City of San Diego

CONTRACTOR'S NAME: Fordyce Construction, Inc.
ADDRESS: 9932 Prospect Avenue #138, Santee, CA 92071
TELEPHONE NO.: (619) 449-4272 **FAX NO.:** (619) 449-1930
CITY CONTACT: Juan E. Espindola, **Contract Specialist, Email:** JEEspindola@sandiego.gov
Phone No. (619) 533-4491, **Fax No.** (619) 533-3633
F. Hossan / R. W. Bustamante / egz

BIDDING DOCUMENTS

e - Bidding

ORIGINAL

FOR

FIRE STATION 14 ROOF & HVAC REPLACEMENT AND FIRE STATION 19 ROOF & HVAC REPLACEMENT

BID NO.: **K-17-1482-DBB-3**
SAP NO. (WBS/IO/CC): **B-13189, B-13190**
CLIENT DEPARTMENT: **1912**
COUNCIL DISTRICT: **3, 9**
PROJECT TYPE: **BC**

THIS CONTRACT WILL BE SUBJECT TO THE FOLLOWING:

- THE CITY'S SUBCONTRACTING PARTICIPATION REQUIREMENTS FOR SLBE PROGRAM.
- BID DISCOUNT PROGRAM (The WHITEBOOK, SLBE-ELBE Program Requirements, Section IV(2))
- PREVAILING WAGE RATES: STATE ☒ FEDERAL ☐
- APPRENTICESHIP

BID DUE DATE:

2:00 PM
JANUARY 11, 2017
CITY OF SAN DIEGO
PUBLIC WORKS CONTRACTS
1010 SECOND AVENUE, 14th FLOOR, MS 614C
SAN DIEGO, CA 92101

ENGINEER OF WORK

The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Professional Engineer :

Simon Girmai 9/26/2016 Seal:

1) Registered Professional Engineer Date

11/23/2016 Seal:

2) For City Engineer Date

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NOTICE INVITING BIDS

1. **SUMMARY OF WORK:** This is the City of San Diego's (City) solicitation process to acquire Construction services for **Fire Station 14 Roof & Hvac Replacement And Fire Station 19 Roof & Hvac Replacement.** For additional information refer to Attachment A.

2. **FULL AND OPEN COMPETITION:** This contract is open to full competition and may be bid on by Contractors who are on the City's current Prequalified Contractors' List. For information regarding the Contractors Prequalified list visit the City's web site: http://www.sandiego.gov.

3. **ESTIMATED CONSTRUCTION COST:** The City's estimated construction cost for this project is **$870,000**.

4. **BID DUE DATE AND TIME ARE: JANUARY 11, 2017, at 2:00 PM.**

5. **PREVAILING WAGE RATES APPLY TO THIS CONTRACT:** Refer to Attachment D.

6. **LICENSE REQUIREMENT**: The City has determined that the following licensing classification(s) are required for this contract: **Class A or Class B.**

7. **SUBCONTRACTING PARTICIPATION PERCENTAGES**: Subcontracting participation percentages apply to this contract.

   7.1. The City has incorporated **mandatory** SLBE-ELBE subcontractor participation percentages to enhance competition and maximize subcontracting opportunities. For the purpose of achieving the mandatory subcontractor participation percentages, a recommended breakdown of the SLBE and ELBE subcontractor participation percentages based upon certified SLBE and ELBE firms has also been provided to achieve the mandatory subcontractor participation percentages:

1.	SLBE participation	**1.6%**
2.	ELBE participation	**3.2%**
3.	Total mandatory participation	**4.8%**

   7.2. The Bid may be declared non-responsive if the Bidder fails the meet the following requirements:

   7.2.1. Attend the Pre-Bid Meeting as described herein.

   7.2.2. Include SLBE-ELBE certified subcontractors at the overall mandatory participation percentage identified in this document; **OR**

   7.2.3. Submit Good Faith Effort documentation, saved in searchable Portable Document Format (PDF) and stored on Compact Disc (CD) or Digital Video

Disc (DVD), demonstrating the Bidder made a good faith effort to outreach to and include SLBE-ELBE Subcontractors required in this document within **3 Working Days** of the Bid opening if the overall mandatory participation percentage is not met.

8. PRE-BID MEETING:

8.1. Prospective Bidders are **required** to attend the Pre-Bid Meeting. The purpose of the meeting is to discuss the scope of the Project, submittal requirements, the pre-qualification process and any Equal Opportunity Contracting Program requirements and reporting procedures. To request a sign language or oral interpreter for this visit, call the Public Works Contracts Division at (619) 533-3450 at least 5 Working Days prior to the meeting to ensure availability. Failure to attend the Mandatory Pre-Bid Meeting may result in the Bid being deemed non-responsive. The Pre-Bid meeting is scheduled as follows:

Date: **December 15, 2016**
Time: **10:00 AM**
Location: **1010 Second Ave, 14th Floor, San Diego, CA 92101**

Attendance at the Pre-Bid Meeting will be evidenced by the Bidder's representative's signature on the attendance roster. It is the responsibility of the Bidder's representative to complete and sign the attendance roster.

Bidders may not be admitted after the specified start time of the mandatory Pre-Bid Meeting.

9. PRE-BID SITE VISIT: All those wishing to submit a bid **MUST** visit the Work Site with the Engineer. The purpose of the Site visit is to acquaint Bidders with the Site conditions. To request a sign language or oral interpreter for this visit, call the Public Works Contracts at (619) 533-3450 at least 5 Working Days prior to the meeting to ensure availability. The Pre-Bid Site Visit is scheduled as follows:

Date: **1:00 PM**
Time: **December 20, 2016**
Location: **Fire Station 19, 3434 Ocean View Blvd., San Diego, CA 92113 and then Fire Station 14, 4011 32nd St., San Diego, CA 92104 (Please see Appendix E - Location Maps)**

10. AWARD PROCESS:

10.1. The Award of this contract is contingent upon the Contractor's compliance with all conditions of Award as stated within these documents and within the Notice of Intent to Award.

10.2. Upon acceptance of a Bid, the City will prepare contract documents for execution within approximately 21 days of the date of the Bid opening. The City will then award the Contract within approximately 14 days of receipt of properly signed Contract, bonds, and insurance documents.

10.3. This contract will be deemed executed and effective only upon the signing of the Contract by the Mayor or his designee and approval as to form the City Attorney's Office.

10.4. The low Bid will be determined by Base Bid alone.

10.5. Once the low bid has been determined, the City may, at its sole discretion, award the contract for the Base bid alone.

11. SUBMISSION OF QUESTIONS:

11.1. The Public Works Department is responsible for opening, examining, and evaluating the competitive Bids submitted to the City for the acquisition, construction and completion of any public improvement except when otherwise set forth in these documents. Any questions related to this solicitation shall be submitted to:

Public Works Contracts
1010 Second Avenue, 14th Floor
San Diego, California, 92101
Attention: Juan E. Espindola

OR:

JEEspindola@sandiego.gov

11.2. Questions received less than 14 days prior to the date for opening of Bids may not be considered.

11.3. Questions or clarifications deemed by the City to be material shall be answered via issuance of an addendum and posted to the City's online bidding service.

11.4. Only questions answered by formal written addenda shall be binding. Oral and other interpretations or clarifications shall be without legal effect. It is the Bidder's responsibility to be informed of any addenda that have been issued and to include all such information in its Bid.

INSTRUCTIONS TO BIDDERS

1. PREQUALIFICATION OF CONTRACTORS:

1.1. Contractors submitting a Bid must be pre-qualified for the total amount proposed, including all alternate items, prior to the date of submittal. Bids from contractors who have not been pre-qualified as applicable and Bids that exceed the maximum dollar amount at which contractors are pre-qualified may be deemed **non-responsive** and ineligible for award. Complete information and links to the on-line prequalification application are available at:

http://www.sandiego.gov/cip/bidopps/prequalification.shtml

1.2. The completed application must be submitted online no later than 2 weeks prior to the bid opening. For additional information or the answer to questions about the prequalification program, contact David Stucky at 619-533-3474 or dstucky@sandiego.gov.

1.3. Due to the City's fiduciary requirement to safeguard vendor data, City staff will not be able to provide information regarding contractors' prequalification status over the telephone. Contractors may access real-time information about their prequalification status via their vendor profile on PlanetBids™.

2. ELECTRONIC FORMAT RECEIPT AND OPENING OF BIDS:

Bids will be received in electronic format (eBids) EXCLUSIVELY at the City of San Diego's electronic bidding (eBidding) site, at: http://www.sandiego.gov/cip/bidopps/index.shtml and are due by the date, and time shown on the cover of this solicitation.

2.1. BIDDERS MUST BE PRE-REGISTERED with the City's bidding system and possess a system-assigned Digital ID in order to submit and electronic bid.

2.2. The City's bidding system will automatically track information submitted to the site including IP addresses, browsers being used and the URLs from which information was submitted. In addition, the City's bidding system will keep a history of every login instance including the time of login, and other information about the user's computer configuration such as the operating system, browser type, version, and more. Because of these security features, Contractors who disable their browsers' cookies will not be able to log in and use the City's bidding system.

2.3. The City's electronic bidding system is responsible for bid tabulations. Upon the bidder's or proposer's entry of their bid, the system will ensure that all required fields are entered. **The system will not accept a bid for which any required information is missing.** This includes all necessary pricing, subcontractor

listing(s) and any other essential documentation and supporting materials and forms requested or contained in these solicitation documents.

2.4. BIDS REMAIN SEALED UNTIL BID DEADLINE. eBids are transmitted into the City's bidding system via hypertext transfer protocol secure (https) mechanism using SSL 128-256 bit security certificates issued from Verisign/Thawte which encrypts data being transferred from client to server. Bids submitted prior to the "Bid Due Date and Time" are not available for review by anyone other than the submitter which has until the "Bid Due Date and Time" to change, rescind or retrieve its proposal should it desire to do so.

2.5. BIDS MUST BE SUBMITTED BY BID DUE DATE AND TIME. Once the bid deadline is reached, no further submissions are accepted into the system. Once the Bid Due Date and Time has lapsed, bidders, proposers, the general public, and City staff are able to immediately see the results on line. City staff may then begin reviewing the submissions for responsiveness, EOCP compliance and other issues. The City may require any Bidder to furnish statement of experience, financial responsibility, technical ability, equipment, and references.

2.6. RECAPITULATION OF THE WORK. Bids shall not contain any recapitulation of the Work. Conditional Bids may be rejected as being non-responsive. Alternative proposals will not be considered unless called for.

2.7. BIDS MAY BE WITHDRAWN by the Bidder only up to the bid due date and time.

2.7.1. Important Note: Submission of the electronic bid into the system may not be instantaneous. Due to the speed and capabilities of the user's internet service provider (ISP), bandwidth, computer hardware and other variables, it may take time for the bidder's submission to upload and be received by the City's eBidding system. It is the bidder's sole responsibility to ensure their bids are received on time by the City's eBidding system. The City of San Diego is not responsible for bids that do not arrive by the required date and time.

2.8. ACCESSIBILITY AND AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE. : To request a copy of this solicitation in an alternative format, contact the Public Works Contract Specialist listed on the cover of this solicitation at least five (5) working days prior to the Bid/Proposal due date to ensure availability.

3. ELECTRONIC BID SUBMISSIONS CARRY FULL FORCE AND EFFECT

3.1. The bidder, by submitting its electronic bid, acknowledges that doing so carries the same force and full legal effect as a paper submission with a longhand (wet) signature.

3.2. By submitting an electronic bid, the bidder certifies that the bidder has thoroughly examined and understands the entire Contract Documents (which consist of the plans and specifications, drawings, forms, affidavits and the solicitation documents), and that by submitting the eBid as its bid proposal, the bidder acknowledges, agrees to and is bound by the entire Contract Documents, including any addenda issued thereto, and incorporated by reference in the Contract Documents.

3.3. The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certification, forms and affidavits submitted as part of this bid are true and correct.

3.4. The Bidder agrees to the construction of the project as described in Attachment "A–Scope of Work" for the City of San Diego, in accordance with the requirements set forth herein for the electronically submitted prices. The Bidder guarantees the Contract Price for a period of 120 days (90 days for federally funded contracts and contracts valued at $500,000 or less) from the date of Bid opening. The duration of the Contract Price guarantee shall be extended by the number of days required for the City to obtain all items necessary to fulfill all conditions precedent.

4. BIDS ARE PUBLIC RECORDS: Upon receipt by the City, Bids shall become public records subject to public disclosure. It is the responsibility of the respondent to clearly identify any confidential, proprietary, trade secret or otherwise legally privileged information contained within the Bid. General references to sections of the California Public Records Act (PRA) will not suffice. If the Contractor does not provide applicable case law that clearly establishes that the requested information is exempt from the disclosure requirements of the PRA, the City shall be free to release the information when required in accordance with the PRA, pursuant to any other applicable law, or by order of any court or government agency, and the Contractor will hold the City harmless for release of this information.

5. CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM:

5.1. **Prior** to the Award of the Contract or Task Order, you and your Subcontractors and Suppliers must register with the City's web-based vendor registration and bid management system. For additional information go to:

http://www.sandiego.gov/purchasing/bids-contracts/vendorreg.shtml.

5.2. The City may not award the contract until registration of all subcontractors and suppliers is complete. In the event this requirement is not met within the time frame specified in the Notice of Intent to Award letter, the City reserves the right to rescind the Notice of Award / Intent to Award and to make the award to the next responsive and responsible bidder / proposer.

6. **JOINT VENTURE CONTRACTORS:** Provide a copy of the Joint Venture agreement and the Joint Venture license to the City within 10 Working Days after receiving the Contract forms. See 2-1.1.2, "Joint Venture Contractors" in The WHITEBOOK for details.

7. **PREVAILING WAGE RATES WILL APPLY:** Refer to Attachment D.

8. **SUBCONTRACTING PARTICIPATION PERCENTAGES**: Subcontracting participation percentages apply to this contract. Refer to Attachment E.

9. **INSURANCE REQUIREMENTS:**

9.1. All certificates of insurance and endorsements required by the contract are to be provided upon issuance of the City's Notice of Intent to Award letter.

9.2. Refer to sections 7-3, "LIABILITY INSURANCE", and 7-4, "WORKERS' COMPENSATION INSURANCE" of the Supplementary Special Provisions (SSP) for the insurance requirements which must be met.

10. **REFERENCE STANDARDS:** Except as otherwise noted or specified, the Work shall be completed in accordance with the following standards:

Title	Edition	Document Number
Standard Specifications for Public Works Construction ("The GREENBOOK") http://www.greenbookspecs.org/	2015	PWPI070116-01
City of San Diego Standard Specifications for Public Works Construction ("The WHITEBOOK")* https://www.sandiego.gov/publicworks/edocref/greenbook	2015	PWPI070116-02
City of San Diego Standard Drawings* https://www.sandiego.gov/publicworks/edocref/standarddraw	2016	PWPI070116-03
Citywide Computer Aided Design and Drafting (CADD) Standards https://www.sandiego.gov/publicworks/edocref/drawings	2016	PWPI092816-04
California Department of Transportation (CALTRANS) Standard Specifications – http://www.dot.ca.gov/des/oe/construction-contract-standards.html	2015	PWPI092816-05

Title	Edition	Document Number
CALTRANS Standard Plans http://www.dot.ca.gov/des/oe/construction-contract-standards.html	2015	PWPI092816-06
California Manual on Uniform Traffic Control Devices Revision 1 (CA MUTCD Rev 1) - http://www.dot.ca.gov/trafficops/camutcd/	2014	PWPIO92816-07
NOTE: *Available online under Engineering Documents and References at: http://www.sandiego.gov/publicworks/edocref/index.shtml		

11. **CITY'S RESPONSES AND ADDENDA:** The City, at its discretion, may respond to any or all questions submitted in writing via the City's eBidding web site in the **form of an addendum**. No other responses to questions, oral or written shall be of any force or effect with respect to this solicitation. The changes to the Contract Documents through addenda are made effective as though originally issued with the Bid. The Bidders shall acknowledge the receipt of Addenda at the time of bid submission.

12. **CITY'S RIGHTS RESERVED:** The City reserves the right to cancel the Notice Inviting Bids at any time, and further reserves the right to reject submitted Bids, without giving any reason for such action, at its sole discretion and without liability. Costs incurred by the Bidder(s) as a result of preparing Bids under the Notice Inviting Bids shall be the sole responsibility of each bidder. The Notice Inviting Bids creates or imposes no obligation upon the City to enter a contract.

13. **CONTRACT PRICING:** This solicitation is for a Lump Sum contract with Unit Price provisions as set forth herein. The Bidder agrees to perform construction services for the City of San Diego in accordance with these contract documents for the prices listed below. The Bidder further agrees to guarantee the Contract Price for a period of 120 days from the date of Bid opening. The duration of the Contract Price guarantee may be extended, by mutual consent of the parties, by the number of days required for the City to obtain all items necessary to fulfill all contractual conditions.

14. **SUBCONTRACTOR INFORMATION:**

    14.1. **LISTING OF SUBCONTRACTORS**. In accordance with the requirements provided in the "Subletting and Subcontracting Fair Practices Act" of the California Public Contract Code, the Bidder shall provide the **NAME** and **ADDRESS** of each Subcontractor who will perform work, labor, render services or who specially fabricates and installs a portion [type] of the work or improvement, in an amount in excess of 0.5% of the Contractor's total Bid. The Bidder shall also state within the description, whether the subcontractor is a **CONSTRUCTOR**, **CONSULTANT** or

SUPPLIER. The Bidder shall further state within the description, the **PORTION** of the work which will be performed by each subcontractor under this Contract. The Contractor shall list only one Subcontractor for each portion of the Work. The **DOLLAR VALUE** of the total Bid to be performed shall be stated for all subcontractors listed. Failure to comply with this requirement may result in the Bid being rejected as **non-responsive** and ineligible for award. The Bidder's attention is directed to the Special Provisions - General; Paragraph 2-3, "Subcontracts", which stipulates the percent of the Work to be performed with the Bidders' own forces. The Bidder shall list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors for which Bidders are seeking recognition towards achieving any mandatory, voluntary (or both) subcontracting participation goals.

