AWWA Manual M23.

B. Butterfly Valves: Install butterfly valves in accordance with the applicable requirements of Appendix A of AWWA C504.

C. Check Valves: Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated.

D. Joints:
   1. Valves on DI, PE and PVC Pipe: Mechanical joint valves for buried locations. Flanged-end valves for installation in vaults/pits.
   2. Valves on Steel Pipe: As indicated for buried locations. Flanged-end valves for installation in vaults/pits.

3.6 INSTALLATION OF VALVE AND METER BOXES

A. Boxes shall be centered over the appurtenance so as not to transmit shock or stress. Covers shall be set flush with the surface of the finished pavement, or as shown on the Plans. Backfill shall be placed around the boxes and compacted to the specified level in a manner that will not damage or displace the box from proper alignment or grade. Misaligned boxed shall be excavated, plumbed, and backfilled at no additional cost to the Kensington Fire Protection District.

3.7 INSTALLATION OF FIRE HYDRANTS

A. Install fire hydrants, except for metal harness, plumbed vertical, in accordance with AWWA C600 for hydrant installation and as indicated.

B. Provide and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Hydrants shall be set so that mounting bolts clear the top of finished grade by three inches so bolts may be easily replace if needed.

C. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached.

3.8 SERVICE LINE CONNECTIONS TO WATER MAINS

A. Connect service lines of size shown on plans to the main with a rigid connection or a corporation stop and gooseneck. Install a gate valve on the service line.

B. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.

C. Connect service lines to PVC plastic water mains in accordance with the recommendations of AWWA Manual M23.

3.9 INSTALLATION OF BACKFLOW PREVENTERS

A. Backflow devices shall be installed horizontal and level, with three feet minimum clearances from obstructions.

3.10 ANCHORAGE INSTALLATION

A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer's instructions.

B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24 hours curing time before introducing water into the pipeline and allow a minimum of 7 days curing time before pressure testing.

3.11 CONNECTION TO EXISTING

A. Contractor shall submit a work plan delineating the work sequence and duration of each task.

B. The Contractor to submit a contingency plan in case work extends beyond the allowable shutdown duration

C. The total allowed duration of shutdown shall not exceed that allowed by EBMUD.

D. Contractor to notify Kensington Fire Protection District 48 hours prior to shut-down.

E. Prior to shut-down the Contractor shall have the following:
1. Approved submittals for the work to be done
2. Approved work plan
3. Approved contingency plan
4. The material, tools and equipment necessary to do the work, including pumps, generator, lighting, etc.

F. No work shall be done within two weeks from a wet weather event.

G. Contractor to check the weather (NOAA website) and plan work during dry weather period.

3.12 HYDROSTATIC PRESSURE AND LEAKAGE TEST

A. General:
1. Provide all necessary materials and equipment, including water.
2. Backfill all trenches sufficient to hold pipe firmly in position.
3. Allow time for thrust blocks to cure prior to testing.
4. Flush all pipes prior to testing to remove all foreign material.
5. Perform pressure and leakage test concurrently.
6. Apply test pressure by means of a pump connected to the pipe.
7. Base test pressure on the elevation of the lowest point in the line.
8. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
9. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.
10. The pressure test on mortar-lined pipe shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption in the cement mortar lining.
11. Allow the system to stabilize at the test pressure before conducting the leakage test.
12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
13. Maintain test pressure as specified for type of pipe being tested.
14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.

B. Preparation for Test
1. Vents shall be provided at the high points of the system and drains provided where means of venting or draining do not exist.
2. Remove or block off, all relief valves, rupture discs, alarms, control instruments, etc. that shall not be subjected to the test pressure.
3. All discs, balls, or pistons from check valves shall be removed if they interfere with filling of the system. Open all valves between inlet and outlet of the section to be tested.
4. Connect pump and provide temporary closures for all of the external openings in the system. Use caution to ensure that the closures are properly designed and strong enough to withstand the test pressure.
5. A joint previously tested in accordance with this specification may be covered or insulated.
6. Expansion joints shall be provided with temporary restraint for additional pressure under test or shall be isolated from the test.
7. Flanged joints, where blanks are inserted to isolate equipment during the test, need not be tested.

C. DIP Leakage Test: Perform in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated as follows:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the

pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.

2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
3. No piping will be accepted if the leakage is greater than that determined by the following formula:

L = (S x D x P1/2)/133,200

L = Allowable leakage, gallons per hour.
S = Length of pipe tested, feet.
D = Nominal diameter of pipe, inches.
P = Average test pressure during the leakage test, pounds per square inch (gauge).

D. PE Pipe Leakage Test:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Apply the test pressure and allow the pipe to stand, without makeup pressure, for sufficient time to allow for diametric expansion or pipe stretching to stabilize, approximately two to three hours.
3. After the above stabilization has occurred, return the section being tested to the test pressure. Hold the test pressure for four hours. If the pressure in the test section drops, and it is determined the drop may be the result of expansion resulting from increasing temperature, a limited amount of additional water may be added to bring the pressure back to the test pressure. Allowable amounts of make-up water, to compensate for expansion due to increasing temperature, are as shown in the following table. Make-up water is only allowed during this final test period and not during the initial stabilization described in the previous paragraph. If the additional water added is less than the allowable shown in the table and there are no visual leaks or significant pressure drops, the tested section passes the test.