14.2. **LISTING OF SUPPLIERS.** Any Bidder seeking the recognition of Suppliers of equipment, materials, or supplies obtained from third party Suppliers towards achieving any mandatory or voluntary (or both) subcontracting participation goals shall provide, at a minimum, the **NAME, LOCATION (CITY)** and the **DOLLAR VALUE** of each supplier. The Bidder will be credited up to 60% of the amount to be paid to the Suppliers for materials and supplies unless vendor manufactures or substantially alters materials and supplies, in which case, 100% will be credited. The Bidder is to indicate within the description whether the listed firm is a supplier or manufacturer. If no indication is provided, the listed firm will be credited at 60% of the listed dollar value for purposes of calculating the Subcontractor Participation Percentage.

14.3. **LISTING OF SUBCONTRACTORS OR SUPPLIERS FOR ALTERNATES.** For subcontractors or suppliers to be used on additive or deductive alternate items, in addition to the above requirements, bidder shall further note "ALTERNATE" and alternate item number within the description.

15. **SUBMITTAL OF "OR EQUAL" ITEMS:** See Section 4-1.6, "Trade Names or Equals" in The WHITEBOOK and as amended in the SSP.

16. **AWARD:**

16.1. The Award of this contract is contingent upon the Contractor's compliance with all conditions precedent to Award.

16.2. Upon acceptance of a Bid, the City will prepare contract documents for execution within approximately 21 days of the date of the Bid opening and award the Contract approximately within 7 days of receipt of properly executed Contract, bonds, and insurance documents.

16.3. This contract will be deemed executed and effective only upon the signing of the Contract by the Mayor or his designee and approval as to form the City Attorney's Office.

17. **SUBCONTRACT LIMITATIONS**: The Bidder's attention is directed to Standard Specifications for Public Works Construction, Section 2-3, "SUBCONTRACTS" in The GREENBOOK and as amended in the SSP which requires the Contractor to self-perform not less than the specified amount. Failure to comply with this requirement shall render the bid **non-responsive** and ineligible for award.

18. **AVAILABILITY OF PLANS AND SPECIFICATIONS:** Contract Documents may be obtained by visiting the City's website: http://www.sandiego.gov/cip/. Plans and Specifications for this contract are also available for review in the office of the City Clerk or Public Works Contracts.

19. **ONLY ONE BID PER CONTRACTOR SHALL BE ACCCEPTED:** No person, firm, or corporation shall be allowed to make, file, or be interested in more than one (1) Bid for the same work unless alternate Bids are called for. A person, firm or corporation who has submitted a sub-proposal to a Bidder, or who has quoted prices on materials to a Bidder, is not hereby disqualified from submitting a sub-proposal or quoting prices to other Bidders or from submitting a Bid in its own behalf. Any Bidder who submits more than one bid will result in the rejection of all bids submitted.

20. **SAN DIEGO BUSINESS TAX CERTIFICATE:** The Contractor and Subcontractors, not already having a City of San Diego Business Tax Certificate for the work contemplated shall secure the appropriate certificate from the City Treasurer, Civic Center Plaza, First floor and submit to the Contract Specialist upon request or as specified in the Contract Documents. Tax Identification numbers for both the Bidder and the listed Subcontractors must be submitted on the City provided forms within these documents.

21. **BIDDER'S GUARANTEE OF GOOD FAITH (BID SECURITY) FOR DESIGN-BID-BUILD CONTRACTS:**

21.1. For bids $250,000 and above, bidders shall submit Bid Security at bid time. Bid Security shall be in one of the following forms: a cashier's check, or a properly certified check upon some responsible bank; or an approved corporate surety bond payable to the City of San Diego for an amount of not less than 10% of the total bid amount.

21.2. This check or bond, and the monies represented thereby, will be held by the City as a guarantee that the Bidder, if awarded the contract, will in good faith enter into the contract and furnish the required final performance and payment bonds.

21.3. The Bidder agrees that in the event of the Bidder's failure to execute this contract and provide the required final bonds, the money represented by the cashier's or certified check will remain the property of the City; and the Surety agrees that it will pay to the City the damages, not exceeding the sum of 10% of the amount of the Bid, that the City may suffer as a result of such failure.

21.4. At the time of bid submission, bidders must upload and submit an electronic PDF copy of the aforementioned bid security. Whether in the form of a cashier's check, a properly certified check or an approved corporate surety bond payable to the City of San Diego, the bid security must be uploaded to the City's eBidding system. Within twenty-four (24) hours after the bid due date and time, the first five (5) apparent low bidders must provide the City with the original bid security.

21.5. Failure to submit the electronic version of the bid security at the time of bid submission AND failure to provide the original within twenty-four (24) hours may cause the bid to be rejected and deemed **non-responsive**.

22. AWARD OF CONTRACT OR REJECTION OF BIDS:

22.1. This contract may be awarded to the lowest responsible and reliable Bidder.

22.2. Bidders shall complete ALL eBid forms as required by this solicitation. Incomplete eBids will not be accepted.

22.3. The City reserves the right to reject any or all Bids, to waive any informality or technicality in Bids received, and to waive any requirements of these specifications as to bidding procedure.

22.4. Bidders will not be released on account of their errors of judgment. Bidders may be released only upon receipt by the City within 3 Working Days of the bid opening, written notice from the Bidder which shows proof of honest, credible, clerical error of a material nature, free from fraud or fraudulent intent; and of evidence that reasonable care was observed in the preparation of the Bid.

22.5. A bidder who is not selected for contract award may protest the award of a contract to another bidder by submitting a written protest in accordance with the San Diego Municipal Code.

22.6. The City of San Diego will not discriminate in the award of contracts with regard to race, religion creed, color, national origin, ancestry, physical handicap, marital status, sex or age.

22.7. Each Bid package properly signed as required by these specifications shall constitute a firm offer which may be accepted by the City within the time specified herein.

22.8. The City reserves the right to evaluate all Bids and determine the lowest Bidder on the basis of the base bid and any proposed alternates or options as detailed herein.

23. BID RESULTS:

23.1. The availability of the bids on the City's eBidding system shall constitute the public announcement of the apparent low bidder. In the event that the apparent low bidder is subsequently deemed non-responsive or non-responsible, a notation of such will be made on the eBidding system. The new ranking and apparent low bidder will be adjusted accordingly.

23.2. To obtain the bid results, view the results on the City's web site, or request the results by U.S. mail and provide a self-addressed, stamped envelope. If requesting by mail, be sure to reference the bid name and number. The bid tabulations will be mailed to you upon their completion. The results will not be given over the telephone.

24. THE CONTRACT:

24.1. The Bidder to whom award is made shall execute a written contract with the City of San Diego and furnish good and approved bonds and insurance certificates specified by the City within 14 days after receipt by Bidder of a form of contract for execution unless an extension of time is granted to the Bidder in writing.

24.2. If the Bidder takes longer than 14 days to fulfill these requirements, then the additional time taken shall be added to the Bid guarantee. The Contract shall be made in the form adopted by the City, which includes the provision that no claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

24.3. If the Bidder to whom the award is made fails to enter into the contract as herein provided, the award may be annulled and the Bidder's Guarantee of Good Faith will be subject to forfeiture. An award may be made to the next lowest responsible and reliable Bidder who shall fulfill every stipulation embraced herein as if it were the party to whom the first award was made.

24.4. Pursuant to the San Diego City Charter section 94, the City may only award a public works contract to the lowest responsible and reliable Bidder. The City will require the Apparent Low Bidder to (i) submit information to determine the Bidder's responsibility and reliability, (ii) execute the Contract in form provided by the City, and (iii) furnish good and approved bonds and insurance certificates specified by the City within 14 Days, unless otherwise approved by the City, in writing after the Bidder receives notification from the City, designating the Bidder as the Apparent Low Bidder and formally requesting the above mentioned items.

24.5. The award of the Contract is contingent upon the satisfactory completion of the above-mentioned items and becomes effective upon the signing of the Contract by the Mayor or designee and approval as to form the City Attorney's Office. If the Apparent Low Bidder does not execute the Contract or submit required documents and information, the City may award the Contract to the next lowest responsible and reliable Bidder who shall fulfill every condition precedent to award. A corporation designated as the Apparent Low Bidder shall furnish evidence of its corporate existence and evidence that the officer signing the Contract and bond for the corporation is duly authorized to do so.

25. **EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF WORK:** The Bidder shall examine carefully the Project Site, the Plans and Specifications, other materials as described in the Special Provisions, Section 2-7, and the proposal forms (e.g., Bidding Documents). The submission of a Bid shall be conclusive evidence that the Bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and scope of Work, the quantities of materials to be furnished, and as to the requirements of the Bidding Documents Proposal, Plans, and Specifications.

26. **CITY STANDARD PROVISIONS:** This contract is subject to the following standard provisions. See The WHITEBOOK for details.

26.1. The City of San Diego Resolution No. R-277952 adopted on May 20, 1991 for a Drug-Free Workplace.

26.2. The City of San Diego Resolution No. R-282153 adopted on June 14, 1993 related to the Americans with Disabilities Act.

26.3. The City of San Diego Municipal Code §22.3004 for Contractor Standards.

26.4. The City of San Diego's Labor Compliance Program and the State of California Labor Code §§1771.5(b) and 1776.

26.5. Sections 1777.5, 1777.6, and 1777.7 of the State of California Labor Code concerning the employment of apprentices by contractors and subcontractors performing public works contracts.

26.6. The City's Equal Benefits Ordinance (EBO), Chapter 2, Article 2, Division 43 of The San Diego Municipal Code (SDMC).

26.7. The City's Information Security Policy (ISP) as defined in the City's Administrative Regulation 90.63.

27. PRE-AWARD ACTIVITIES:

27.1. The contractor selected by the City to execute a contract for this Work shall submit the required documentation as specified in the herein and in the Notice of Award. Failure to provide the information as specified may result in the Bid being rejected as **non-responsive.**

27.2. The decision that bid is non-responsive for failure to provide the information required within the time specified shall be at the sole discretion of the City.

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

Fordyce Construction, Inc., a corporation, as principal, and _____, a corporation authorized to do business in the State of California, as Surety, hereby obligate themselves, their successors and assigns, jointly and severally, to The City of San Diego a municipal corporation in the sum of One Million Two Hundred Sixty Seven Thousand Eight Hundred Five Dollars and Zero Cents ($1,267,805.00) for the faithful performance of the annexed contract, and in the sum of One Million Two Hundred Sixty Seven Thousand Eight Hundred Five Dollars and Zero Cents ($1,267,805.00) for the benefit of laborers and materialmen designated below.

Conditions:

If the Principal shall faithfully perform the annexed contract with the City of San Diego, California, then the obligation herein with respect to a faithful performance shall be void; otherwise it shall remain in full force.

If the Principal shall promptly pay all persons, firms and corporations furnishing materials for or performing labor in the execution of this contract, and shall pay all amounts due under the California Unemployment Insurance Act then the obligation herein with respect to laborers and materialmen shall be void; otherwise it shall remain in full force.

The obligation herein with respect to laborers and materialmen shall inure to the benefit of all persons, firms and corporations entitled to file claims under the provisions of Article 2. Claimants, (iii) public works of improvement commencing with Civil Code Section 9100 of the Civil Code of the State of California.

Changes in the terms of the annexed contract or specifications accompanying same or referred to therein shall not affect the Surety's obligation on this bond, and the Surety hereby waives notice of same.

The Surety shall pay reasonable attorney's fees should suit be brought to enforce the provisions of this bond.

Bond No. 0703366
Premium: $15,369.00

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND

FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

Fordyce Construction, Inc., a corporation, as principal, and International Fidelity Insurance Company, a corporation authorized to do business in the State of California, as Surety, hereby obligate themselves, their successors and assigns, jointly and severally, to The City of San Diego a municipal corporation in the sum of One Million Two Hundred Sixty Seven Thousand Eight Hundred Five Dollars and Zero Cents ($1,267,805.00) for the faithful performance of the annexed contract, and in the sum of One Million Two Hundred Sixty Seven Thousand Eight Hundred Five Dollars and Zero Cents ($1,267,805.00) for the benefit of laborers and materialmen designated below.

Conditions:

If the Principal shall faithfully perform the annexed contract with the City of San Diego, California, then the obligation herein with respect to a faithful performance shall be void; otherwise it shall remain in full force.

If the Principal shall promptly pay all persons, firms and corporations furnishing materials for or performing labor in the execution of this contract, and shall pay all amounts due under the California Unemployment Insurance Act then the obligation herein with respect to laborers and materialmen shall be void; otherwise it shall remain in full force.

The obligation herein with respect to laborers and materialmen shall inure to the benefit of all persons, firms and corporations entitled to file claims under the provisions of Article 2. Claimants, (iii) public works of improvement commencing with Civil Code Section 9100 of the Civil Code of the State of California.

Changes in the terms of the annexed contract or specifications accompanying same or referred to therein shall not affect the Surety's obligation on this bond, and the Surety hereby waives notice of same.

The Surety shall pay reasonable attorney's fees should suit be brought to enforce the provisions of this bond.

PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND (continued)

Dated March 14, 2017

Approved as to Form

Mara W. Elliott, City Attorney

By Christina Rae 5/10/17

Deputy City Attorney

Approved:

By

Stephen Samara, Principal Contract Specialist
Public Works Department

Fordyce Construction, Inc.

Principal

By

Brian Fordyce

Printed Name of Person Signing for Principal

International Fidelity Insurance Company

Surety

By

Bart Stewart, Attorney-in-fact

2400 E. Katella Ave Suite 250

Local Address of Surety

Anaheim, CA 92806

Local Address (City, State) of Surety

714-602-9170

Local Telephone No. of Surety

Premium $ 15,369.00

Bond No. 0703366

Tel (973) 624-7200

POWER OF ATTORNEY

INTERNATIONAL FIDELITY INSURANCE COMPANY
ALLEGHENY CASUALTY COMPANY

ONE NEWARK CENTER, 20TH FLOOR NEWARK, NEW JERSEY 07102-5207

KNOW ALL MEN BY THESE PRESENTS: That **INTERNATIONAL FIDELITY INSURANCE COMPANY**, a corporation organized and existing under the laws of the State of New Jersey, and **ALLEGHENY CASUALTY COMPANY** a corporation organized and existing under the laws of the State of New Jersey, having their principal office in the City of Newark, New Jersey, do hereby constitute and appoint

MOLLY CASHMAN, BART STEWART

Encinitas, CA.

their true and lawful attorney(s)-in-fact to execute, seal and deliver for and on its behalf as surety, any and all bonds and undertakings, contracts of indemnity and other writings obligatory in the nature thereof, which are or may be allowed, required or permitted by law, statute, rule, regulation, contract or otherwise, and the execution of such instrument(s) in pursuance of these presents, shall be as binding upon the said INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY, as fully and amply, to all intents and purposes, as if the same had been duly executed and acknowledged by their regularly elected officers at their principal offices.

This Power of Attorney is executed, and may be revoked, pursuant to and by authority of the By-Laws of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY and is granted under and by authority of the following resolution adopted by the Board of Directors of INTERNATIONAL FIDELITY INSURANCE COMPANY at a meeting duly held on the 20th day of July, 2010 and by the Board of Directors of ALLEGHENY CASUALTY COMPANY at a meeting duly held on the 15th day of August, 2000:

"RESOLVED, that (1) the President, Vice President, Chief Executive Officer or Secretary of the Corporation shall have the power to appoint, and to revoke the appointments of, Attorneys-in-Fact, or agents with power and authority as defined or limited in their respective powers of attorney, and to execute on behalf of the Corporation and affix the Corporation's seal thereto, bonds, undertakings, recognizances, contracts of indemnity and other written obligations in the nature thereof or related thereto; and (2) any such Officers of the Corporation may appoint and revoke the appointments of joint-control custodians, agents for acceptance of process, and Attorneys-in-fact with authority to execute waivers and consents on behalf of the Corporation; and (3) the signature of any such Officer of the Corporation and the Corporation's seal may be affixed by facsimile to any power of attorney or certification given for the execution of any bond, undertaking, recognizance, contract of indemnity or other written obligation in the nature thereof or related thereto, such signature and seals when so used whether heretofore or hereafter, being hereby adopted by the Corporation as the original signature of such officer and the original seal of the Corporation, to be valid and binding upon the Corporation with the same force and effect as though manually affixed."

IN WITNESS WHEREOF, INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY have each executed and attested these presents on this 31st day of December, 2015.

INTERNATIONAL FIDELITY INSURANCE CORPORATE SEAL 1904 NEW JERSEY INCORPORATED

STATE OF NEW JERSEY
County of Essex

ROBERT W. MINSTER
Chief Executive Officer (International Fidelity Insurance Company) and President (Allegheny Casualty Company)

ALLEGHENY CASUALTY COMPANY 1936 NEW JERSEY

On this 31st day of December 2015, before me came the individual who executed the preceding instrument, to me personally known, and, being by me duly sworn, said he is the therein described and authorized officer of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY; that the seals affixed to said instrument are the Corporate Seals of said Companies; that the said Corporate Seals and his signature were duly affixed by order of the Boards of Directors of said Companies.