Nominal Pipe Size (in.)	Allowance for Expansion (U.S. Gals./100 Feet of Pipe) 1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.50
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0

40	11.0	22.0	33.0
48	15.0	27.0	43.0

E. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:
1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
3. No piping will be accepted if the leakage is greater than that determined by the following formula:

L = (N x D x P1/2)/7,400

L = Allowable leakage, gallons per hour.
N = Number of joints in the length of the pipeline tested.
D = Nominal diameter of pipe, inches.
P = Average test pressure during the leakage test, pounds per square inch (gauge).

F. Cement Mortar Lined and Coated Steel Pipe Leakage Test: Perform in accordance with AWWA M11. Selected requirements of AWWA M11 are repeated as follows:
1. All pipelines shall be tested by subjecting each section to a pressure, measured at the lowest end of the section, of at least 150 percent of the class rating or design pressure of the pipe under test. In no case shall the pipe be tested at less than 150 psi, nor shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
3. There shall be no significant leakage for pipe with welded joints or mechanical couplings.
4. For pipe joined with O-ring rubber gaskets, a leakage of 25 gallons per inch of diameter per mile per 24 hours is allowed.

3.13 CLEANING

A. At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Kensington Fire Protection District will examine the pipes for leaks. If any further defective pipes or joints are discovered, the Contractor shall repair them. Finished paving shall not be installed prior to completion of all cleaning and testing.

3.14 DISINFECTION OF PIPELINES

A. After completion of the hydrostatic test, the mains shall be thoroughly flushed with a minimum pipe velocity of 2.5 fps and chlorinated in accordance with the latest revision of AWWA 651, Standards of Disinfecting Water Mains. Any one of the methods therein described may be used, with the additional requirement of 50 ppm chlorination minimum initial application. At the end of the contact period, the mains shall again be flushed, and bacteriological samples taken.

B. If necessary, the Contractor shall provide, at his expense, outlets from which to take the samples. The location of the chlorination and sampling points will be determined by the Kensington Fire Protection District in the field. Taps for chlorination and sampling shall be installed. The Contractor shall uncover and backfill the taps as required.

C. Disinfection of tie-ins shall be performed by the Contractor by swabbing with chlorine or by other approved methods. Following a tie-in, the area affected by the tie-in shall be thoroughly flushed and bacteriological samples will be taken as deemed necessary.

D. All treated water flushed from the lines shall be dechlorinated and disposed of by discharging to the locations identified in the Plans, or by other approved means. No discharge of chlorinated water to any storm sewer or natural water course will be allowed, unless properly dechlorinated.

E. The Contractor shall dechlorinate and retest any lines that do not meet the requirements of the above testing. The line shall not be placed in service until the requirements of the State Public Health Department are met.

3.15 BACTERIOLOGICAL TESTING

A. Samples shall be gathered and tests conducted at the expense of the Contractor by a laboratory approved by the Kensington Fire Protection District.

B. Water samples are to be taken at representative points no less than one test per 500 feet of pipe, plus one test at each end of the pipe; or as required by the Kensington Fire Protection District.

C. After the samples have passed the bacteriological testing, the Contractor will be notified and arrangements can be made to make tie-ins and connections to house services.

D. Each water sample will have passed the bacteria tests if they show zero total coliform per 100 ml and not more than 50 non-sheen bacteria per 100 ml, and when the turbidity is no greater than the source water.

E. Samples shall be taken no sooner than 24 hours after final flushing.

F. Jumpers and/or plates shall be pulled within 14 days of the notification of a successful test, or new bacteria samples will have to be taken.

G. Follow-up bacteriological testing shall take place after tie-ins have been made, and shall meet the same passing requirements as the initial tests.

END OF SECTION

SECTION 33 3000

SANITARY SEWER SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary gravity sewers and force mains up to five feet from any on-site building

1.2 RELATED SECTIONS

A. Section 31 2100, Utility Trenching and Backfill

B. Section 32 1318, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. AASHTO
1. M199: Standard Specification for Precast Reinforced Concrete Manhole Sections
2. M252: Standard Specification for Corrugated Polyethylene Drainage Pipe
3. M294: Standard Specification for Corrugated Polyethylene Pipe, 12 to 60 inch Diameter

B. ASTM
1. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
2. ASTM A674: Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
3. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete
4. C443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
5. C478: Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
6. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
7. C1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems
8. C1244: Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
9. D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
10. D3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
11. D4101: Standard Specification for Propylene Injection and Extrusion Materials
12. F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
13. F679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
14. ASTM F1056: Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings

15. F1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings

C. AWWA
1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
3. C110: Ductile-Iron and Gray-Iron Fittings
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. C115: Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
6. C116: Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
7. C150: Thickness design of Ductile Iron Pipe
8. C151: Ductile-Iron Pipe, Centrifugally Cast
9. C153: Ductile-Iron Compact Fittings
10. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
11. C512: Air Release , Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
12. C600: Installation of Ductile-Iron Water Mains and Their Appurtenances.
13. C606: Grooved and Shouldered Joints
14. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. for Water Transmission and Distribution
15. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. for Water Transmission and Distribution
16. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. for Waterworks
17. M23: PVC Pipe – Design and Installation
18. M41: Ductile Iron Pipe and Fittings