IN TESTIMONY WHEREOF, I have hereunto set my hand affixed my Official Seal, at the City of Newark, New Jersey the day and year first above written.

CATHY CRUZ MY COMMISSION EXPIRES NOTARY PUBLIC 04-16-2019 STATE OF NEW JERSEY

A NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 16, 2019

CERTIFICATION

I, the undersigned officer of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY do hereby certify that I have compared the foregoing copy of the Power of Attorney and affidavit, and the copy of the Sections of the By-Laws of said Companies as set forth in said Power of Attorney, with the originals on file in the home office of said companies, and that the same are correct transcripts thereof, and of the whole of the said originals, and that the said Power of Attorney has not been revoked and is now in full force and effect.

IN TESTIMONY WHEREOF, I have hereunto set my hand this 14th day of March 2017

MARIA BRANCO, Assistant Secretary

ALL- PURPOSE
CERTIFICATE OF ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California }

County of San Diego }

On 03/14/2017 before me, Brittany Aceves, Notary Public,
(Here Insert name and title of the officer)

personally appeared Bart Stewart,
who proved to me on the basis of satisfactory evidence to be the person(~~s~~) whose name(~~s~~) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(~~ies~~), and that by his/her/their signature(~~s~~) on the instrument the person(~~s~~), or the entity upon behalf of which the person(~~s~~) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Notary Public Signature (Notary Public Seal)

BRITTANY ACEVES
Commission No. 2044569
NOTARY PUBLIC - CALIFORNIA
SAN DIEGO COUNTY
Commission Expires October 7, 2017

ADDITIONAL OPTIONAL INFORMATION

DESCRIPTION OF THE ATTACHED DOCUMENT

(Title or description of attached document)

(Title or description of attached document continued)

Number of Pages _____ Document Date_____

CAPACITY CLAIMED BY THE SIGNER

- ☐ Individual (s)
- ☐ Corporate Officer
  (Title)
- ☐ Partner(s)
- ☐ Attorney-in-Fact
- ☐ Trustee(s)
- ☐ Other _____

2015 Version www.NotaryClasses.com 800-873-9865

INSTRUCTIONS FOR COMPLETING THIS FORM

This form complies with current California statutes regarding notary wording and, if needed, should be completed and attached to the document. Acknolwedgents from other states may be completed for documents being sent to that state so long as the wording does not require the California notary to violate California notary law.

- State and County information must be the State and County where the document signer(s) personally appeared before the notary public for acknowledgment.
- Date of notarization must be the date that the signer(s) personally appeared which must also be the same date the acknowledgment is completed.
- The notary public must print his or her name as it appears within his or her commission followed by a comma and then your title (notary public).
- Print the name(s) of document signer(s) who personally appear at the time of notarization.
- Indicate the correct singular or plural forms by crossing off incorrect forms (i.e. ~~he~~/she/~~they,~~ is /~~are~~) or circling the correct forms. Failure to correctly indicate this information may lead to rejection of document recording.
- The notary seal impression must be clear and photographically reproducible. Impression must not cover text or lines. If seal impression smudges, re-seal if a sufficient area permits, otherwise complete a different acknowledgment form.
- Signature of the notary public must match the signature on file with the office of the county clerk.
  - Additional information is not required but could help to ensure this acknowledgment is not misused or attached to a different document.
  - Indicate title or type of attached document, number of pages and date.
  - Indicate the capacity claimed by the signer. If the claimed capacity is a corporate officer, indicate the title (i.e. CEO, CFO, Secretary).
- Securely attach this document to the signed document with a staple.

ATTACHMENTS

ATTACHMENT A

SCOPE OF WORK

SCOPE OF WORK

1. **SCOPE OF WORK:** The intent of the City is to construct the improvements at both Fire stations (FS) 14 & 19 according to the construction documents. The scope shall include but not limited to the replacement of roof; HVAC systems; vehicle exhaust extraction systems; temporary trailer mobilization and interior repairs.

   1.1. The Work shall be performed in accordance with:

   1.1.1. The Notice Inviting Bids, and Plans numbered **38114-1-D** through **38114-41-D** and **38115-1-D** through **38115-34-D** respectively, inclusive.

2. **ESTIMATED CONSTRUCTION COST:** The City's estimated construction cost for this project is **$870,000**.

3. **LOCATION OF WORK: The location of the Work is as follows:**

   1. **Fire Station 14:** 4011 32nd St, San Diego, CA 92104

   2. **Fire Station 19:** 3434 Ocean View Blvd, San Diego, CA 92113

   3. See also Attachment E – Location Maps.

4. **CONTRACT TIME:** The Contract Time for completion of the Work shall be **154 Working Days.**

   4.1. **CONTRACTOR'S LICENSE CLASSIFICATION:** In accordance with the provisions of California Law, the Contractor shall possess valid, appropriate license(s) at the time that the Bid is submitted. Failure to possess the specified license(s) may render the Bid as **non-responsive** and ineligible for award.

   4.2. The City has determined that the following licensing classifications are required for this contract:

Option	Classifications
1	CLASS A
2	CLASS B

   4.3. The Bidder shall satisfy the licensing requirement by meeting at least one of the listed options.

ATTACHMENT B

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ATTACHMENT C

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ATTACHMENT D

PREVAILING WAGES

1. **PREVAILING WAGE RATES:** Pursuant to San Diego Municipal Code section 22.3019, construction, alteration, demolition, repair and maintenance work performed under this Contract is subject to State prevailing wage laws. For construction work performed under this Contract cumulatively exceeding $25,000 and for alteration, demolition, repair and maintenance work performed under this Contract cumulatively exceeding $15,000, the Contractor and its subcontractors shall comply with State prevailing wage laws including, but not limited to, the requirements listed below.

1.1. **Compliance with Prevailing Wage Requirements.** Pursuant to sections 1720 through 1861 of the California Labor Code, the Contractor and its subcontractors shall ensure that all workers who perform work under this Contract are paid not less than the prevailing rate of per diem wages as determined by the Director of the California Department of Industrial Relations (DIR). This includes work performed during the design and preconstruction phases of construction including, but not limited to, inspection and land surveying work.

1.1.1. Copies of such prevailing rate of per diem wages are on file at the City and are available for inspection to any interested party on request. Copies of the prevailing rate of per diem wages also may be found at http://www.dir.ca.gov/OPRL/DPreWageDetermination.htm. Contractor and its subcontractors shall post a copy of the prevailing rate of per diem wages determination at each job site and shall make them available to any interested party upon request.

1.1.2. The wage rates determined by the DIR refer to expiration dates. If the published wage rate does not refer to a predetermined wage rate to be paid after the expiration date, then the published rate of wage shall be in effect for the life of this Contract. If the published wage rate refers to a predetermined wage rate to become effective upon expiration of the published wage rate and the predetermined wage rate is on file with the DIR, such predetermined wage rate shall become effective on the date following the expiration date and shall apply to this Contract in the same manner as if it had been published in said publication. If the predetermined wage rate refers to one or more additional expiration dates with additional predetermined wage rates, which expiration dates occur during the life of this Contract, each successive predetermined wage rate shall apply to this Contract on the date following the expiration date of the previous wage rate. If the last of such predetermined wage rates expires during the life of this Contract, such wage rate shall apply to the balance of the Contract.

1.2. **Penalties for Violations.** Contractor and its subcontractors shall comply with California Labor Code section 1775 in the event a worker is paid less than the prevailing wage rate for the work or craft in which the worker is employed.

1.3. **Payroll Records.** Contractor and its subcontractors shall comply with California Labor Code section 1776, which generally requires keeping accurate payroll records, verifying and certifying payroll records, and making them available for inspection. Contractor shall require its subcontractors to also comply with section 1776. Contractor and its subcontractors shall submit weekly certified payroll records online via the City's web-based Labor Compliance Program. Contractor is responsible for ensuring its subcontractors submit certified payroll records to the City.

1.3.1. For contracts entered into on or after April 1, 2015, Contractor and their subcontractors shall furnish records specified in Labor Code section 1776 directly to the Labor Commissioner in the manner required by Labor Code section 1771.4.

1.4. **Apprentices.** Contractor and its subcontractors shall comply with California Labor Code sections 1777.5, 1777.6 and 1777.7 concerning the employment and wages of apprentices. Contractor is held responsible for the compliance of their subcontractors with sections 1777.5, 1777.6 and 1777.7.

1.5. **Working Hours.** Contractor and their subcontractors shall comply with California Labor Code sections 1810 through 1815, including but not limited to: (i) restrict working hours on public works contracts to eight hours a day and forty hours a week, unless all hours worked in excess of 8 hours per day are compensated at not less than 1½ times the basic rate of pay; and (ii) specify penalties to be imposed on design professionals and subcontractors of $25 per worker per day for each day the worker works more than 8 hours per day and 40 hours per week in violation of California Labor Code sections1810 through 1815.

1.6. **Required Provisions for Subcontracts.** Contractor shall include at a minimum a copy of the following provisions in any contract they enter into with a subcontractor: California Labor Code sections 1771, 1771.1, 1775, 1776, 1777.5, 1810, 1813, 1815, 1860 and 1861.

1.7. **Labor Code Section 1861 Certification.** Contractor in accordance with California Labor Code section 3700 is required to secure the payment of compensation of its employees and by signing this Contract, Contractor certifies that "I am aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers' 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."

1.8. **Labor Compliance Program.** The City has its own Labor Compliance Program authorized in August 2011 by the DIR. The City will withhold contract payments when payroll records are delinquent or deemed inadequate by the City or other governmental entity, or it has been established after an investigation by the City or other governmental entity that underpayment(s) have occurred. For questions or assistance, please contact the City of San Diego's Equal Opportunity Contracting Department at 619-236-6000.

1.9. **Contractor and Subcontractor Registration Requirements.** This project is subject to compliance monitoring and enforcement by the DIR. As of March 1, 2015, no contractor or subcontractor may be listed on a bid or proposal for a public works project unless registered with the DIR pursuant to Labor Code section 1725.5. As of April 1, 2015, a contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal, or enter into any contract for public work, unless currently registered and qualified to perform public work pursuant to Labor Code section 1725.5 By submitting a bid or proposal to the City, Contractor is certifying that he or she has verified that all subcontractors used on this public work project are registered with the DIR in compliance with Labor Code sections 1771.1 and 1725.5, and Contractor shall provide proof of registration to the City upon request.

1.9.1. A Contractor's inadvertent error in listing a subcontractor who is not registered pursuant to Labor Code section 1725.5 in response to a solicitation shall not be grounds for filing a bid protest or grounds for considering the bid non-responsive provided that any of the following apply: (1) the subcontractor is registered prior to bid opening; (2) within twenty-four hours after the bid opening, the subcontractor is registered and has paid the penalty registration fee specified in Labor Code section 1725.5; or (3) the subcontractor is replaced by another registered subcontractor pursuant to Public Contract Code section 4107.

ATTACHMENT E

SUPPLEMENTARY SPECIAL PROVISIONS

SUPPLEMENTARY SPECIAL PROVISIONS

The following Supplementary Special Provisions (SSP) modifies the following documents:

1) The **2015 Edition** of the Standard Specifications for Public Works Construction (The "GREENBOOK").

2) The **2015 Edition** of the City of San Diego Standard Specifications for Public Works Construction (The "WHITEBOOK"), addressed as the "City Supplement" herein, including the following:

   1. General Provisions (A) for all Contracts.

SECTION 1 – TERMS, DEFINITIONS, ABBREVIATIONS, UNITS OF MEASURE, AND SYMBOLS

1-2 **TERMS AND DEFINITIONS.** To the City Supplement, item 54, "Normal Working Hours", ADD the following:

The **Normal Working Hours** are **7:00 AM** to **3:30 PM**.

SECTION 2 - SCOPE AND CONTROL OF WORK

2-3.2 **Self Performance.** DELETE in its entirety and SUBSTITUTE with the following:

1. You shall perform, with your own organization, Contract Work amounting to at least 30% of the base Bid **AND** 30% of any alternates.
2. The self performance percentage requirement will be waived for Prime Contractors meeting the Class B License requirement of this Contract.

2-14.3 **Coordination.** To the City Supplement, ADD the following:

2. Other adjacent City projects are scheduled for construction for the same time period in the vicinity of **Fire Station 14 Roof & HVAC Replacement.** See **Appendix F** for the approximate location. Coordinate the Work with the adjacent projects as listed below:
   a) Lincoln Ave (30th St to Wabash Ave) Boundary, Project Manager: Ali Alaepour, (619) 533-5141
   b) Lincoln Avenue, Project Manager: James Bajet, (619) 533-3046
   c) Sewer & Water Group Job 687B, Project Manager: Owen Regan, (619) 533-5205

2-16 **CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM.** To the City Supplement, item 1, DELETE in its entirety.

SECTION 4 - CONTROL OF MATERIALS

4-1.3.6 **Preapproved Materials.** To the City Supplement, ADD the following:

3. You shall submit in writing a list of all products to be incorporated in the Work that are on the AML.

4-1.6 **Trade Names or Equals.** To the City Supplement, ADD the following:

11. You shall submit your list of proposed substitutions for an "equal" item **no later than 5 Working Days after the determination of the Apparent Low Bidder** and on the City's Product Submittal Form available at:

http://www.sandiego.gov/publicworks/edocref/index.shtml

SECTION 5 – UTILITIES

5-2 **PROTECTION.** To the City Supplement, item 2, ADD the following:

g) Refer to **Appendix I** for more information on the protection of AMI devices.

5-6 **COOPERATION.** ADD the following:

1. Notify SDG&E at least 10 Working Days prior to excavating within 10 feet of SDG&E Underground High Voltage Transmission Power Lines (69 KV and higher).

SECTION 6 - PROSECUTION, PROGRESS AND ACCEPTANCE OF WORK

ADD:

6-3.2.1.1 **Environmental Document.**

1. The City of San Diego Development Services Department has prepared a **Notice of Exemptions** for **Fire Station 14 Roof & HVAC Replacement and Fire Station 19 Roof & HVAC Replacement**, as referenced in the Contract Appendix. You shall comply with all requirements of the **Notice of Exemptions** as set forth in **Appendix A**.

2. Compliance with the City's environmental document shall be included in the Contract Price.

SECTION 7 - RESPONSIBILITIES OF THE CONTRACTOR

7-3 **INSURANCE.** DELETE in its entirety and SUBSTITUTE with the following:

7-3 **INSURANCE.**

1. The insurance provisions herein shall not be construed to limit your indemnity obligations contained in the Contract.

7-3.1 **Policies and Procedures.**

1. You shall procure the insurance described below, at its sole cost and expense, to provide coverage against claims for loss including injuries to persons or damage to property, which may arise out of or in connection with the performance of the Work by you, your agents, representatives, officers, employees or Subcontractors.

2. Insurance coverage for property damage resulting from your operations is on a replacement cost valuation. The market value will not be accepted.

3. You shall maintain this insurance for the duration of this Contract and at all times thereafter when you are correcting, removing, or replacing Work in accordance with this Contract. Your liabilities under the Contract, e.g., your indemnity obligations, is not deemed limited to the insurance coverage required by this Contract.

4. The payment for insurance shall be included in the Contract Price as bid by you. Except as specifically agreed to by the City in writing, you are not entitled to any additional payment. Do not begin any Work under this Contract until you have provided and the City has approved all required insurance.

5. Policies of insurance shall provide that the City is entitled to 30 Days (10 Days for cancellation due to non-payment of premium) prior written notice of cancellation or non-renewal of the policy. Maintenance of specified insurance coverage is a material element of the Contract. Your failure to maintain or renew coverage or to provide evidence of renewal during the term of the Contract may be treated by the City as a material breach of the Contract.

7-3.2 **Types of Insurance.**

7-3.2.1 **Commercial General Liability Insurance.**

1. Commercial General Liability Insurance shall be written on the current version of the ISO Occurrence form CG 00 01 07 98 or an equivalent form providing coverage at least as broad.

2. The policy shall cover liability arising from premises and operations, XCU (explosions, underground, and collapse), independent contractors, products/completed operations, personal injury and advertising injury, bodily injury, property damage, and liability assumed under an insured's contract (including the tort liability of another assumed in a business contract).

3. There shall be no endorsement or modification limiting the scope of coverage for either "insured vs. insured" claims or contractual liability. You shall maintain the same or equivalent insurance for at least 10 years following completion of the Work.

4. All costs of defense shall be outside the policy limits. Policy coverage shall be in liability limits of not less than the following:

General Annual Aggregate Limit	Limits of Liability
Other than Products/Completed Operations	$2,000,000
Products/Completed Operations Aggregate Limit	$2,000,000
Personal Injury Limit	$1,000,000
Each Occurrence	$1,000,000

7-3.2.2 Commercial Automobile Liability Insurance.

1. You shall provide a policy or policies of Commercial Automobile Liability Insurance written on the current version of the ISO form CA 00 01 12 90 or later version or equivalent form providing coverage at least as broad in the amount of $1,000,000 combined single limit per accident, covering bodily injury and property damage for owned, non-owned, and hired automobiles ("Any Auto").

2. All costs of defense shall be outside the limits of the policy.

7-3.2.3 Contractors Pollution Liability Insurance.

1. You shall procure and maintain at your expense or require your Subcontractor, as described below, to procure and maintain the Contractors Pollution Liability Insurance including contractual liability coverage to cover liability arising out of cleanup, removal, storage, or handling of hazardous or toxic chemicals, materials, substances, or any other pollutants by you or any Subcontractor in an amount not less than $2,000,000 limit for bodily injury and property damage.

2. All costs of defense shall be outside the limits of the policy. Any such insurance provided by your Subcontractor instead of you shall be approved separately in writing by the City.