D. Caltrans Standard Specifications, 2015
1. Section 51, Concrete Structures
2. Section 65, Concrete Pipe
3. Section 75 Miscellaneous Metal
4. Section 90, Concrete

E. Federal Specification
1. SS-S-00210 (GSA-FSS)

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing Materials

C. AWWA: American Water Works Association

D. HDPE: High-density polyethylene

E. PE: Polyethylene

F. DIP: Ductile iron pipe

G. PVC: Polyvinyl Chloride

H. RCP: Reinforced concrete pipe

I. NPS: Nominal pipe size

1.5 SUBMITTALS

A. Product data for the following:
1. Piping materials and fittings
2. Special pipe couplings
3. Joint sealants
4. Cleanout plugs or caps
5. Sewage air relief valves

B. Shop drawings: Include plans, elevations, details and attachments for the following:
1. Precast concrete manholes, frames and covers
2. Precast concrete clean out boxes and box covers
3. Force main piping access openings

C. Design Mix Reports and Calculations: For each class of cast in place concrete

D. Field Test Reports: Indicate test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage
1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

B. Handling
1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.
2. Handle precast concrete pipe, manholes and other precast structures according to manufacturer’s written instructions.
3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 PVC PIPE

A. Pipe:
1. 4 inch through 15 inch: ASTM D3034, SDR 26
2. 18 inch through 36 inch: ASTM F679, T-1 wall

B. Bell and spigot joints

C. Fittings:
1. 4 inch through 27 inch: ASTM F1336
2. 30 inch through 36 inch: ASTM D3034, SDR 26

D. Joint Gasket: Elastomeric seal, ASTM F477

E. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.2 GRAVITY PIPE CLEANOUTS

A. Piping: Same as sanitary sewer line if possible

B. Top Cap: Threaded and of same material as piping if possible

C. Box Size: As required to provide access and allow easy removal and reinstallation of cap

D. Box Types:
1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty
2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading

E. Box Cover Markings: “SANITARY SEWER” unless otherwise specified

F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
1. Associated Concrete Products, Inc.
2. Brooks Products Inc.
3. Christy Concrete Products, Inc., or approved equal

2.3 MANHOLES

A. Manholes shall be pre-cast concrete of the size and shape shown on the Plans and shall conform to ASTM C478. Equivalent poured-in-place structures may be used at the Contractor’s option. Concrete shall consist of Caltrans Type I/II cement. Rate for AASHTO H20 loading in traffic areas.

B. All interior concrete surfaces shall be coated with “Xypex Crystalline” or approved equivalent. Use of a water-resistant admix is acceptable, at Contractor option.

C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-2.02B. Manhole covers shall have the words “SANITARY SEWER” in letters not less than 2 inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.

D. Frames and lids for manholes shall be match-marked in pairs before delivery to the job site. The lids shall fit into their frames without rocking.

E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Plans. Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.

F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of Caltrans Standard Specifications Section 90 and as specified herein. The concrete shall be Class “A” containing six (6) sacks of portland cement per cubic yard of concrete. The grading of the combined aggregate shall be in accordance with the Caltrans requirements of the three-quarter inch maximum. The consistency of the concrete shall be such that the slump does not exceed four inches, as determined by ASTM C143. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.

G. Steps: ASTM C478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, or equal.

2.4 JOINT SEALANT FOR STRUCTURES AND MANHOLES

A. Mortar: Caltrans Standard Specification Section 51-1.02F
   1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.

B. Gaskets: Preformed flexible rubber or plastic gasket
   1. Rubber Gaskets: ASTM C443
   2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is “Ram-Nek,” as manufactured by the Henry Company, or equal

2.5 SERVICE LATERAL RECONNECTIONS

A. Service lateral reconnections shall be made using a PVC SDR 26 45 degree Wye; sized to fit the sewer main and the diameter of the sewer lateral.

2.6 PIPE TO STRUCTURE CONNECTOR/SEAL

A. A flexible pipe to manhole connector shall be used for all pipe penetrations to pre-cast and/or cast-in-place concrete structures.
   1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.
   2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C923.

3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.
4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

PART 3 - EXECUTION

3.1 GRAVITY PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03 for reinforced concrete pipe and chapter 11.3.3 of AWWA M41 for ductile iron pipe.

B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Section 31 2100, Utility Trenching and Backfill.

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance at the end of each day's work or when work is not in progress.

3.2 INSTALLATION OF POLYVINYL CHLORIDE PIPING

A. Comply with the recommendations for pipe installation, joint assembly and appurtenance installation in AWWA M23.

B. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.

C. Jointing:
1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the applicable requirements of AWWA C600 for joint assembly.
6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

D. Pipe Anchorage:
1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.3 INSTALLATION OF POLYETHYLENE PIPING

A. Install pipe, fittings, and appurtenances in accordance with manufacturer's recommendations.

B. Jointing:
1. Provide mechanical joints, compression fittings, or flanges as recommended by the manufacturer.
2. Jointing shall be performed using proper equipment and machinery by trained and certified personnel.
3. Joints, fittings and tools shall be clean and free of burrs, oil, and dirt.
4. Butt fusion:
   a. Pipe ends shall be faced to establish clean, parallel mating surfaces.
   b. Align and securely fasten the components to be joined squarely between the jaws of the joining machine.
   c. Heat the ends of the pipe to the pipe manufacturer's recommended temperature interface pressure and time duration. A pyrometer or other surface temperature measuring device should be used to insure proper temperature of the heating tool. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
   d. Prevent molten plastic from sticking to the heater faces. Molten plastic on the heater faces shall be removed immediately according to the tool manufacturer's instructions.
   e. Bring the molten ends together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. Hold the molten joint under pressure until cooled adequately to develop strength. Refer to the manufacturer's recommendations for temperature, pressure, holding, and cooling times.

f. Remove the inside bead from the fusion process using Manufacturer's recommended procedure.

5. Socket fusion:
   a. Mixing manufacturers' heating tools and depth gages will not be allowed unless the tools conform to ASTM F1056.
   b. Pipe ends shall be faced square to establish clean, parallel mating surfaces.
   c. Clamp the cold ring on the pipe at the proper position using a depth gauge.
   d. Heat the tool to the pipe manufacturer's recommended temperature. A pyrometer or other surface temperature measuring device should be used to insure proper temperature. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
   e. Follow manufacturer's recommendations for bringing the hot tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket fitting.
   f. Simultaneously remove the pipe and fitting from the tool.
   g. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion.
   h. Hold or block the pipe in place during cooling.
6. Electrofusion:
   a. Unless the operation is for a saddle-type electrofusion joint, pipe ends shall be faced square to establish clean, parallel mating surfaces.
   b. Clamp the pipe and fitting at the proper position in the fixture.
   c. Connect the electrofusion control box to the fitting and to the power source. Apply the electric current using manufacturer's instructions.
   d. Allow the joint to cool before removing the clamping fixtures.

3.4 SPECIAL PIPE COUPLINGS

A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

B. Installation: Manufacturers' instructions

3.5 POURED-IN-PLACE CONCRETE

A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of Caltrans Standard Specifications.

B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the Caltrans Standards Specifications. Unless otherwise noted herein or in the Plans, exposed surfaces of structures shall be Class 1 surface finish.

C. Curing shall conform to applicable portions in Section 90 of Caltrans Standard Specifications. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.

D. Concrete shall not be cropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.6 GRAVITY PIPELINE AIR TESTING AND FLUSHING

A. All new sections of sanitary sewer shall be tested using the following procedures:

1. Test is conducted between two consecutive manholes, or as directed by the Project Manager.
2. The test section of the sewer shall be plugged at each end. One of the plugs used at the manhole shall be tapped and equipped for the air inlet connection for filling the line from an air compressor.
3. All service laterals, stubs, and fittings into the sewer test section shall be properly capped or plugged and carefully braced against the internal pressure to prevent air leakage by slippage and blowout.
4. Connect air hose to tapped plug selected for the air inlet. Connect the other end of the air hose to the portable air control equipment, which consists of valves and pressure gauges used to control the air entry rate into the sewer test section, and to monitor the air pressure in the pipeline. More specifically, the air control equipment includes a shut-off valve, pressure regulating valve, pressure reduction valve, and a monitoring pressure gauge having a pressure range from 0-5 psi. The gauge shall have minimum divisions of 0.10 psi and an accuracy of 0.40 psi.
5. Connect another air hose between the air compressor (or other source of compressed air) and the air control equipment. This completes the test equipment set-up. Test operations may commence.
6. Supply air to the test section slowly, filling the pipeline until a constant pressure of 3.5 psig is maintained. The air pressure must be regulated to prevent the pressure inside the pipe from exceeding 5.0 psig.
7. When constant pressure of 3.5 psig is reached, throttle the air supply to maintain the internal pressure above 3.0 psig for at least 5 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall. During this stabilization period, it is advisable to check all capped and plugged fittings with a soap solution to detect any leakage at these connections. If leakage is detected at any cap plug, release the pressure in the line and tighten all leaky caps and plugs. Start the test operation again by supplying air. When it is necessary to bleed off the air to tighten or repair a faulty plug, a new 5-minute interval must be allowed after the pipeline has been refilled.
8. After the stabilization period, adjust the air pressure to 3.5 psig and shut-off or disconnect the air supply. Observe the gauge until the air pressure reached 3.0 psig. At 3.0 psig, commence timing with a stopwatch until the pressure drops to 2.5 psig, at which time the stop watch is stopped. The time required, as shown on the stopwatch, for a pressure loss of 0.5 psig is used to compute the air loss.
9. If the time, in minutes and seconds, for the air pressure drop from 3.0 to 2.5 psi is greater than that shown in the following table for the designated pipe size, the section undergoing test shall have passed and shall be presumed to be free of defects. The test may be discontinued at any time.
10. If the time, in minutes and seconds, for the 0.5 psig drop is less than that shown in the following table for the designated pipe size, the section of the pipe shall not have passed the test; therefore, adequate repairs must be made and the line retested.