3. For approval of a substitution of your Subcontractor's insurance, you shall certify that all activities for which the Contractors Pollution Liability Insurance will provide coverage will be performed exclusively by the Subcontractor providing the insurance. The deductible shall not exceed $25,000 per claim.

4. Contractual liability shall include coverage of tort liability of another party to pay for bodily injury or property damage to a third person or organization. There shall be no endorsement or modification of the coverage limiting the scope of coverage for either "insured vs. insured" claims or contractual liability.

5. Occurrence based policies shall be procured before the Work commences and shall be maintained for the Contract Time. Claims Made policies shall be procured before the Work commences, shall be maintained for the Contract Time, and shall include a 12 month extended Claims Discovery Period applicable to this contract or the existing policy or policies that shall continue to be maintained for 12 months after the completion of the Work without advancing the retroactive date.

6. Except as provided for under California law, the policy or policies shall provide that the City is entitled to 30 Days prior written notice (10 Days for cancellation due to non-payment of premium) of cancellation or non-renewal of the policy or policies.

7-3.2.4 Contractors Hazardous Transporters Pollution Liability Insurance.

1. You shall provide at your expense or require your Subcontractor to provide, as described below, Contractors Hazardous Transporters Pollution Liability Insurance including contractual liability coverage to cover liability arising out of transportation of hazardous or toxic, materials, substances, or any other pollutants by you or any Subcontractor in an amount not less than $2,000,000 limit per occurrence/aggregate for bodily injury and property damage.

2. All costs of defense shall be outside the limits of the policy. The deductible shall not exceed $25,000 per claim. Any such insurance provided by a subcontractor instead of you shall be approved separately in writing by the City.

3. For approval of the substitution of Subcontractor's insurance the Contractor shall certify that all activities for which Contractors Hazardous Transporters Pollution Liability Insurance will provide coverage will be performed exclusively by the Subcontractor providing the insurance.

4. Contractual liability shall include coverage of tort liability of another party to pay for bodily injury or property damage to a third person or organization. There shall be no endorsement or modification of the coverage limiting the scope of coverage for either "insured vs. insured" claims or contractual liability. Occurrence based policies shall be procured before the Work commences and shall be maintained for the duration of this Contract. Claims Made policies shall be procured before the Work commences, shall be maintained for the duration of this contract, and shall include a 12 month extended Claims Discovery Period applicable to this contract or the existing policy or policies that shall continue to be maintained for 12 months after the completion of the Work under this Contract without advancing the retroactive date.

Except as provided for under California law, the policy or policies shall provide that the City is entitled to 30 Days prior written notice (10 Days for cancellation due to non-payment of premium) of cancellation or non-renewal of the policy or policies.

7-3.3 **Rating Requirements.** Except for the State Compensation Insurance Fund, all insurance required by this Contract as described herein shall be carried only by responsible insurance companies with a rating of, or equivalent to, at least "A-, VI" by A.M. Best Company, that are authorized by the California Insurance Commissioner to do business in the State, and that have been approved by the City.

7-3.3.1 **Non-Admitted Carriers.** The City will accept insurance provided by non-admitted, "surplus lines" carriers only if the carrier is authorized to do business in the State and is included on the List of Approved Surplus Lines Insurers (LASLI list).

All policies of insurance carried by non-admitted carriers shall be subject to all of the requirements for policies of insurance provided by admitted carriers described herein.

7-3.4 **Evidence of Insurance.** Furnish to the City documents e.g., certificates of insurance and endorsements evidencing the insurance required herein, and furnish renewal documentation prior to expiration of this insurance. Each required document shall be signed by the insurer or a person authorized by the insurer to bind coverage on its behalf. We reserve the right to require complete, certified copies of all insurance policies required herein.

7-3.5 **Policy Endorsements.**

7-3.5.1 **Commercial General Liability Insurance.**

7-3.5.1.1 **Additional Insured.**

1. You shall provide at your expense policy endorsement written on the current version of the ISO Occurrence form CG 20 10 11 85 or an equivalent form providing coverage at least as broad.
2. To the fullest extent allowed by law e.g., California Insurance Code §11580.04, the policy shall be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured.
3. The additional insured coverage for projects for which the Engineer's Estimate is $1,000,000 or more shall include liability arising out of:
   a) Ongoing operations performed by you or on your behalf,
   b) your products,
   c) your Work, e.g., your completed operations performed by you or on your behalf, or
   d) premises owned, leased, controlled, or used by you.

4. The additional insured coverage for projects for which the Engineer's Estimate is less than $1,000,000 shall include liability arising out of:

   a) Ongoing operations performed by you or on your behalf,

   b) your products, or

   c) premises owned, leased, controlled, or used by you.

7-3.5.1.2 **Primary and Non-Contributory Coverage.** The policy shall be endorsed to provide that the coverage with respect to operations, including the completed operations, if appropriate, of the Named Insured is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives. Further, it shall provide that any insurance maintained by the City and its elected officials, officers, employees, agents and representatives shall be in excess of your insurance and shall not contribute to it.

7-3.5.1.3 **Project General Aggregate Limit.** The policy or policies shall be endorsed to provide a Designated Construction Project General Aggregate Limit that will apply only to the Work. Only claims payments which arise from the Work shall reduce the Designated Construction Project General Aggregate Limit. The Designated Construction Project General Aggregate Limit shall be in addition to the aggregate limit provided for the products-completed operations hazard.

7-3.5.2 **Commercial Automobile Liability Insurance.**

7-3.5.2.1 **Additional Insured.** Unless the policy or policies of Commercial Auto Liability Insurance are written on an ISO form CA 00 01 12 90 or a later version of this form or equivalent form providing coverage at least as broad, the policy shall be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured, with respect to liability arising out of automobiles owned, leased, hired or borrowed by you or on your behalf. This endorsement is limited to the obligations permitted by California Insurance Code §11580.04.

7-3.5.3 **Contractors Pollution Liability Insurance Endorsements.**

7-3.5.3.1 **Additional Insured.**

1. The policy or policies shall be endorsed to include as an Insured the City and its respective elected officials, officers, employees, agents, and representatives, with respect to liability arising out of:

   a) Ongoing operations performed by you or on your behalf,

   b) your products,

   c) your work, e.g., your completed operations performed by you or on your behalf, or

   d) premises owned, leased, controlled, or used by you.

Except that in connection with, collateral to, or affecting any construction contract to which the provisions of subdivision (b) of § 2782 of the California Civil Code apply, this endorsement shall not provide any duty of indemnity coverage for the active negligence of the City and its respective elected officials, officers, employees, agents, and representatives in any case where an agreement to indemnify the City and its respective elected officials, officers, employees, agents, and representatives would be invalid under subdivision (b) of §2782 of the California Civil Code.

2. In any case where a claim or loss encompasses the negligence of the Insured and the active negligence of the City and its respective elected officials, officers, employees, agents, and representatives that are not covered because of California Insurance Code §11580.04, the insurer's obligation to the City and its respective elected officials, officers, employees, agents, and representatives shall be limited to obligations permitted by California Insurance Code §11580.04.

7-3.5.3.2 **Primary and Non-Contributory Coverage.** The policy or policies shall be endorsed to provide that the insurance afforded by the Contractors Pollution Liability Insurance policy or policies is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives with respect to operations including the completed operations of the Named Insured. Any insurance maintained by the City and its elected officials, officers, employees, agents and representatives shall be in excess of your insurance and shall not contribute to it.

7-3.5.3.3 **Severability of Interest.** For Contractors Pollution Liability Insurance, the policy or policies shall provide that your insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability and shall provide cross-liability coverage.

7-3.5.4 **Contractors Hazardous Transporters Pollution Liability Insurance Endorsements.**

7-3.5.4.1 **Additional Insured.**

1. The policy or policies shall be endorsed to include as an Insured the City and its respective elected officials, officers, employees, agents, and representatives, with respect to liability arising out of:

   a) Ongoing operations performed by you or on your behalf,

   b) your products,

   c) your work, e.g., your completed operations performed by you or on your behalf, or

   d) premises owned, leased, controlled, or used by you.

Except that in connection with, collateral to, or affecting any construction contract to which the provisions of subdivision (b) of §2782 of the California Civil Code apply, this endorsement shall not provide any duty of indemnity coverage for the active negligence of the City and its respective elected officials, officers, employees, agents, and representatives in any case where an agreement to indemnify the City and its respective elected officials, officers, employees, agents, and representatives would be invalid under subdivision (b) of §2782 of the California Civil Code.

2. In any case where a claim or loss encompasses the negligence of the Insured and the active negligence of the City and its respective elected officials, officers, employees, agents, and representatives that are not covered because of California Insurance Code §11580.04, the insurer's obligation to the City and its respective elected officials, officers, employees, agents, and representatives shall be limited to obligations permitted by California Insurance Code §11580.04.

7-3.5.4.2 **Primary and Non-Contributory Coverage.** The policy or policies shall be endorsed to provide that the insurance afforded by the Contractors Pollution Liability Insurance policy or policies is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives with respect to operations including the completed operations of the Named Insured. Any insurance maintained by the City and its elected officials, officers, employees, agents and representatives shall be in excess of your insurance and shall not contribute to it.

7-3.5.4.3 **Severability of Interest.** For Contractors Hazardous Transporters Pollution Liability Insurance, the policy or policies shall provide that your insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability and shall provide cross-liability coverage.

7-3.6 **Deductibles and Self-Insured Retentions.** You shall pay for all deductibles and self-insured retentions. You shall disclose deductibles and self-insured retentions to the City at the time the evidence of insurance is provided.

7-3.7 **Reservation of Rights.** The City reserves the right, from time to time, to review your insurance coverage, limits, deductibles and self-insured retentions to determine if they are acceptable to the City. The City will reimburse you, without overhead, profit, or any other markup, for the cost of additional premium for any coverage requested by the Engineer but not required by this Contract.

7-3.8 **Notice of Changes to Insurance.** You shall notify the City 30 Days prior to any material change to the policies of insurance provided under this Contract.

7-3.9 **Excess Insurance.** Policies providing excess coverage shall follow the form of the primary policy or policies e.g., all endorsements.

7-4 **NOT USED.** DELETE in its entirety and SUBSTITUTE with the following:

7-4 **WORKERS' COMPENSATION INSURANCE AND EMPLOYERS LIABILITY INSURANCE.**

1. In accordance with the provisions of §3700 of the California Labor Code, you shall provide at your expense Workers' Compensation Insurance and Employers Liability Insurance to protect you against all claims under applicable state workers compensation laws. The City, its elected officials, and employees will not be responsible for any claims in law or equity occasioned by your failure to comply with the requirements of this section.

2. Limits for this insurance shall be not less than the following:

Workers' Compensation	Statutory Employers Liability
Bodily Injury by Accident	$1,000,000 each accident
Bodily Injury by Disease	$1,000,000 each employee
Bodily Injury by Disease	$1,000,000 policy limit

3. By signing and returning the Contract you certify that you are aware of the provisions of §3700 of the Labor Code which requires 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 you shall comply with such provisions before commencing the Work as required by §1861 of the California Labor Code.

7-4.1. **Waiver of Subrogation.** The policy or policies shall be endorsed to provide that the insurer will waive all rights of subrogation against the City and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and which arise from Work performed by the Named Insured for the City.

7-8.6 **Water Pollution Control.** To the City Supplement, ADD the following:

6. Based on a preliminary assessment by the City, this Contract is subject to **WPCP**.

7-9 **PROTECTION AND RESTORATION OF EXISTING IMPROVEMENTS.** To the City Supplement, ADD the following:

The project involves improvements at Fire Stations which are considered emergency facilities. Accordingly, the contractor shall consider the following:

- Fire Station 14 and Fire Station 19 will remain in operation throughout the contract duration. All Construction activities and staging shall not impede with the operation of the Fire Crew especially during an emergency. The Contractor shall have an **emergency management plan** in place to clear the way during any fire and rescue operation emergency call.

- The Contractor shall provide and coordinate in advance the working schedule to the tenants.

- The Contractor shall plan the work activities to minimize construction impacts to their day to day activities and to their sleeping quarters; maintain a clean site to prevent accidents; minimize noise impact and maintain a professional conduct and work environment.

7-20 **ELECTRONIC COMMUNICATION.** To the City Supplement, ADD the following:

2. Virtual Project Manager shall be used on this Contract.

7-21.1 **General.** To the City Supplement, item 3, DELETE in its entirety and SUBSTITUTE with the following:

3. During the construction phase of projects, the minimum waste management reduction goal is 90% of the inert material (a material not subject to decomposition such as concrete, asphalt, brick, rock, block, dirt, metal, glass, and etc.) and 65% of the remaining project waste. You shall provide appropriate documentation, including a Waste Management Form attached as an appendix, and evidence of recycling and reuse of materials to meet the waste reduction goals specified.

SECTION 9 - MEASUREMENT AND PAYMENT

9-3.1 **General.** To the City Supplement, ADD the following:

3. The Contractor shall comply with all the works included in the Plans numbered **38114-1-D** through **38114-41-D** and **38115-1-D** through **38115-34-D** inclusive and its related specifications for Fire Station (FS) 14 Roof & HVAC Replacement and Fire Station 19 Roof & HVAC Replacement Project.

4. The payment for **FS 14 Roof & HVAC Replacement, FS 14 – Temporary measures during construction impacts to the sleeping quarters** shall be paid under the Lump Sum Bid Item **"Construction of Fire Station 14 Roof & HVAC Replacement"**. Please refer to Attachment A- Scope of Work and Technical Specification Section 015000 Temporary Facilities and Controls.

5. The payment for **FS 19 Roof & HVAC Replacement, FS 19 – Temporary Trailer** shall be paid under Lump Sum Bid item **"Construction of Fire Station 19 Roof & HVAC Replacement"**. Please refer to Attachment A- Scope of Work and Technical Specification Section 015000 Temporary Facilities and Controls.

6. The Payment for the **FS 14 – Laydown/Staging area** shall be paid under Allowance (AL) Bid item **"Building Permits (EOC Type I), and Staging required Permits"**. Please refer to Technical Specification Section 015000 Temporary Facilities and Controls .

7. The Payment for the **FS 19 – Communication Alerting Systems in Trailer** shall be paid under Lump Sum Bid item **"Communication Alerting Systems".** Please refer to Technical Specification Section 015000 Temporary Facilities and Controls .

8. The payment for handling and disposal of Non-friable asbestos-containing materials shall be paid under Allowance (AL) Bid item **"Handling and Disposal of Non-friable Asbestos (Mastic for Fire Station 19) (EOC Type I)"**. Please refer to Appendix J – Asbestos Abatement Specification.

9. All the **Termite Treatment/Structural damage replacement** works are to be verified and approved by the Resident Engineer and the Payment to the Contractor shall be based on Allowance (AL) Bid item **"Termite Treatment/Structural Damage Replacement (EOC Type I)"**.

ADD:

9-3.7 **Compensation Adjustments for Price Index Fluctuations.** To the City Supplement ADD the following:

5. This Contract is not subject to the provisions of The "WHITEBOOK" for Compensation Adjustments for Price Index Fluctuations for paving asphalt.

EQUAL OPPORTUNITY CONTRACTING PROGRAM (EOCP) SECTION A – GENERAL REQUIREMENTS

4.1 **Nondiscrimination in Contracting Ordinance.** To the City Supplement, subsection 4.1.1, paragraph (2), sentence (1), DELETE in its entirety and SUBSTITUTE with the following:

You shall not discriminate on the basis of race, gender, gender expression, gender identity, religion, national origin, ethnicity, sexual orientation, age, or disability in the solicitation, selection, hiring, or treatment of subcontractors, vendors, or suppliers.

END OF SUPPLEMENTARY SPECIAL PROVISIONS (SSP)

TECHNICALS

TECHNICAL SPECIFICATIONS

Fire Station 14 & 19 Roof & HVAC Replacement

The City of San Diego, California

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GENERAL REQUIREMENTS – Refer to City of San Diego Greenbook/Whitebook/Supplementary Special Provisions

SECTION 01 1000 – SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. The Contract Documents as defined in SECTION 1-2, Definitions, of the Standard Specification for Public Works Construction (Greenbook), apply to the Work of this SECTION. Additional requirements and information necessary to complete the Work of this SECTION may be found in other documents.

C. Standard Specifications for Public Works Construction, Latest Edition, including City of San Diego Whitebook.

D. California Department of Transportation, Manual of Traffic Controls for Construction and Maintenance Work Zones, Latest Edition.

E. City of San Diego Standard Drawings including some Regional Standard Drawings, Latest Edition.

1.2 SUMMARY

A. SECTION Includes:
1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Work under separate contracts.
5. Owner-furnished products.
6. Coastal Development Permit Restrictions.
7. Height Restrictions.
8. Community Liaison and Principal Investigator.
9. Access to site.
10. Coordination with occupants.
11. Work restrictions.
12. Specification and drawing conventions.

B. Related Requirements:
1. SECTION 0150000 TEMPORARY FACILITIES AND CONTROLS for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: FIRE STATION #14 and FIRE STATION #19

B. Project Location: 4011 32nd Street and 3434 Ocean View Blvd, San Diego, California

C. Owner: City of San Diego.
Owner's Representative: Tamara Miller, Project Manager
Engineering and Capital Projects Department
600 B Street, Suite 800, MS #908A
San Diego, CA 92101

D. Architect: camiDESIGN
529 Market Street, Suite 2A
San Diego, CA 92101

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of but not limited to the following:
   1. Demolition of roofing material, mechanical equipment and other related items noted on plans.
   2. Construction of a new roof ladders, roofing material downspouts and gutter, mechanical equipment curbs and installation of mechanical equipment and related electrical work as well as other items noted in plans.