Requirements for Air Testing

Pipe Size	Time	
(in inches)	Minutes	Seconds
4	2	32
6	3	50

8	5	6
10	6	22
12	7	39
14	8	56
15	9	35
16	10	12
18	11	34
20	12	30

11. For 8 inch and smaller pipe, only: if, during the 5-minute saturation period, pressure drops less than 0.5 psig after the initial pressurization and air is not added, the pipe section undergoing test shall have passed.
12. Multi-pipe sizes: when the sewer line undergoing test is 8-inch or larger diameter pipe and includes 4-inch or 6-inch laterals, the figures in the table for uniform sewer main sizes will not give reliable or accurate criteria for the test. Where multi-pipe sizes are to undergo the air test, the Project Manager can compute the "average" size in inches which is then multiplied by 38.2 seconds. The results will give the minimum time in seconds acceptable for a pressure drop of 0.5 psig for the "averaged" diameter pipe.
13. Adjustment Required for Groundwater:
    a. An air pressure correction is required when the ground water table is above the sewer line being tested. Under this condition, the air test pressure must be increased .433 psi for each foot the ground water level is above the invert of the pipe.
    b. Where ground water is encountered or is anticipated to be above the sewer pipe before the air testing will be conducted, the following procedure shall be implemented at the time the sewer main and manholes are constructed.
        1) Install a ½ inch diameter pipe nipple (threaded one or both ends, approximately 10-inch-long) through the manhole wall directly on top of one of the sewer pipes entering the manhole with threaded end of nipple extending inside the manhole.
        2) Seal pipe nipple with a threaded ½ inch cap.
        3) Immediately before air testing, determine the ground water level by removing the threaded cap from the nipple, blowing air through the pipe nipple to remove any obstruction, and then connecting a clear plastic tube to the pipe nipple.
        4) Hold plastic tube vertically permitting water to rise in it to the groundwater level.
        5) After water level has stabilized in plastic tube, measure vertical height of water, in feet, above invert of sewer pipe.
        6) Determine air pressure correction, which must be added to the 3.0 psig normal starting pressure of test, by dividing the vertical height in feet by 2.31. The result gives the air pressure correction in pounds per square inch to be added.

B. After the line has passed the air test, it shall be balled and flushed with water to clean. A metal screen shall be used downstream at the point of connection to the existing system to collect and remove any rock or other debris that is flushed out during cleaning.

3.7 TESTING OF MANHOLES ON GRAVITY LINES

A. At the option of the Contractor, either the following hydrostatic or vacuum test shall be performed.

1. Hydrostatic Test: In general, the following hydrostatic test is in conformance with that presented in Stege Sanitary District Standard Specifications.
2. Insert inflatable plugs in all sewer inlets and outlets.
3. Fill the manhole with water to a point six inches below the base of the manhole frame.
4. Maintain the water at this point for one hour to allow time for absorption.
5. Begin one-hour test period. Measure the amount of water added in one-hour period to maintain the water level at six inches below the base of the manhole frame. Do not allow water level to drop more than 25% of the manhole depth.
6. Determine the allowable leakage by the following formula.

   $L = 0.0002 \times D \times H1/2$

   L = Allowable leakage, gallons per minute.
   D = Depth of manhole from top to bottom, feet.
   H = Head of water in feet as measured from the surface of the water in the manhole to the sewer line invert or to the prevailing ground water surface outside the manhole. The lesser height governs.

7. If the leakage exceeds the allowable, determine the cause, take remedial action and re-test the manhole. If the leakage is less than the allowable and leaks are observed, repair the leaks.

B. Vacuum Test:
1. General: Test in accordance with ASTM C1244.
2. Test prior to backfilling around the manhole.
3. Test Preparation: Plug all lift holes and pipes entering or exiting the manhole.
4. Place test head inside the top section of the manhole's cone section and inflate in accordance with the manufacturer's instructions.
5. Draw a vacuum of 10 inches of mercury and shut the pump off.
6. With the valve closed, the time for the vacuum to drop 9 inches shall be measured.
7. The manhole shall pass the test if the time is greater than 60 seconds for a 48 inch diameter manhole, 75 seconds for a 60 inch diameter manhole and 90 seconds for a 72 inch diameter manhole.
8. If the manhole fails the initial test, make necessary repairs with a non-shrink grout. Once the repair material has cured according to the manufacturer's recommendations the vacuum test shall be repeated. This process shall continue until a satisfactory test is obtained.
9. All temporary plugs and braces shall be removed after each test.

3.8 DEFLECTION TESTING

A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.

B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.

C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.

D. Pull-Through Device:
   1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
      a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.
      b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
   2. Ball, cylinder, or circular sections shall conform to the following:
      a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
      b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
      c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
      d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

E. Pull-Through Device:
   1. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
   2. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.

F. Deflection measuring Device:
   1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
   2. Obtain approval of deflection measuring device prior to use.

G. Deflection Measuring Device Procedure:
   1. Measure deflections through each run of installed pipe.
   2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
   3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.

H. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.9 CLEANING

A. Thoroughly clean sewer lines and manholes of sediments, dirt, debris, and obstructions of any kind.

3.10 TELEVISION INSPECTION

A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the sewer line shall be televised with a color closed-circuit television with tilt-head camera recorded in DVD format. The original disc and log sheets shall be provided to the Kensington Fire Protection District for review.

B. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
   1. Low spot (1 inch or greater - mainlines only)
   2. Joint separations (3/4 inch or greater opening between pipe sections)
   3. Cocked joints present in straight runs or on the wrong side of pipe curves
   4. Chips in pipe ends
   5. Cracked or damaged pipe
   6. Dropped joints
   7. Infiltration
   8. Debris or other foreign objects
   9. Other obvious deficiencies
   10. Irregular condition without logical explanation

END OF SECTION

SECTION 33 4100

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roadway and/or site storm drainage system up to five feet of any on-site building

1.2 RELATED SECTIONS

A. Section 31 2100, Utility Trenching and Backfill

B. Section 32 1318, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. AASHTO
1. M199: Precast Reinforced Concrete Manhole Sections
2. M252: Corrugated Polyethylene Drainage Pipe
3. M294: Corrugated Polyethylene Pipe, 12 to 604-inch Diameter

B. ASTM
1. A74: Cast Iron Soil Pipe and Fittings
2. A615: Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
3. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete
4. C443: Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
5. C478: Circular Precast Reinforced Concrete Manhole Sections
6. C564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings
7. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
8. C1173: Flexible Transition Couplings for Underground Piping Systems
9. D1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
10. D2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
11. D2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
12. D3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
13. D4101: Propylene Injection and Extrusion Materials
14. F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe
15. F656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
16. F679: Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
17. F1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings

C. AWWA
1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. for Water
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

6. C116: Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
7. C150: Thickness design of Ductile Iron Pipe
8. C151: Ductile-Iron Pipe, Centrifugally Cast
9. C153: Ductile-Iron Compact Fittings
10. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
11. M41: Ductile Iron Pipe and Fittings

D. Caltrans Standard Specifications, 2015
1. Section 51, Concrete Structures
2. Section 52, Reinforcement
3. Section 65, Concrete Pipe
4. Section 66, Corrugated Metal Pipe
5. Section 70, Miscellaneous Drainage Facilities
6. Section 72, Slope Protection
7. Section 75, Miscellaneous Metal
8. Section 90, Concrete

E. Caltrans Standard Plans, 2015
1. Plan D94A: Metal and Plastic Flared End Sections
2. Plan D94B: Concrete Flared End Sections
3. Plan D97A: Corrugated Metal Pipe Coupling Details No. 1, Annular Coupling Band Bar and Strap and Angle Connection
4. Plan D97C: Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers
5. Plan D97D: Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands
6. Plan D97E: Corrugated Metal Pipe Coupling Details No. 5, Standard Joint
7. Plan D97F: Corrugated Metal Pipe Coupling Details No. 6, Positive Joint
8. Plan D97G: Corrugated Metal Pipe Coupling Details No. 7, Downdrain
9. Plan D98A: Slotted Corrugated Steel Pipe Drain Details
10. Plan D98B: Slotted Corrugated Steel Pipe Drain Details

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing Materials

C. AWWA: American Water Works Association

D. CMP: Corrugated metal pipe

E. DIP: Ductile iron pipe

F. HDPE: High-density polyethylene

G. NPS: Nominal pipe size

H. PE: Polyethylene

I. PVC: Polyvinyl Chloride

J. RCP: Reinforced concrete pipe

1.5 SUBMITTALS

A. Product data for the following:
1. Piping materials and fittings
2. Special pipe couplings
3. Polymer-concrete, channel drainage systems (trench drains)
4. Joint sealants
5. Plastic area drains
6. Cleanout plugs or caps
7. Precast concrete catch basins, inlets, curb inlets, junction structures and area drains, including frames and grates
8. Precast clean out boxes and box cover
9. Concrete, metal and plastic flared end sections

B. Shop drawings: Include plans, elevations, details and attachments for the following:
1. Precast concrete manholes, frames and covers

C. Design Mix Reports and Calculations: For each class of cast in place concrete

D. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage
1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

B. Handling
1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.
2. Handle precast concrete pipe, manholes and other precast structures according to manufacturer’s written instructions.
3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.1 CAST IRON PIPE AND FITTINGS: 2 INCH THROUGH 15 INCH

A. Hub and spigot, ASTM A74, service class

B. Gaskets: ASTM C564, rubber, compression type, thickness to match class of pipe

C. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined

2.2 CORRUGATED METAL PIPE AND FITTINGS:

A. CMP pipe shall be in accordance to Caltrans Standard Specification Section 66

B. Bituminous Coating: Caltrans Standard Specification Section 66-1.02C

C. Bituminous Lining: Caltrans Standard Specification Section 66-1.02C

D. Bituminous Paving: Caltrans Standard Specification Section 66-1.02C

E. Corrugated Aluminum Pipe: Caltrans Standard Specification Section 66-1.02F

F. Corrugated Steel Pipe: Caltrans Standard Specification Section 66-1.02E

G. Slotted Corrugated Steel Pipe: Caltrans Standard Specification Section 66-2

H. Details: Caltrans Standard Plans D97A, D97C, D97D, D97E, D97F, D97G, D98A and D98B

2.3 DIP: SIZES 4 INCH THROUGH 48 INCH

A. Pipe conforming to AWWA C151 and C150

B. Pipe: Pressure Class Pressure Class: Minimum pressure class for size indicated [Check loading and determine wall thickness if pipe is deep or shallow with AASHTO H20 loading]

C. Pipe and Fitting Lining: Cement Mortar, AWWA C104

D. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115

E. Fittings
1. Standard: AWWA C110, sizes 4 inch through 48 inch
2. Compact: AWWA C153, sizes 4 inch through 24 inch
3. All fittings shall be fusion epoxy coated per AWWA C116

F. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105

G. Unrestrained Joints (Rubber Gasket Joints):
1. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111.
2. Mechanical Joint: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111.