1.5 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.6 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts. Cooperate with the concurrent project contractor and provide schedule for work, incorporating works under this and concurrent project for Owner's approval.

B. There will be NO storage of equipment or materials outside of the property or in the Right-of-Way.

C. During Construction there will be no public access. Signage shall be installed to direct the public to the next closest fire station, cool zone or safe drop-off.

D. All staging/storage sites shall be removed and restored to original condition immediately following completion of the development.

1.7 HEIGHT RESTRICTIONS

A. 30 Foot Height Limit: At the completion of the Work, the Contractor shall certify that no portion of the building or its equipment exceeds 30 feet when measured from the highest adjacent grade within 5 feet of the building.

1.8 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this SECTION.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Limits: Confine construction operations to area proposed by the Contractor and approved by the Owner.
   2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.9 COORDINATION WITH OCCUPANTS

A. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, and other adjacent occupied or used facilities. Do not close or obstruct walkways, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
   2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
   1. Architect, under direction of the Resident Engineer (RE), will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
   2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.

3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.10 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to hours of 7:30 a.m. to 3:30 p.m., Monday through Friday, unless otherwise indicated.
   1. Weekend Hours: Not allowed.
   2. Hours for Utility Shutdowns: Contractor shall coordinate with RE for all shutdowns.
   3. Hours for work by heavy and noisy equipment: 9:00 am to 3:30 pm.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Owner not less than two days in advance of proposed disruptive operations.
   2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Building and Site: Smoking is not permitted within the building or on site.

F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

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. DIVISION 1 General Requirements: Requirements of SECTIONs in DIVISION 1 apply to the Work of all SECTIONs in the Specifications.

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 published as part of the U.S. National CAD Standard and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification SECTION numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

SECTION 01 4200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA Aluminum Association, Inc. (The) (703) 358-2960 www.aluminum.org
AAADM American Association of Automatic Door Manufacturers (216) 241-7333 www.aaadm.com
AABC Associated Air Balance Council (202) 737-0202 www.aabchq.com
AAMA American Architectural Manufacturers Association (847) 303-5664 www.aamanet.org
AASHTO Amer Assoc of State Highway and Trans Officials (202) 624-5800 www.transportation.org
AATCC American Association of Textile Chemists and Colorists (919) 549-8141 www.aatcc.org
ABAA Air Barrier Association of America (866) 956-5888 www.airbarrier.org
ABMA American Bearing Manufacturers Association (202) 367-1155 www.abma-dc.org
ACI American Concrete Institute (248) 848-3700 www.concrete.org
ACPA American Concrete Pipe Association (972) 506-7216 www.concrete-pipe.org
AEIC Association of Edison Illuminating Companies, Inc. (The) (205) 257-2530 www.aeic.org
AF&PA American Forest & Paper Association (800) 878-8878 www.afandpa.org (202) 463-2700
AGA American Gas Association (202) 824-7000 www.aga.org
AGC Associated General Contractors of America (The) (703) 548-3118 www.agc.org
AHA American Hardboard Association (Now part of CPA)
AHAM Association of Home Appliance Manufacturers (202) 872-5955 www.aham.org
AI Asphalt Institute (859) 288-4960 www.asphaltinstitute.org
AIA American Institute of Architects (The) (800) 242-3837 www.aia.org (202) 626-7300
AISC American Institute of Steel Construction (800) 644-2400 www.aisc.org (312) 670-2400
AISI American Iron and Steel Institute (202) 452-7100 www.steel.org
AITC American Institute of Timber Construction (303) 792-9559 www.aitc-glulam.org
ALCA Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)
ALSC American Lumber Standard Committee, Incorporated (301) 972-1700 www.alsc.org
AMCA Air Movement and Control Association International, Inc. (847) 394-0150 www.amca.org
ANSI American National Standards Institute (202) 293-8020 www.ansi.org
AOSA Association of Official Seed Analysts, Inc. (405) 780-7372 www.aosaseed.com
APA Architectural Precast Association (239) 454-6989 www.archprecast.org
APA - The Engineered Wood Association (253) 565-6600 www.apawood.org
EWS - Engineered Wood Systems (See APA - The Engineered Wood Association)

API American Petroleum Institute (202) 682-8000 www.api.org
ARI Air-Conditioning & Refrigeration Institute (703) 524-8800 www.ari.org
ARMA Asphalt Roofing Manufacturers Association (202) 207-0917 www.asphaltroofing.org
ASCE American Society of Civil Engineers (800) 548-2723 www.asce.org (703) 295-6300
ASCE/SEI American Society of Civil Engineers/Structural Engineering Institute (See ASCE)
ASHRAE Amer Soc of Heating, Refrig and AC Eng (800) 527-4723 www.ashrae.org
ASME ASME International (800) 843-2763 (Amer Soc of Mech Eng Internat'l) www.asme.org
ASSE American Society of Sanitary Engineering (440) 835-3040 www.asse-plumbing.org
ASTM ASTM International (610) 832-9500 (Amer Soc for Testing and Matls International) www.astm.org
AWCI Association of the Wall and Ceiling Industry (703) 534-8300 www.awci.org
AWCMA American Window Covering Manufacturers Association (Now WCMA)
AWI Architectural Woodwork Institute (571) 323-3636 www.awinet.org
AWPA American Wood Protection Association (205) 733-4077 www.awpa.com
AWS American Welding Society (800) 443-9353 www.aws.org (305) 443-9353
AWWA American Water Works Association (800) 926-7337 www.awwa.org (303) 794-7711
BHMA Builders Hardware Manufacturers Association (212) 297-2122 www.buildershardware.com
BIA Brick Industry Association (The) (703) 620-0010 www.bia.org
BICSI BICSI, Inc. (800) 242-7405 www.bicsi.org (813) 979-1991
BIFMA BIFMA International (616) 285-3963 (Bus and Institut'l Furn Manfs Assoc Internat'l) ww.bifma.com
BISSC Baking Industry Sanitation Standards Committee (866) 342-4772 www.bissc.org
BWF Badminton World Federation 6-03-9283 7155 www.internationalbadminton.org
CCC Carpet Cushion Council (610) 527-3880 www.carpetcushion.org
CDA Copper Development Association (800) 232-3282 www.copper.org (212) 251-7200
CEA Canadian Electricity Association (613) 230-9263 www.canelect.ca
CEA Consumer Electronics Association (866) 858-1555 www.ce.org (703) 907-7600
CFFA Chemical Fabrics & Film Association, Inc. (216) 241-7333 www.chemicalfabricsandfilm.com
CGA Compressed Gas Association (703) 788-2700 www.cganet.com
CIMA Cellulose Insulation Manufacturers Association (888) 881-2462 www.cellulose.org (937) 222-2462
CISCA Ceilings & Interior Systems Construction Association (630) 584-1919 www.cisca.org
CISPI Cast Iron Soil Pipe Institute (423) 892-0137 www.cispi.org
CLFMI Chain Link Fence Manufacturers Institute (301) 596-2583 www.chainlinkinfo.org
CRRC Cool Roof Rating Council (866) 465-2523 www.coolroofs.org (510) 485-7175
CPA Composite Panel Association (301) 670-0604 www.pbmdf.com
CPPA Corrugated Polyethylene Pipe Association (800) 510-2772 www.cppa-info.org (202) 462-9607
CRI Carpet and Rug Institute (The) (800) 882-8846 www.carpet-rug.com (706) 278-3176
CRSI Concrete Reinforcing Steel Institute (847) 517-1200 www.crsi.org
CSA Canadian Standards Association (800) 463-6727 (416) 747-4000
CSA CSA International (866) 797-4272 (416) 747-4000 www.csagroup.org
CSI Cast Stone Institute (717) 272-3744 www.caststone.org
CSI Construction Specifications Institute (The) (800) 689-2900 www.csinet.org (703) 684-0300
CSSB Cedar Shake & Shingle Bureau (604) 820-7700 www.cedarbureau.org
CTI Cooling Technology Institute (281) 583-4087 www.cti.org
DHI Door and Hardware Institute (703) 222-2010 www.dhi.org
EIA Electronic Industries Alliance (703) 907-7500 www.eia.org
EIMA EIFS Industry Members Association (800) 294-3462 www.eima.com (770) 968-7945
EJCDC Engineers Joint Contract Documents Committee (703) 295-5000 www.ejdc.org
EJMA Expansion Joint Manufacturers Association, Inc. (914) 332-0040 www.ejma.org
ESD ESD Association (315) 339-6937 (Electrostatic Discharge Association) www.esda.org
ETL SEMCO Intertek ETL SEMCO (800) 967-5352 www.intertek.com
FIBA Federation Internationale de Basketball 41 22 545 00 00 www.fiba.com
FIVB Federation Internationale de Volleyball 41 21 345 35 35 www.fivb.ch

FM Approvals FM Approvals LLC (781) 762-4300 www.fmglobal.com
FM Global FM Global (401) 275-3000 www.fmglobal.com
FMRC Factory Mutual Research (Now FM Global)
FRSA Florida Roofing, Sheet Metal & AC Contractors Assoc, Inc. (407) 671-3772 www.floridaroof.com
FSA Fluid Sealing Association (610) 971-4850 www.fluidsealing.com
FSC Forest Stewardship Council (612) 353-4511 www.fsc.org
GA Gypsum Association (202) 289-5440 www.gypsum.org
GANA Glass Association of North America (785) 271-0208 www.glasswebsite.com
GRI (Part of GSI)
GS Green Seal (202) 872-6400 www.greenseal.org
GSI Geosynthetic Institute (610) 522-8440 www.geosynthetic-institute.org
HI Hydraulic Institute (973) 267-9700 www.pumps.org
HI Hydronics Institute (908) 464-8200 www.gamanet.org
HMMA Hollow Metal Manufacturers Association (Part of NAAMM)
HPVA Hardwood Plywood & Veneer Association (703) 435-2900 www.hpva.org
HPW H. P. White Laboratory, Inc. (410) 838-6550 www.hpwhite.com
IAS International Approval Services (Now CSA International)
IBF International Badminton Federation (Now BWF)
ICEA Insulated Cable Engineers Association, Inc. (770) 830-0369 www.icea.net
ICRI International Concrete Repair Institute, Inc. (847) 827-0830 www.icri.org
IEC International Electrotechnical Commission 41 22 919 02 11 www.iec.ch
IEEE Institute of Electrical and Electronics Engineers, Inc. (The) (212) 419-7900 www.ieee.org
IESNA Illuminating Engineering Society of North America (212) 248-5000 www.iesna.org
IEST Institute of Environmental Sciences and Technology (847) 255-1561 www.iest.org
IGCC Insulating Glass Certification Council (315) 646-2234 www.igcc.org
IGMA Insulating Glass Manufacturers Alliance (613) 233-1510 www.igmaonline.org
ILI Indiana Limestone Institute of America, Inc. (812) 275-4426 www.iliai.com
ISO International Organization for Standardization 41 22 749 01 11 www.iso.ch
Available from ANSI (202) 293-8020 www.ansi.org
ISSFA International Solid Surface Fabricators Association (877) 464-7732
www.issfa.net (702) 567-8150
ITS Intertek Testing Service NA (Now ETL SEMCO)
ITU International Telecommunication Union 41 22 730 51 11 www.itu.int/home
KCMA Kitchen Cabinet Manufacturers Association (703) 264-1690 www.kcma.org
LMA Laminating Materials Association (Now part of CPA)
LPI Lightning Protection Institute (800) 488-6864 www.lightning.org
MBMA Metal Building Manufacturers Association (216) 241-7333 www.mbma.com
MFMA Maple Flooring Manufacturers Association, Inc. (888) 480-9138 www.maplefloor.org
MFMA Metal Framing Manufacturers Association, Inc. (312) 644-6610
www.metalframingmfg.org
MH Material Handling (Now MHIA)
MHIA Material Handling Industry of America (800) 345-1815 www.mhia.org (704) 676-1190
MIA Marble Institute of America (440) 250-9222 www.marble-institute.com
MPI Master Painters Institute (888) 674-8937 www.paintinfo.com (604) 298-7578
MSS Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
(703) 281-6613 www.mss-hq.com
NAAMM National Association of Architectural Metal Manufacturers (630) 942-6591 www.naamm.org
NACE NACE International (800) 797-6623 (National Association of Corrosion Engineers International) (281) 228-6200 www.nace.org
NADCA National Air Duct Cleaners Association (202) 737-2926 www.nadca.com
NAGWS Nat'l Assoc for Girls and Women in Sport (800) 213-7193 www.aahperd.org/nagws/

NAIMA North American Insulation Manufacturers Association (703) 684-0084 www.naima.org
NBGQA National Building Granite Quarries Association, Inc. (800) 557-2848 www.nbgqa.com
NCAA National Collegiate Athletic Association (The) (317) 917-6222 www.ncaa.org
NCMA National Concrete Masonry Association (703) 713-1900 www.ncma.org
NCPI National Clay Pipe Institute (262) 248-9094 www.ncpi.org
NCTA National Cable & Telecommunications Association (202) 775-2300 www.ncta.com
NEBB National Environmental Balancing Bureau (301) 977-3698 www.nebb.org
NECA National Electrical Contractors Association (301) 657-3110 www.necanet.org
NeLMA Northeastern Lumber Manufacturers' Association (207) 829-6901 www.nelma.org
NEMA National Electrical Manufacturers Association (703) 841-3200 www.nema.org
NETA International Electrical Testing Association (888) 300-6382 www.netaworld.org (269) 488-6382
NFHS National Federation of State High School Associations (317) 972-6900 www.nfhs.org
NFPA NFPA (800) 344-3555 (National Fire Protection Association) (617) 770-3000 www.nfpa.org
NFRC National Fenestration Rating Council (301) 589-1776 www.nfrc.org
NGA National Glass Association (866) 342-5642 www.glass.org (703) 442-4890
NHLA National Hardwood Lumber Association (800) 933-0318 www.natlhardwood.org (901) 377-1818
NLGA National Lumber Grades Authority (604) 524-2393 www.nlga.org
NOFMA NOFMA: The Wood Flooring Manufacturers Association (901) 526-5016 www.nofma.com
NOMMA National Ornamental & Miscellaneous Metals Association (888) 516-8585 www.nomma.org
NRCA National Roofing Contractors Association (800) 323-9545 www.nrca.net (847) 299-9070
NRMCA National Ready Mixed Concrete Association (888) 846-7622 www.nrmca.org (301) 587-1400
NSF NSF International (800) 673-6275 (Natl Sanitation Found Intern'l) (734) 769-8010 www.nsf.org
NSSGA National Stone, Sand & Gravel Association (800) 342-1415 www.nssga.org (703) 525-8788
NTMA National Terrazzo & Mosaic Assoc, Inc. (The) (800) 323-9736 www.ntma.com (540) 751-0930
NTRMA National Tile Roofing Manufacturers Association (Now TRI)
NWWDA National Wood Window and Door Association (Now WDMA)
OPL Omega Point Laboratories, Inc. (Now ITS)
PCI Precast/Prestressed Concrete Institute (312) 786-0300 www.pci.org
PDCA Painting & Decorating Contractors of America (800) 332-7322 www.pdca.com (314) 514-7322
PDI Plumbing & Drainage Institute (800) 589-8956 www.pdionline.org (978) 557-0720
PGI PVC Geomembrane Institute (217) 333-3929 http://pgi-tp.ce.uiuc.edu
PLANET Professional Landcare Network (800) 395-2522 (703) 736-9666 www.landcarenetwork.org
PTI Post-Tensioning Institute (602) 870-7540 www.post-tensioning.org
RCSC Research Council on Structural Connections www.boltcouncil.org
RFCI Resilient Floor Covering Institute (301) 340-8580 www.rfci.com
RIS Redwood Inspection Service (888) 225-7339 www.redwoodinspection.com (415) 382-0662
SAE SAE International (877) 606-7323 www.sae.org (724) 776-4841
SDI Steel Deck Institute (847) 458-4647 www.sdi.org
SDI Steel Door Institute (440) 899-0010 www.steeldoor.org
SEFA Scientific Equipment and Furniture Assoc (877) 294-5424 www.sefalabs.com (516) 294-5424
SEI/ASCE Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SGCC Safety Glazing Certification Council (315) 646-2234 www.sgcc.org
SIA Security Industry Association (866) 817-8888 www.siaonline.org (703) 683-2075
SIGMA Sealed Insulating Glass Manufacturers Association (Now IGMA)
SJI Steel Joist Institute (843) 626-1995 www.steeljoist.org
SMA Screen Manufacturers Association (561) 533-0991 www.smacentral.org
SMACNA Sheet Metal and AC Contractors' (703) 803-2980 Nat'l Assoc www.smacna.org
SMPTE Society of Motion Picture and Television Engineers (914) 761-1100 www.smpte.org
SPFA Spray Polyurethane Foam Alliance (800) 523-6154 www.sprayfoam.org
SPI/SPFD - The Soc of the Plastics Industry, Inc.;Spray Polyurethane Foam DIVISION (See SPFA)
SPIB Southern Pine Inspection Bureau (The) (850) 434-2611 www.spib.org

SPRI Single Ply Roofing Industry (781) 647-7026 www.spri.org
SSINA Specialty Steel Industry of North America (800) 982-0355 www.ssina.com (202) 342-8630
SSPC SSPC: The Society for Protective Coatings (877) 281-7772 www.sspc.org (412) 281-2331
STI Steel Tank Institute (847) 438-8265 www.steeltank.com
SWI Steel Window Institute (216) 241-7333 www.steelwindows.com
SWRI Sealant, Waterproofing, & Restoration Institute (816) 472-7974 www.swrionline.org
TCA Tile Council of America, Inc. (Now TCNA)
TCNA Tile Council of North America, Inc. (864) 646-8453 www.tileusa.com
TIA/EIA Telecomm Industry Assoc/Electronic Industries Alliance (703) 907-7700 www.tiaonline.org
TMS The Masonry Society (303) 939-9700 www.masonrysociety.org
TPI Truss Plate Institute, Inc. (703) 683-1010 www.tpinst.org
TPI Turfgrass Producers International (800) 405-8873 www.turfgrasssod.org (847) 649-5555
TRI Tile Roofing Institute (312) 670-4177 www.tileroofing.org
UL Underwriters Laboratories Inc. (877) 854-3577 www.ul.com (847) 272-8800
UNI Uni-Bell PVC Pipe Association (972) 243-3902 www.uni-bell.org
USAV USA Volleyball (888) 786-5539 www.usavolleyball.org (719) 228-6800
USGBC U.S. Green Building Council (800) 795-1747 www.usgbc.org
USITT United States Institute for Theatre Technology, Inc. (800) 938-7488 www.usitt.org (315) 463-6463
WASTEC Waste Equipment Technology Association (800) 424-2869 www.wastec.org (202) 244-4700
WCLIB West Coast Lumber Inspection Bureau (800) 283-1486 www.wclib.org (503) 639-0651
WCMA Window Covering Manufacturers Association (212) 297-2122 www.wcmanet.org
WCSC Window Covering Safety Council (800) 506-4636 (212) 297-2109 www.windowcoverings.org
WCMA - Window Covering Manufacturers Association (Now WCSC)
WDMA Window & Door Manufacturers Association (800) 223-2301 (847) 299-5200 www.wdma.com
NWWDA - National Wood Window and Door Association (Now WDMA)
WI Woodwork Institute (916) 372-9943 www.wicnet.org
WIC Woodwork Institute of California (Now WI)
WMMPA Wood Moulding & Millwork Producers Assoc (800) 550-7889 www.wmmpa.com (530) 661-9591
WSRCA Western States Roofing Contractors Assoc (800) 725-0333 www.wsrca.com (650) 570-5441
WWPA Western Wood Products Association (503) 224-3930 www.wwpa.org

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO International Association of Plumbing and Mechanical Officials (909) 472-4100 www.iapmo.org
ICC International Code Council (888) 422-7233 www.iccsafe.org
ICC-ES ICC Evaluation Service, Inc. (800) 423-6587 www.icc-es.org (562) 699-0543
UBC Uniform Building Code (See ICC)

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE Army Corps of Engineers (202) 761-0011 www.usace.army.mil
CPSC Consumer Product Safety Commission (800) 638-2772 www.cpsc.gov (301) 504-7923
DOC Department of Commerce (202) 482-2000 www.commerce.gov

DOD Department of Defense (215) 697-6257 http://.dodssp.daps.dla.mil
DOE Department of Energy (202) 586-9220 www.energy.gov
EPA Environmental Protection Agency (202) 272-0167 www.epa.gov
FAA Federal Aviation Administration (866) 835-5322 www.faa.gov
FCC Federal Communications Commission (888) 225-5322 www.fcc.gov
FDA Food and Drug Administration (888) 463-6332 www.fda.gov
GSA General Services Administration (800) 488-3111 www.gsa.gov
HUD Department of Housing and Urban Development (202) 708-1112 www.hud.gov
LBL Lawrence Berkeley National Laboratory (510) 486-4000 www.lbl.gov
NCHRP National Cooperative Highway Research Program (See TRB)
NIST National Institute of Standards and Technology (301) 975-6478 www.nist.gov
OSHA Occupational Safety & Health Administration (800) 321-6742 www.osha.gov (202) 693-1999
PBS Public Buildings Service (See GSA)
PHS Office of Public Health and Science (202) 690-7694 www.osophs.dhhs.gov/ophs
RUS Rural Utilities Service (202) 720-9540 (See USDA)
SD State Department (202) 647-4000 www.state.gov
TRB Transportation Research Board (202) 334-2934 http://gulliver.trb.org
USDA Department of Agriculture (202) 720-2791 www.usda.gov
USPS Postal Service (202) 268-2000 www.usps.com

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG Americans with Disabilities Act (ADA) (800) 872-2253
Architectural Barriers Act (ABA) (202) 272-0080 Accessibility Guidelines for Buildings and Facilities
Available from U.S. Access Board www.access-board.gov
CFR Code of Federal Regulations (866) 512-1800
Available from Government Printing Office (202) 512-1800 www.gpoaccess.gov/cfr/index.html
DOD Department of Defense Military Specifications and Standards (215) 697-2664
Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil
DSCC Defense Supply Center Columbus (See FS)
FED-STD Federal Standard (See FS)
FS Federal Specification (215) 697-2664
Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil
Available from Defense Standardization Program www.dps.dla.mil
Available from General Services Administration (202) 619-8925 www.gsa.gov
Available from National Institute of Building Sciences (202) 289-7800 www.wbdg.org/ccb
FTMS Federal Test Method Standard (See FS)
MIL (See MILSPEC)
MIL-STD (See MILSPEC)
MILSPEC Military Specification and Standards (215) 697-2664
Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil
UFAS Uniform Federal Accessibility Standards (800) 872-2253
Available from Access Board (202) 272-0080 www.access-board.gov

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation (800) 952-5210 www.dca.ca.gov/bhfti (916) 574-2041
CCR California Code of Regulations (916) 323-6815 www.calregs.com
CPUC California Public Utilities Commission (415) 703-2782 www.cpuc.ca.gov
TFS Texas Forest Service (979) 458-6650 Forest Resource Development www.txforestservice.tamu.edu

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

1.2 SUMMARY

A. SECTION includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:
   1. DIVISION 1 SECTION 01 1000 SUMMARY, for limitations on work restrictions and utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary construction facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of authorities having jurisdiction.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
   1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
   2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
   3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8- inch- OD corner and pull posts, with 1-5/8-inch- OD top rails and with screening fabric around construction and staging sites. Provide vehicular and pedestrian gates with locks.

B. Wood Enclosure Fence: Plywood, 8 feet high, framed with four 2-by-4-inch rails, with preservativetreated wood posts spaced not more than 8 feet apart. Provide covered walkways required by governing authorities for public rights-or-way.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

2.2 TEMPORARY FIRE STATION FACILITIES

A. **FS 14 - Temporary measures during construction impacts to the sleeping quarters:**
During the construction period where the heating/cooling systems are placed out of service, the Contractor shall provide temporary rental portable heating/cooling units to all the sleeping rooms at the station.

During the removal of the ceiling within the station, the Contractor shall temporary restore the ceiling by covering it with a minimum of 10 mil polyethylene clear plastic cover to minimize the impact and allow the usage of the rooms during construction.

The cost for providing the temporary/potable heating/cooling units shall be paid under the Lump Sum bid item "Construction of Fire Station 14 Roof & HVAC Replacement"

B. **FS 14 - Laydown / Staging area:**
The FS 14 has limited space for Contractor's laydown and staging on site. The Contractor shall utilize street parking for his staging need if available and shall apply to the City for the required permits. The Contractor has the option to utilize the available laydown areas at FS 19 for his related work at FS 14.

The cost for obtaining the required permits shall be covered under the allowance bid item "Building Permits, and Staging required permits"

C. **FS 19 - Temporary Trailer:**
The Fire Department has a trailer (24ftx60ft - Double Wide) available for the use as a temporary living quarters during the construction work at FS19. The trailer is presently stored at FS 38 located at 8441 New Salem St., San Diego, CA 92126.

The Contractor shall pick up the trailer, transport it, set it up at FS 19 on the Eastside Parking Lot for its using during the construction work. Following the restoration of the living quarters at the FS 19, the Contractor shall return the trailer to its original location at FS 38.

The cost for transporting - mobilizing and demobilizing the trailer including all require permits shall be covered under Lump Sum bid item "Construction of Fire Station 19 Roof & HVAC Replacement"

D. **FS 19 – Communication Alerting Systems in Trailer:**
The Contractor shall purchase seven (7) new illuminating Alerting Speakers. Please refer to the specification listed in Appendix L " Alerting Speakers Specification".

The owner's subcontractor, a City wide approved vendor, will provide and install the temporary wiring and equipment inside the building and the trailer for the voice, data and communication alerting system.

The cost for the seven (7) illuminating Alerting Speakers purchase shall be paid under the Lump Sum bid item "Communication Alerting Systems "

2.3 TEMPORARY CONSTRUCTION FACILITIES

A. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Store combustible materials apart from building.

2.4 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by during construction.

B. Temporary Sanitary Facilities (Porta-Potty): Provide temporary toilet and wash facilities for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. Facilities shall be cleaned on a weekly basis or more as needed.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Provide location for Temporary Sanitary Facilities (Porta-Potty) in a location for easy access to cleaning.

3.2 TEMPORARY UTILITY INSTALLATION

A. City Facilities Crew to provide the following utilities, arrange with owner after delivery of trailer and at completion of trailer use:
   1. Sewers and Drainage
   2. Water Service
   3. Electric Power Service
   4. Telephone Service

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Maintain support facilities until Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Provide limited temporary parking areas for construction personnel.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater and groundwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.

E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.
   3. Maintain and touchup signs so they are legible at all times.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in THE WHITEBOOK.

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

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

I. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
   1. Comply with work restrictions specified in DIVISION 1 SECTION 01 1000 SUMMARY.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
   2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Comply with requirements specified in SECTION 02 4119 SELECTIVE DEMOLITION.

F. Pest Control: 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. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations and as approved by Owner.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
   1. Construct covered walkways using scaffold or shoring framing.

2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work.

L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fireprevention program.
1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: 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, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   2. Use temporary equipment to control humidity until all wet work have been completed for 14 days.
   3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
      a. 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.
      b. 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.
      c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: 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. 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.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in "The Whitebook."

END OF SECTION 01 5000

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. ASTM INTERNATIONAL (ASTM) - ASTM E1971 (2005; R 2011) Stewardship for the Cleaning of Commercial and Institutional Buildings
2. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline, 2015.

1.2 SUBMISSION OF OPERATION AND MAINTENANCE DATA

A. Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The subcontractors must compile and prepare data and deliver to the Contractor prior to the training of Government personnel. The Contractor shall compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal.

B. Package Quality
   1. Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

C. Package Content
   1. Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Commissioned items with a specified data package requirement in the individual technical sections must use Data Package.

D. Changes to Submittals
   1. Manufacturer-originated changes or revisions to submitted data must be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data.Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

E Review and Approval

1. The Independent Commissioning Authority (CA) must review the commissioned systems and equipment submittals for completeness and applicability. The CA must verify that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The CA must communicate deficiencies to the Contracting Officer. Upon a successful review of the corrections, the CA must recommend approval and acceptance of these O&M manuals to the Contracting Officer. This work is in addition to the normal review procedures for O&M data.

F. O&M Database

1. Develop a database from the O&M manuals that contains the information required to start a preventative maintenance program.

1.3 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

A. Operating Instructions

1. Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

B. Safety Precautions

1. List personnel hazards and equipment or product safety precautions for all operating conditions.

C. Operator Prestart

1. Include procedures required to install, set up, and prepare each system for use.

D. Startup, Shutdown, and Post-Shutdown Procedures

1 Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

E. Normal Operations

1 Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

F. Emergency Operations

1 Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

G. Operator Service Requirements

1. Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

H. Environmental Conditions
   1. Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

I. Preventive Maintenance
   1. Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

J. Lubrication Data
   1. Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":
      a. A table showing recommended lubricants for specific temperature ranges and applications.
      b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
      c. A Lubrication Schedule showing service interval frequency.

K. Preventive Maintenance Plan and Schedule
   1. Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

L. Cleaning Recommendations
   1. Provide environmentally preferable cleaning recommendations in accordance with ASTM E1971.

M. Corrective Maintenance (Repair)
   1. Include manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

N. Troubleshooting Guides and Diagnostic Techniques
   1. Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

O. Wiring Diagrams and Control Diagrams

1. Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

P. Maintenance and Repair Procedures

1. Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

R. Removal and Replacement Instructions

1. Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

S. Spare Parts and Supply Lists

1. Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations.
   List spare parts and supplies that have a long lead-time to obtain.

T. Corrective Maintenance Work-Hours

1. Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

U. Appendices

1. Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

V. Product Submittal Data

1. Provide a copy of all SD-03 Product Data submittals required in the applicable technical sections.

W. Manufacturer's Instructions

1. Provide a copy of all SD-08 Manufacturer's Instructions submittals required in the applicable technical sections.

X. O&M Submittal Data

1. Provide a copy of all SD-10 Operation and Maintenance Data submittals required in the applicable technical sections.

Y. Parts Identification

1. Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

Z. Warranty Information

1. List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

AA. Personnel Training Requirements

1. Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

BB. Testing Equipment and Special Tool Information

1. Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

CC. Testing and Performance Data

1 Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms.

DD. Contractor Information

1. Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.4 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

A. Include Data Package and the following for control systems:
   1. Narrative description on how to perform and apply all functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built sequence of operations.
   3. Copies of all checkout tests and calibrations performed by the Contractor (not Cx tests).
   4. Full points list. A listing of rooms shall be provided with the following information for each room:
      a. Floor
      b. Room number
      c. Room name
      d. Air handler unit ID
      e. Reference drawing number
      f. Minimum cfm
      g. Maximum cfm
   5. Full print out of all schedules and set points after testing and acceptance of the system.
   6. Full as-built print out of software program.
   7. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

1.5 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

A. Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:
   1. Data Package
      a. Safety precautions
      b. Operator prestart
      c. Startup, shutdown, and post-shutdown procedures
      d. Normal operations
      e. Emergency operations
      f. Environmental conditions
      g. Lubrication data
      h. Preventive maintenance plan and schedule
      i. Cleaning recommendations
      i. Troubleshooting guides and diagnostic techniques
      k. Wiring diagrams and control diagrams
      l. Maintenance and repair procedures
      m. Removal and replacement instructions
      n. Spare parts and supply list
      o. Product submittal data
      p. O&M submittal data
      q. Parts identification
      r. Warranty information
      s. Testing equipment and special tool information
      t. Testing and performance data
      u. Contractor information

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7823

SECTION 01 8200 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Related Requirements:
   1. DIVISIONS 2 through 16 SECTIONS for specific requirements for demonstration and training for products in those sections.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in specified section or THE WHITEBOOK, for experienced in operation and maintenance procedures and training.

B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in THE WHITEBOOK for Project Management and Coordination. Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Resident Engineer.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual specification sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in DIVISION 1 SECTION 01 7823 OPERATION AND MAINTENANCE DATA.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner with at least fourteen days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 8200

SECTION 02 4115 - ELECTRICAL DEMOLITION

GENERAL

1.1 SUMMARY

A. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.

B. Disposal of materials.

C. Storage of removed materials.

D. Identification of utilities.

E. Removal of salvaged items.

F. Protection of items to remain as indicated on Drawings.

G. Relocate existing electrical equipment to accommodate construction.

1.2 RELATED DOCUMENTS

A. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS , DIVISION 1 SPECIFICATION SECTIONS AND THE THE WHITEBOOK, APPLY TO THIS SECTION.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of the *National Electrical Code* (NEC), OSHA, NFPA 70E – *Standard for Electrical Safety in the Workplace.*

B. Each person performing electrical demolition shall be a "qualified person" as defined by NFPA 70E and the NEC.

C. The following publications form a part of this specification to the extent referenced.
   1. Environmental Protection Agency (EPA).
      a. 40 CFR Part 761, *Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.*
      b. 40 CFR Part 273, *Standards for Universal Waste Management.*
   2. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA):
      a. 29 CFR Part 1910.94 Subpart G, *Occupational Health and Environmental Control.*
   3. Department of Transportation (DOT):
      a. 49 CFR Part 178, *Regulations for Shipping Container Specifications.*

1.4 COORDINATION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

C. Shut-down Periods:
   1. Arrange timing of electrical shut-down periods with the owner. Do not shut down any utility without prior written approval.
   2. Keep shut-down period to minimum or use intermittent period as directed by the owner.
   3. Maintain life-safety systems in full operation in occupied facilities, or provide notice minimum 3 days in advance.

D. Identify salvage items in cooperation with the owner.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Provide materials and equipment for patching and extending work as specified in the individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Before work begins on the demolition or salvage of electrical equipment, wiring, or systems:
   1. Inspect the site to identify any hazardous materials such as PCBs, asbestos, lead, mercury or other heavy metal, or toxic, flammable or explosive materials, or radioactive materials that may be handled, disturbed or removed. Typical locations of hazardous materials include:
      a. PCBs: Oil-filled transformers; potting material and/or capacitors in lighting ballasts; oil-filled capacitors associated with motors, UPS systems, voltage regulators, power-factor correction equipment
      b. Asbestos: Electrical insulation
   2. Have the inspection results available at the worksite, including any drawings, plans or specifications, as appropriate, to show the locations of any hazardous substances.
   3. Ensure that any hazardous materials found are safely contained or removed.
   4. During demolition work, if hazardous materials are discovered that were not identified in the initial inspection required above, stop work in the area and notify the owner. Do not resume work in the area until directed by the owner.

B. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.

C. Verify termination points and lockout-tagout device locations for services, circuits, and systems to be disconnected or removed.

D. Demolition Drawings are based on casual field observation and/or existing record documents. Report discrepancies to the owner before beginning demolition work.

E. Beginning of demolition work means Subcontractor accepts existing conditions.

3.2 PREPARATION

A. Protect existing materials, appurtenances and equipment which are not to be demolished. Repair or replace existing materials, appurtenances and equipment, building exterior and interior, and landscaping altered or damaged during demolition work to match existing undisturbed conditions at no additional cost to the owner.

B. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, maintenance personnel, Subcontractor's employees, and existing improvements to remain.

C. Maintain parking areas, driveways, exterior walkways, exit paths, and landscaping in a clean, undisturbed condition.

D. Coordinate utility service outages with the owner.
   1. Request underground utilities to be located and marked within and surrounding construction areas.
   2. Protect utilities indicated to remain, from damage.

E. Existing Low-Voltage Electrical Service: Maintain existing low-voltage (e.g. 480 V, 208 V) electrical service system in operation until new service system is complete and ready for operation. Disable service system only to make switchovers and connections. Obtain permission from the owner at least 3 working days before partially or completely disabling system. Minimize outage durations. If required, make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish, relocate, and extend existing electrical work to installations to accommodate new construction.

B. Establish an electrically safe work condition in areas where electrical work is to be removed.
   1. Disconnect, remove, and cap designated utility lines within demolition areas. Mark locations of disconnected utilities. Identify utilities and indicate capping locations on Project Record Documents.

C. Protect and retain power to existing active equipment that is to remain.
   1. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
   2. Install temporary wiring and connections to maintain existing systems in service during construction.

D. Carefully remove equipment, materials, or fixtures which are to be reused. Store and protect to prevent damage.
   1. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.

E. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not part of final project.
   1. Remove items in an orderly and careful manner.
   2. Remove abandoned wiring to panelboard circuit breaker or source of supply.
   3. Remove exposed abandoned raceways, including abandoned raceways above accessible ceiling finishes. Cut raceways flush with walls and floors, seal openings, and patch surfaces.
   4. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
   5. Remove exposed abandoned fasteners and supports. Cut embedded support elements flush with walls and floors.

F. Provide proper and permanent support to adjacent structure for all raceways and equipment to remain.

G. Repair adjacent construction and finishes damaged during demolition and extension work.
   1. Patch and seal unused existing wall penetrations to match existing conditions and to restore fire rating.

H. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. This includes the extension of the circuit from the last active device to the next device in the system to be activated.
   1. Reconnect equipment being disturbed by renovation work and required for continued service to its original source.

I. Investigate and measure the nature and extent of unanticipated items that conflict with intended function or design. Submit written report with accurate detailed information to the owner. While awaiting instructions from the owner, rearrange selective demolition schedule as necessary to continue overall job progress without delay.

J. Remove demolished materials as work progresses.

3.4 EXISTING ELECTRICAL DISTRIBUTION EQUIPMENT

A. Verify and identify loads served by circuits in existing electrical distribution equipment (e.g. switchgear, switchboards, motor control centers, panelboards) affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new circuit breakers as required.

B. Tag unused circuits as spare.

C. Where existing circuits are indicated to be reused, use measuring devices to verify circuits feeding Project area are not in use.

D. Remove existing wire no longer in use from distribution equipment to equipment.

E. Re-label circuit breakers, switches, and controllers to indicate loads served. Provide new, updated circuit directories where more than three circuits in a panelboard have been modified or rewired.

3.5 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Electrical Distribution Equipment: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide approved closure plates for vacant positions.

3.6 DISPOSITION OF MATERIAL AND EQUIPMENT

A. Remove and protect items indicated on Drawings to be salvaged and deliver in good condition to the owner.

B. Unless indicated otherwise, material removed under this Subcontract which is not to be salvaged or reused in the Project shall become the property of the Subcontractor.

C. Unless indicated otherwise, immediately remove demolished material from site. Do not store or permit debris to accumulate at the site. Dispose of materials legally off site. Do not burn or bury materials on site.

D. Upon completion, clean the entire area of demolition residue satisfactory for the continuation of the Work. Remove temporary work.

3.7 INSTALLATION OF RELOCATED EQUIPMENT

A. Install relocated materials and equipment under the provisions of the applicable sections of these specifications.

END OF SECTION 02 4115

SECTION 02 4119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. System Description:
   1. Demolition and removal of selected portions of building materials and/or equipment as noted on plans.
   2. Demolition and removal of selected site elements as noted on plans.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

A. Pre-Demolition Conference: Conduct conference at Project site.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for dust control and , for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Coordination of Owner's continuing occupancy of portions of existing building and the Owner's partial occupancy of completed Work.

C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

D. Pre-demolition Photographs or Video: Submit Photographs or Video of field conditions prior to beginning and work.

E. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

F. Notify Resident Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

G. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Resident Engineer. Any work related to hazardous materials will be paid for under an allowance.

H. Storage or sale of removed items or materials on-site is not permitted.

I. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITE BOOK, PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITE BOOK, SUBSTITUTION PROCEDURES.

2.2 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Resident Engineer.

E. Survey of Existing Conditions:
   1. Record existing conditions by use of preconstruction photographs.
   2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

3.3 PREPARATION

A. Provide items and procedures in compliance with THE WHITE BOOK - EXECUTION REQUIREMENTS

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
3. Cover and protect furniture, furnishings, and equipment that have not been removed.
4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Greenbook.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   5. Maintain adequate ventilation when using cutting torches.
   6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   9. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Resident Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.7 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 02 4119

SECTION 05 5133 - METAL LADDERS
[SEE SECTION 2.3 APPLICATION FOR EACH PROJECT]

PART 1 - GENERAL

1.1 SUMMARY

A. Provide Roof Access Ladders as noted on plans and with Paragraph 2.2 of this SECTION.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. Related sections:
   1. SECTION 06 1000 ROUGH CARPENTRY for attachment

1.3 REFERENCES

A. AA – Aluminum Association.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. OSHA 1910.27 – Fixed Ladders.

1.4 FIELD MEASUREMENTS

A. Verify by field measurement dimensions prior to shop fabrication.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITE BOOK, SUBMITTAL PROCEDURES
   1. Product Data: Manufacturer's data sheets on each product to be used, including the following:
      a. Preparation instructions and recommendations.
      b. Storage and handling requirements and recommendations.
      c. Installation methods.

2. Shop Drawings: Detailed drawings showing complete dimensions, all materials, mounting attachments, and fabrication details.
   a. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
   b. Provide templates for anchors and bolts specified for installation under other sections.
   c. Provide reaction loads for each hanger and bracket.
3. Evaluation Reports:
4. Sample of metal finish required by drawings.
5. Warranty: See Paragragh 1.9

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section.
   2. Installer : Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with The WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope materials and components to ensure drainage.

C. Store products in manufacturer's unopened packaging until ready for installation.

D. Prevent contact with materials causing discoloration or staining.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install ladders during inclement weather.

B. Do not install ladders to damp or frozen surfaces.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.
   1. Record of successful in-service performance.
   2. Sufficient production capacity to produce required units.
   3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

D. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.
   1. Record of successful in-service performance.
   2. Sufficient production capacity to produce required units.
   3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

   4. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

E. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

1.9 WARRANTY

A. See THE WHITEBOOK FOR EXECUTION REQUIREMENTS, for additional warranty requirements.

B. Manufacturer has responsibility for an extended Corrective Period for work of this section for a period of 5 years commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
   1. Defects in materials and workmanship.
   2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
   3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

C. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

PART 2 PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 MANUFACTURERS

A. Acceptable Manufacturer: O'Keeffe's, Inc.; 100 N Hill Drive, Suite 12, Brisbane, CA 94005. Toll Free Tel: (888) 653-3333. Tel: (415) 824-4900. Fax: (415) 824-5900. Email: info@okeeffes.com. Web: http://www.okeeffes.com.

B. OR Approved Equal

2.3 APPLICATIONS

A. Provide the following [3] ladders for Fire Station 14:
   1. Fixed Access Ladder:
   2. Heavy Duty Tubular Rail.
   3. Model 501 as manufactured by O'Keeffe's Inc.
   4. Off-floor Mounting Bracket with 7" backset also available @ 7'-0"oc.
   5. Include Safety post for each ladder

B. Provide the following ladders for Fire Station 19:
   1. Provide the [5] Tubular Rail Low Parapet Access Ladder with Roofover Rail Extension, Model 502 as manufactured by O'Keeffe's Inc. Off-floor Mounting Bracket with 7" backset also available @ 7'-0"oc.
   2. Provide the [1] Tubular Rail Low Parapet Access Ladder with Platform and Return, Model 503 as manufactured by O'Keeffe's Inc. Off-floor Mounting Bracket with 7" backset also available @ 7'-0"oc.

2.4 FINISHES

A. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.

2.5 MATERIALS

A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

C. Fasteners: Aluminum solid aircraft rivets rated at 300 lbs (1335 N) shear strength.

D. Cast fittings, connectors and rung ends: Cast Aluminum alloy 356

2.6 FABRICATION

A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
   1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.

B. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.

C. Ladder Safety Post: Retractable hand hold and tie off.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If structure or substrate preparation is unsatisfactory preparation , notify Resident Engineer before proceeding.

C. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

D. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

3.2 INSTALLATION

A. Provide items and procedures in compliance with THE WHITEBOOK for EXECUTION REQUIREMENTS

B. Install in accordance with manufacturer's instructions and approved shop drawings, and in compliance with ANSI A14.3 and OSHA 1910.27.

C. Install electrical grounding of ladders.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.4 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 05 5133

SECTION 06 1000 - ROUGH CAPENTRY

PART 1.-.GENERAL

1.1 SUMMARY

A. Provide lumber and sheathing as indicated on the plans and as necessary for installation of products indicated on drawings.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

1.4 FIELD MEASUREMENTS

A. Verify field measurements for installation only.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
   1. Catalog or Product Data:
   2. Evaluation Reports:

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope materials and components to ensure drainage.

C. Prevent contact with materials causing deterioration and mold.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install lumber materials during inclement weather.

B. Do not install lumber materials to damp or frozen surfaces.

1.8 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. Regulatory Requirements: Comply with applicable provisions of the following codes and standards, unless modified by the specifications or drawings.
   1. California Building Code, adopted edition, Chapter 25, "Wood".

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 GRADE STAMPS

A. Framing lumber: Identify all framing lumber by the grade stamp of the West Coast Lumber Inspection Bureau.

B. Plywood: Identify all plywood as to species, grade, and glue type by the stamp of the American Plywood Association.

C. Other: Identify all other materials of this section by the appropriate stamp of the agency listed in the reference standards, or by such other means as are approved by the Resident Engineer.

2.3 GENERAL REQUIREMENTS

A. Moisture content at time of placing:
   1. Untreated lumber shall not exceed 19%.
   2. Plywood shall not exceed 15%.

B. Sizing and Surfacing: Mill size. All exposed surfaces of wood members shall be surfaced smooth except as indicated otherwise.

2.4 LUMBER

A. See drawings for grades for specific uses and locations.

2.5 PLYWOOD

A. Structural Plywood: U.S. Product Standard PS-1 per Structural Wood Notes.

B. All plywood shall be grade-marked by the American Plywood Association (APA). Remove all sheets not grade marked.

C. Plywood used for structural purposes shall have exterior glue.

2.6 BUILDING PAPER

A. "Tyvek", or equal.

2.7 ROUGH HARDWARE

A. Furnish all items of rough hardware, connections, bolts, etc., required to complete the work. Bolts, nuts, and washers where exposed to elements shall be hot-dipped galvanized, conforming to ASTM A153.

1. Nails: Common wire. Use galvanized nails for all exposed framing. Use ring shank nails for floor sheathing.
2. Bolts: Standard mild steel, square or hexagonal head machine bolts with matching nuts and cut washers, or carriage bolts with square nuts and cut washers as indicated.
3. Lag Bolts and Screws: Conform to Fed. Spec. FF-B-561B, of sizes shown or noted on drawings.
4. Toggle Bolts: Galvanized conforming to Fed. Spec. FF-B-588B(2), of sizes shown or noted on drawings.
5. Concrete and Masonry Anchors: Where anchors are not included in the concrete or masonry construction, anchors shall be galvanized machine screws or bolts with standard expansion-shield type concrete anchors, "Wej-It" Concrete Anchors as manufactured by Wej-It Expansion Products, Inc., Ramset Fasteners' "Dynabolt", McCullock Industries, "Kwik-Bolt", or approved equal, of the size and types noted on drawings or as required. Do not use expansion bolts or anchors where other type anchors are shown or noted on the drawings.
6. Powder-Driven Fasteners: "Drive-It" system of the Powder Power Tool Corporation, "Ramset" system of Ramset Fasteners, Inc., the equivalent system of Remington-Dupont, or equal. Use washers with all fasteners. Powder-driven fasteners shall not be used except where first approved by the Resident Engineer in writing.
7. Framing Anchors: Simpson Co. Strong-tie connectors or equal, galvanized framing connectors and joist hangers as detailed, not less than 18 gage before galvanizing, having minimum design and load capacity given on the drawings, with manufacturer supplied nails.
    a. Submit current ICBO report of alternate connectors and list of comparable connector values.

2.8 MISCELLANEOUS ITEMS

A. Rough carpentry work and miscellaneous items and their related components which are to be furnished and/or installed under this section are not necessarily individually described. The most important features and those requiring detail description are mentioned. Rough carpentry work and miscellaneous items not mentioned or described shall be furnished and/or installed in accordance with the intent of the drawings and specifications and as required to complete the work.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Provide items and procedures in compliance with THE WHITEBOOK for EXECUTION REQUIREMENTS

B. Coordinate as required with other work to assure proper and adequate provision in other work for interface with the work of this section.

C. Install the work of this section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures, anchoring all components firmly into position for long life under hard use.

D. All rough carpentry shall produce joints true, tight, and well nailed, with all members assembled in accordance with the Drawings and with all pertinent codes and regulations.

E. Selection of lumber pieces:
   1. Carefully select all members. Select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing or making connections.
   2. Cut out and discard all defects which will render a piece unable to serve its intended function. Lumber may be rejected by the Resident Engineer, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

3.3 INSTALLATION OF PLYWOOD SHEATHING

A. Placement:
   1. Place all plywood with face grain perpendicular to supports and continuously over at least two supports, except where otherwise specifically indicated on the Drawings.
   2. Center joints accurately over supports. Unless otherwise specifically shown on the Drawings, stagger the end joints of plywood panels to achieve a minimum of continuity of joints.
   3. Where required by drawings, provide adequate notification of Special Inspector for plywood installation.

B. Protection of Plywood: Protect all plywood from moisture by use of all required waterproof coverings until the plywood has in turn been covered with the next succeeding component or finish.

3.4 FASTENING

A. Nailing:
   1. Use only common wire nails or spikes of the dimension shown on the Nailing Schedule, except where otherwise called for on the Drawings.
   2. For conditions not covered in the Nailing Schedule, provide penetration into the piece receiving the point of not less than 1/2 the length of the nail or spike provided, however, that 16d nails may be used to connect two pieces of two inch nominal thickness.
   3. Do all nailing without splitting wood. Pre-bore as required. Replace all split members.

B. Bolting: Drill holes 1/16 inch larger in diameter than the bolts being used. Drill straight and true from one side only. Bolt threads shall not bear on wood. Use washers under head and nut where both bear on wood; use washers under all nuts.

   1. Bolt in studs of partitions which abut a concrete wall at top, bottom and middle using 1/2" bolts.

C. Screws: For lag screws and wood screws, pre-bore holes same diameter as root of thread; enlarge holes to shank diameter for length of shank. Screw, do not drive, all lag screws and wood screws.

D. Where powder-driven anchors are approved for use, plates anchored to concrete floor shall be attached with pins not over 32 inches on center. All vertical furring shall be attached to concrete with pins not over 4 feet on center. Each pin shall penetrate to a minimum of 1-1/2 inch. Use washers with all pins. There shall be a minimum of 2 anchors for each member.

3.5 INSTALLATION OF BUILDING PAPER

A. Install the specified building paper over all exterior framing members lapping all joints to prevent penetration of water into the stud spaces, and securely fastening the paper in place in accordance with the manufacturer's published recommendations as approved by the Resident Engineer.

3.6 CLEANING UP

A. Keep the premises in neat, safe, and orderly condition at all times during execution of this portion of the Work, free from accumulation of sawdust, cut ends, and debris.

3.7 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATING AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 061000

SECTION 07 2500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide weather barriers as necessary to cover new or exposed wood products, prior to installation finish products.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. Related sections:
   1. SECTION 06 1000 ROUGH CARPENTRY
   2. SECTION 09.2400 STUCCO / CEMENT PLASTER

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

1.4 FIELD MEASUREMENTS

A. Verify field measurements for installation only.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
   1. Catalog or Product Data: for each product:
      a. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.
      b. Flexible flashing.
   2. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.
   3. Warranty: See Paragragh 1.9

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope materials and components to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply gutter or downspout materials during inclement weather.

B. Do not apply gutter or downspout materials to damp or frozen surfaces.

1.8 QUALITY ASSURANCE

A. Perform work per SMACNA Architectural Sheet Metal Manual and NRCA Roofing and Waterproofing Manual.

1.9 WARRANTY

A. Furnish [5] year manufacturer warranty for metal components against corrosion with an additional installers warranty for [5] years against fastener failure, water penetration at joints or failure to drain.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Chemical Company (The); Styrofoam Weathermate Plus Brand Housewrap.
      b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.

c. Raven Industries Inc.; Fortress Pro Weather Protective Barrier.
d. Or Approved Equal.

2. Water-Vapor Permeance: Not less than 150 g through 1 sq. m of surface in 24 hours per ASTM E 96/E 96M, Desiccant Method (Procedure A).

3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.