H. Insulating Flanged Joints:
1. Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
2. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.
3. Provide gasket of the dielectric type, full face, as recommended in AWWA C115.
4. Provide bolts and nuts as recommended in AWWA C115.

I. Couplings:
1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. Stainless steel bolts and nuts and special coatings available for extra protection from corrosion. Smith-Blair, Inc., Dresser, or approved equal.
2. Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. Stainless steel bolts and nuts and special coatings available for extra protection from corrosion. Smith-Blair, Inc., Dresser, or approved equal.

2.4 PE PIPE AND FITTINGS (HDPE): 4 INCH THROUGH 10 INCH

A. Pipe shall be in accordance with AASHTO M252 Type S, smooth interior and corrugated exterior

B. Bell and spigot joints

C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477

D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.5 PE PIPE AND FITTINGS (HDPE): 12 INCH THROUGH 48 INCH

A. Pipe shall be in accordance to AASHTO M294. Type S, smooth interior and corrugated exterior.

B. Bell and spigot joints

C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477

D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.6 PVC PIPE AND FITTINGS-SMALLER THAN 4 INCH

A. Pipe shall be in accordance to ASTM D1785, Schedule 40. [Check external load and laying condition, schedule 80 and 120 are also available if stronger pipe is required.]

B. Joints: Solvent Cement, ASTM D2564

C. Include primer according to ASTM F656

D. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.7 PVC PIPE, 4 INCH AND LARGER

A. Pipe
1. 4 inch through 15 inch: ASTM D3034, SDR 26
2. 18 inch through 36 inch: ASTM F679, T-1 wall

B. Bell and spigot joints

C. Fittings:
1. 4 inch through 27 inch: ASTM F1336
2. 30 inch through 36 inch: ASTM D3034, SDR 35

D. Joint Gasket: Elastomeric seal, ASTM F477

E. Special Pipe Coupling: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined

2.8 REINFORCED CONCRETE PIPE

A. Designated by Class, rubber gasketed joints, Type II or V cement
1. Circular Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-2.02C(2). Class III
2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Caltrans Standard Specification Section 65-2.02D. Class HE-III and VE-III

B. Rubber Gasketed Joints: Caltrans Standard Specification Section 65-2.02F

C. Special Pipe Couplings: Portland cement collar as indicated

2.9 PIPE ANCHORS

A. General: Location, configuration bearing area, etc. as indicated

B. Portland Cement Concrete: Section 32 13 18, Cement and Concrete for Exterior Improvements

2.10 PIPE CLEANOUTS

A. Piping: Same as storm drain line if possible

B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.

C. Box Size: As required to provide access and allow easy removal and reinstallation of cap

D. Box Types
1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty
2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading

E. Box Cover Markings: “S.D.,” unless otherwise specified

F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
1. Associated Concrete Products, Inc.
2. Brooks Products Inc.
3. OldCastle Precast/Christy Concrete Products, Inc.

2.11 AREA DRAINS

A. Grate and Riser: Area drain shall be as manufactured by Nyloplast or approved equal. Riser shall be constructed of 6 inch PVC SDR 35 piping per paragraph 2.1(A) of this section and connected to area drain by a gasket joint. Riser shall be vertical except as otherwise noted in the plans. Riser may include a reducer if necessary to make connection to the storm drain line.

B. Elevation and Grading: Area Drain rim elevation shall be set and area around area drain shall be graded to drain away from any adjacent structures, walks, or roadways and towards area drain.

2.12 CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC.

A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.

B. Portland Cement Concrete and Reinforcing: Section 32 13 18, Cement and Concrete for Exterior Improvements.

C. Precast Structure: Rate for AASHTO H20 loading in traffic areas.

D. Steps: ASTM C 478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091).

E. Frames, Grates and Covers: Caltrans Standard Specification Section 75-1.02, 75-1.02.B and 75-2
1. Galvanize steel frames, grates and covers
2. Grates and covers shall be non-rocking
3. Rate for AASHTO H20 loading in traffic areas

2.13 MANHOLES

A. Manholes shall be pre-cast concrete of the size and shape shown on the Plans and shall conform to ASTM C478. Equivalent poured-in-place structures may be used at the Contractor's option. Concrete shall consist of Caltrans Type I/II cement. Rate for AASHTO H20 loading in traffic areas.

B. All interior concrete surfaces shall be coated with "Xypex Crystalline" or approved equivalent. Use of a water-resistant admix is acceptable, at Contractor option.

C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-2.02B. Manhole covers shall have the words "STORM DRAIN" in letters not less than 2 inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.

D. Frames and lids for manholes shall be match-marked in pairs before delivery to the job site. The lids shall fit into their frames without rocking.

E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Plans. Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.

F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of Caltrans Standard Specifications Section 90 and as herein specified. The concrete shall be Class “A” containing six (6) sacks of portland cement per cubic yard of concrete. The grading of the combined aggregate shall conform with the CDT requirements of the three-quarter inch maximum. The consistency of the fresh aggregate shall be such that the slump does not exceed four inches, as determined by ASTM C143. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.

G. Steps: ASTM C478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, or approved equal.

2.14 JOINT SEALANT FOR PRECAST STRUCTURES AND MANHOLES

A. Mortar: Caltrans Standard Specification Section 51-1.02F
   1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.

B. Gaskets: Preformed flexible rubber or plastic gasket
   1. Rubber Gaskets: ASTM C443
   2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is “Ram-Nek,” as manufactured by Henry Company, or approved equal.

2.15 PIPE TO STRUCTURE CONNECTOR/SEAL

A. A flexible pipe to manhole connector shall be used for all pipe penetrations to pre-cast and/or cast-in-place concrete structures.
   1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.
   2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C923.
   3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.
   4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

2.16 POLYMER-CONCRETE TRENCH DRAINS

A. General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total length required.

B. Include the following components:
1. Channel Sections: Interlocking-joint, precast modular units with end caps. Inside width as indicated with deep, rounded bottom, with built in slope or flat invert as indicated and outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
2. Frame and Grate: Gray iron, ductile iron or galvanized steel as indicated. Where drain is located in traffic areas, rate for AASHTO H20 loading.

C. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. "Polydrain" by ABT Inc.
2. "ACO Drain" by ACO Polymer Products Inc. , or approved equal

2.17 METAL, CONCRETE OR PLASTIC FLARED END SECTIONS

A. General: Caltrans Standard Specification Section 70-5.02 and Caltrans Standard Plan D94A and D94B

2.18 CONCRETE/SHOTCRETE DITCH LINING

A. General: Caltrans Standard Specification Section 72-5.02
1. Bar Reinforcement: Caltrans Standard Specification Section 52-1.02B, minimum Grade 40
2. Welded Wire Fabric: Caltrans Standard Specification Section 52-1.02C. Use 6 x 6-W1.4 x W1.4 unless otherwise indicated.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03 for reinforced concrete pipe, Caltrans Standard Specification Section 66-1.03 for corrugated metal pipe, and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.

B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.

C. Excavation, Bedding, Backfill, and Compaction: Section 31 2100, Utility Trenching and Backfill

D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.

E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.

G. Closure: Close open ends of pipes and appurtenance at the end of each day's work or when work is not in progress.

3.2 SPECIAL PIPE COUPLINGS

A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

B. Installation: Manufacturers' instructions

3.3 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC. AND MANHOLES

A. Excavation, Bedding, Backfill, and Compaction: Section 31 2100, Utility Trenching and Backfill

B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
   1. Shape bottoms to convey flows as indicated.

C. Precast Structures: Install as indicated.
   1. Seal all joints and pipe entrances and exits.
   2. Place concrete in bottom and shape to convey flows as indicated.

3.4 POLYMER-CONCRETE TRENCH DRAIN INSTALLATION

A. Excavation, Bedding, Backfill, and Compaction: Section 31 2100, Utility Trenching and Backfill

B. Install: As indicated and in accordance with the manufacturer's instructions.

3.5 SLOPE PROTECTION PLACEMENT

A. Rock Slope Protection: Caltrans Standard Specification Section 72-2.03 and as indicated.
   1. Use Method B Placement unless otherwise indicated.

B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-5.03

C. Concreted-Rock Slope Protection: Caltrans Standard Specification Section 72-3.03
   1. Use Method B Placement unless otherwise indicated.

D. Sacked Concrete Slope Protection
   1. Detailed configuration: As indicated
   2. Use one cubic foot of concrete per sack.
   3. Locate headers and stretchers as indicated.
   4. Headers: Folded end to bank
   5. Stretchers: Folded ends are not to be adjacent.
   6. Place no more than four vertical courses until initial set has taken place in first course.

3.6 CONCRETE/SHOTCRETE DITCH LINING PLACEMENT

A. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-5.03

3.7 POURED-IN-PLACE CONCRETE

A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of Caltrans Standard Specifications.

B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the Caltrans Standards Specifications. Unless otherwise noted herein or in the Plans, exposed surfaces of structures shall be Class 1 surface finish.

C. Curing shall conform to applicable portions in Section 90 of Caltrans Standard Specifications. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.

D. Concrete shall not be cropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.8 PIPELINE FLUSHING

A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning.

3.9 DEFLECTION TESTING

A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.

B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.

C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.

D. Pull-Through Device:
   1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
      a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.
      b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
   2. Ball, cylinder, or circular sections shall conform to the following:
      a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
      b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
      c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
      d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
   3. Pull-Through Device:
      a. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
      b. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.

E. Deflection measuring Device:
   1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
   2. Obtain approval of deflection measuring device prior to use.

F. Deflection Measuring Device Procedure:
   1. Measure deflections through each run of installed pipe.
   2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
   3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.

G. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year

warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.10 CLEANING

A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

3.11 TELEVISION INSPECTION

A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the drain line shall be televised with a color closed-circuit television with tilt-head camera recorded in DVD format. The original disc and log sheets shall be provided to the Kensington Fire Protection District for review.

B. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
1. Low spot (1 inch or greater - mainlines only)
2. Joint separations (3/4 inch or greater opening between pipe sections)
3. Cocked joints present in straight runs or on the wrong side of pipe curves.
4. Chips in pipe ends
5. Cracked or damaged pipe
6. Dropped joints
7. Infiltration
8. Debris or other foreign objects
9. Other obvious deficiencies
10. Irregular condition without logical explanation

END OF SECTION