4. Allowable UV Exposure Time: Not less than three months.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.3 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch.
1. Products: Subject to compliance with requirements, provide one of the following:
a. DuPont (E. I. du Pont de Nemours and Company); DuPont Flashing Tape.
b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Butyl Self-Adhered Flashing.
c. Protecto Wrap Company; BT-25 XL for openings and PS-45 for roof.
d. Raven Industries Inc.; Fortress Flashshield.
e. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
f. Fortifiber Building Systems Group; Fortiflash 25 or Fortiflash 40.
g. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Plus Self-Adhered Flashing or Vycor V40 Self-Adhered Flashing.
h. Polyguard Products, Inc.; Polyguard JT-20 Tape or Polyguard JT-30 Tape.

B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

C. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Provide items and procedures in compliance with THE WHITEBOOK for EXECUTION REQUIREMENTS

B. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

C. Cover sheathing with water-resistive barrier as follows:
   1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

D. Building Wrap: Comply with manufacturer's written instructions.
   1. Seal seams, edges, fasteners, and penetrations with tape.
   2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
   1. Prime substrates as recommended by flashing manufacturer.
   2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
   3. Lap flashing over water-resistive barrier at bottom and sides of openings.
   4. Lap water-resistive barrier over flashing at heads of openings.
   5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.3 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 07 2500

SECTION 07 6200 - SINGLE-PLY MEMBRANE

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install specified roofing and related components as follows:

B. Work includes:
   1. Removal of existing roofing and flashings down to wood deck:
   2. Installation of the following:
      a. 1.5" Isocyanurate and air/vapor barrier, mechanically fastened to wood deck. Install additional tapered insulation as required to provide positive slope to drain. 1/4" Dens-Deck Prime gypsum cover board set in low rise foam adhesive.
      b. 80 mil fleece back G410 PVC membrane.
      c. Specified flashing and accessories. Provide new 96 mil walkway protection from roof access points to and around units.
      d. Secure PVC membrane at perimeter and penetration flashings with mechanical fastener.
      e. PVC wall flashings, set in V.O.C. Compliant Bonding Adhesive, short parapet walls shall be wrapped to outside edge, termination at high walls, units will require termination bar with butyl tape.
      f. Install perimeter clad metal detail to match existing perimeter profile.
      g. Through roof penetrations shall be sealed with PVC Boot Flashings.
      h. Remove obsolete roof mounted equipment designated during walk though.
      i. Remove and replace existing roof drains with new cast iron drain assemblies.
      j. Remove designated slope metal roof section to allow for proper tie in under existing underlayment with PVC membrane system.
      k. Install treated blocking set on PVC walkpads system to properly support service lines on roof.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. Related sections:
   1. SECTION 06 1000 ROUGH CARPENTRY for attachment

C. THE CITY OF SAN DIEGO FACILITIES DIVISION CONSTRUCTION STANDARDS AND SPECIFICATION GUIDELINE, 2015
DIVISION 7 Thermal and Moisture Protection Roofing: Option 3.
Roof material and specifications on ¼" to 3" per foot roof slope:
Facilities DIVISION also uses Single Ply membranes. This system is designed to be applied with a heat welding application. Single Ply roofing include TPO and PVC. Membrane is suitable for use in all types of systems: Mechanically Attached, Ballast Applied, and or Fully Adhered. TPO or PVC shall consist of a minimum of 60 Mil Membrane and Installed to Manufacturers Specifications.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

1.4 FIELD MEASUREMENTS

A. Verify field measurements for installation only.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
1. Catalog or Product Data:
2. Shop Drawings: of required details
3. Evaluation Reports:
4. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.
5. Warranty: See Paragragh 1.9
6. Maintenance: Provide in writing the quantities to be provided by Paragraph 1.10

B. Qualifications
1. Manufacturer: Company specializing in manufacturing products specified in this section.
2. Installer : Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope materials and components to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

D. Delivery of materials:
   1. Deliver materials to job site in new, dry, unopened, and well-marked containers showing product and manufacturer's name.
   2. Deliver materials in sufficient quantity to allow continuity of work.
   3. Coordinate delivery with the City.

E. Do not order project materials or start work before receiving written approval from the City.

F. Storage of materials:
   1. Store roll goods on ends only. Discard rolls which have been flattened, creased, or otherwise damaged. Place materials on pallets. Do not stack pallets.
   2. For insulation, remove plastic packaging shrouds. For felt rolls, slit the top of the plastic shrink wrap only. Cover top and sides of all stored materials with tarpaulin (no polyethylene). Secure tarpaulin.
   3. Rooftop storage: Disperse material to avoid concentrated loading.
   4. No materials may be stored in open or in contact with ground or roof surface.
   5. Should Contractor be required to quickly cover material temporarily, such as during an unanticipated rain shower, all materials shall be stored on a raised platform covered with secured canvas tarpaulin (not polyethylene), top to bottom.
   6. Contractor shall assume full responsibility for the protection and safekeeping of products stored on premises.

G. Material handling:
   1. Handle materials to avoid bending, tearing, or damage during transportation and installation.
   2. Material handling equipment shall be selected and operated so as not to damage existing construction or applied roofing. Do not operate or situate material handling equipment in locations that will hinder smooth flow of vehicular or pedestrian traffic.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing materials during inclement weather.

B. Do not apply roofing materials to damp or frozen surfaces.

C. Field measurements and material quantities:
   1. Contractor shall have SOLE responsibility for accuracy of all measurements, estimates of material quantities and sizes, and site conditions that affect work

D. Existing conditions:
   1. Building space directly under roof area covered by this specification will be utilized by ongoing operations. Do not interrupt City operations unless prior written approval is received from the City.
   2. Access to roof shall be from exterior only.

3. Air conditioning units and other equipment shall be moved as required to install roofing materials complete and in accordance with plans and specifications. When units and equipment are to be moved. They shall be carefully disconnected and removed to a protected area so as not to damage any part or component thereof, and shall be reconnected in such a way that they are restored to a prior-work operating condition. Appropriate measures shall be taken to prevent dust, vapors, gases, or odors from entering the building during roof removal, replacement, or repair.
4. All disconnection and re-connection shall be performed by city's pre-selected mechanical contractor under separate contract between city and mechanical contractor.

E. Safety requirements:
1. All application, material handling, and associated equipment shall conform to and be operated in conformance with OSHA safety requirements.
2. Comply with federal, state, local, and City fire and safety requirements.
3. Advise the City whenever work is expected to be hazardous to any persons of the City community, employees, and/or operators.
4. Maintain a crewman as a floor area guard whenever roof decking is being repaired or replaced.
5. Maintain fire extinguisher within easy access whenever power tools, roofing kettles, and torches are being used.

F. Waste disposal:

Do not re-use, re-cycle or dispose of material manufacturers product containers except in accordance with all applicable regulations. The user of manufactured products is responsible for proper use and disposal of product containers.

G. Environmental requirements:
1. Do not work in rain, or in presence of water.

H. Security requirements:
1. Comply with City security requirements.
2. Provide City with current list of persons on the job site.

1.8 QUALITY ASSURANCE

A. Contractor shall:
1. Be a Manufacturer's Certified or Approved Contractor to meet the manufacturer's warranty to install the System Single -Ply Roofing Membrane Installation.

B. Roofing material manufacturer shall:
1. Be an Associate Member in good standing with the National Roofing Contractors' Association (NRCA).
2. Be nationally recognized in roofing, waterproofing, and moisture survey industry.
3. Be approved by the city.
4. The City is a supporter of responsible Health, Safety and Environmental (HS&E) issues and requires all manufacturers to have similar concerns, convictions, and

commitments. To this end, the primary manufacturers of materials used on building city roof must submit a formalized Corporate HS&E Policy and demonstrate active participation in such a policy.

5. Provide a Project Close-out Report upon delivery of the project warranty. This report shall include the following sections:
   a. Project Specifications
   b. Project Summary
   c. Project reports as a result of roof inspections.
   d. Job progress photos.
   e. Warranty document.
   f. Owners's Manual describing maintenance and emergency repair.
   g. Inspection Report to be completed by the roofing material manufacturer on annually.
6. The roofing material manufacturer will be ISO 9001 Certified.
7. Provide local Field Representative to make daily site visits, report work quality and job progress.

C. Project meetings:
   1. Final inspection:
      a. Will be scheduled by City upon job completion.
         1. Contractor.
         2. Roofing material manufacturer.
         3. Architect and City representative.
      b. Minimum agenda:
         1. Walkover inspection.
         2. Identification of problems which may impede issuance of warranty.

D. Random sampling:
   1. Roofing material:
      a. During course of work, City's Representative may secure samples according to ASTM D140-93 of materials being used from containers at job site and submit them to an independent laboratory for comparison to specified material.
      b. Should test results prove that a material is not functionally equal to specified material:
         1. Contractor shall pay for all testing.
         2. Roofing installed and found not to comply with the specifications shall be removed and replaced at no change in the contract price.

E. Regulatory requirements:
   1. Uniform Building Code.
   2. UL Classified Fire Rating - UL 790.
   3. Class A.

F. Plans and specifications:

1. Contractor shall notify the Project Manager of any omissions, contradictions, or conflicts prior to start of work. The Resident Engineer shall provide necessary corrections or additions to plans and specifications by addendum. If Contractor does not so notify the City of any such condition, it will be assumed that the Contractor has included the necessary items in the bid to complete this specification.
2. It is the intent that at the end of this project the roof be completed and watertight. Contractor must make own contracts with various subcontractors and be held responsible for completion of the project.
3. If the Contractor feels a conflict exists between what is considered good roofing practice and these specifications, contractor shall state in writing all objections prior to submitting quotations.
4. It is the Contractor's responsibility during the course of the work to bring to the attention of the City's representative any defective membrane, insulation or deck discovered where not previously identified.

1.9 WARRANTY

A. Warranty

1. Upon project completion, Manufacturer acceptance, and once complete payment has been received, by both Contractor and Manufacturer, submit executed copy of manufacturer's 30 Year Quality Assurance Warranty, with the Sika Sarnfil System.
2. Warranty Coverage Includes:
   - The Roof Membrane and adhesives.
   - The Flashings.
   - Insulation.
   - Edge components
   - Projection flashings.
   - Sheet metal terminations.
   - Wind speed coverage shall be a minimum of 74 M.P.H

B. Guarantee

1. Upon project completion and City acceptance, effective upon complete payment, Contractor shall issue the City a guarantee against defective workmanship and materials for a period of five (5) years.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Sika Sarnafil System Inc., basis of design OR Approved Equal

C. Comply with quality control, references, specifications, and manufacturer's data. Products containing asbestos are prohibited on this project. Use only asbestos-free products.

D. Use all products with appropriate personal protection. User must read container label and material safety data sheets prior to use.

2.2 MANUFACTURER

A. Sika Sarnafil Inc., basis of design

B. OR APPROVED EQUAL

2.3 ROOF DECKING

A. Wood Decking: match existing for repairs / spot replacement.

2.4 INSULATION

A. Base layer: 1.5" x 4' x 8' Class 1 Polyisocyanurate.
Fasteners: #12 fasteners with 3" metal plates.

B. Cover Board: 1/4" Dens-Deck Prime.
Cover Board Adhesive: Low Rise Foam.

2.5 AIR/VAPOR BARRIER

A. Sarnavap 10:
1. A 10 mil thick polyethylene vapor barrier/air barrier. When unrolled off the core and unfolded, the sheet dimensions are 20 feet wide by 100 feet long. Consult Product Data Sheet for additional information.

2.6 MECHANICAL FASTENERS

A. Galvanized sheet steel to wood blocking:
1. Type II, Style 20, roofing nails; galvanized steel wire, flat-head, diamond-point, round, barbed shank.
2. Length: Sufficient to penetrate wood blocking 1-1/4 inches (32 mm) minimum.

B. Insulation Fasteners:
1. #12 Fasteners with 3" metal discs for base layer insulation. Length, sufficient to penetrate wood deck by ¾" below deck.

2.7 ROOFING MATERIALS

A. MEMBRANE:
1. Single Ply Membrane
   a. White G410 80 mil Fleece Back by Sika Sarnafil.
   b. Certified Minimum Thickness.

B. FLASHING:
1. G410 60 mil by Sika Sarnafil.

C. ADHESIVES:
1. Membrane Adhesive: 2121 Membrane Adhesive.
2. Flashing Adhesive: VOC Flashing Adhesive.
3. Sealants:
   a. Drawband sealant:
   b. Sika 1A by Sika.
4. Walkway panels:
   a. Walkway Rolls 39" x 50' 96 Mil Light Gray

D. MATERIAL PERFORMANCE DATA:
Thermoplastic PVC, fiberglass reinforced with polyester fleece backed. Must be CA Title 24 Compliant.

Single Ply Roof System - White

Parameters	ASTM Test Meth	Minimum ASTM Requiremer	Typical Physical Properties
Reinforcing Material	-		Fiberglass
Overall Thickness, min., inches (mm)	D638	0.080	0.080
Tensile Strength, min., psi (MPa)	D638	1500	1600
Elongation at Break, min. (machine x tranver	D638	250% / 230'	270% / 250%
Seam strength, min. (% of tensile strength)	D638	75	80
Retention of Properties After Heat Aging	D3045	-	-
Tensile Strength, min., (% of original)	D638	90	95
Elongation, min., (% of original)	D751	90	90
Tearing Resistance, min., lbf (N)	D1004	10	14
Low Temperature Bend, -40° F (-40° C)	D2136	Pass	Pass
Accelerated Weathering Test (Xenon Arc)	D2565	5,000 Hour	10,000 Hour
Cracking (7x magnification)	-	None	None
Discoloration (by observation)	-	Negligible	Negligible
Crazing (7 x magnification)	-	None	None
Linear Dimensional Change, max.	D1204	0.10 %	0.02%
Weight Change After Immersion in Water, m	D570	± 3.0%	2.5%
Static Puncture Resistance, 33 lbf (15 kg)	D5602	Pass	Pass
Dynamic Puncture Resistance, 7.3 ft-lbf (10	D5635	Pass	Pass

* Failure occurs through membrane rupture not seam failure.

2.8 METAL FLASHINGS

A. Edge flashing/Coping Metal:
   1. All edge metal, scupper metal shall be PVC Clad Metal.
   2. Work shall be in accordance with Architectural Sheet Metal Manual, as issued by Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA).
   3. Coping Metal shall be 24 gauge Kynar on 22 gage wind cleats, color to be selected by Resident Engineer..

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions as satisfactory to receive work.

B. Do not begin roofing until all unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions.

C. Verify that work of other trades penetrating roof deck or requiring men and equipment to traverse roof deck has been approved by the City, manufacturer, and roofing contractor.

D. Check projections, curbs, and deck for inadequate anchorage, foreign material, moisture or unevenness that would prevent quality and execution of new roofing system.

3.2 GENERAL WORKMANSHIP

A. Substrate shall be free of foreign particles prior to laying roof membrane.

3.3 PREPARATION

A. Protection:
   1. Contractor shall be responsible for protection of property during course of work. Lawns, shrubbery, pavement areas, and buildings shall be protected from damage. Repair damage at no extra cost to the City.
   2. Prior to commencing removal of debris, provide at the site, a dumpster or dump truck to be located adjacent to building as directed by the City.
   3. Roofing, flashings, membrane repairs, and installation shall be installed and sealed in a watertight manner on same day of installation or before arrival of inclement weather.
   4. At start of each work day, drains within daily work area shall be plugged. Plugs to be removed at end of each work day or before arrival of inclement weather.
   5. Preparation work shall be limited to those areas that can be covered with installed roofing material on same day and before arrival of inclement weather.
   6. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surface, and equipment movement. Move equipment and ground storage areas as work progresses.

7. Protect building surfaces at set-up areas with tarpaulin. Secure tarpaulin. Remove dumpster from premises when full and empty at approved dumping or refuse area. Deliver empty dumpster to site for further use. Upon job completion, dumpster shall be removed from premises. Spilled or scattered debris shall be cleaned up immediately. Removed material to be disposed from roof as it accumulates.
8. At the end of each working day, removal area shall be sealed with water stops along edges to prevent water entry

B. Surface preparation:
1. Remove: Existing roofing/flashings to roof deck, remove flashings to substrate.
2. Sweep roof deck clean.

3.4 DECK REPAIRS

A. Replace any defective wood decking under unit price provisions of contract. Match existing type / profile.

3.5 INSULATION

A. Mechanically Fasten base layer of 1.5" 4' x 8' Polyisocyanurate Insulation to wood deck – 1 fastener every 2 square feet. Install ¼" Den-Deck Prime gypsum cover board in low rise foam adhesive.

3.6 ROOF SYSTEM APPLICATION

A. Provide items and procedures in compliance with THE WHITEBOOK for EXECUTION REQUIREMENTS

B. Install 80 mil Fleece Back PVC membrane over cover board, fully adhere in PVC Membrane Adhesive.

C. Heat weld all side / end laps per Manufacturer Field Requirements for heat welding of single ply membrane. All laps will be field tested to ensure complete and continuous weld /seal. Minimum 2" weld on all hand welds required, 1.5" on automatic welders. Heat welding of seams:
1. Wipe both sides of lap with approved solvent.
2. Adjust welding equipment air temperature prior to start.
3. Maintain air nozzle temperature and nozzle speed when joining laps together.
4. Remove lap sample from roof and test lap areas to assure proper bonding. When cool, pull test lap apart. When torn, the reinforcing scrim should become exposed. Patch test areas with new PVC of the same color and style, using a minimum 2" lap area.
5. Weld cover strips on end laps per warranty detail requirements.

3.7 FLASHINGS

A. General flashing requirements:
   1. Elastomeric flashing (and Expansion Joints):
      a. Install boots to plumbing vent supports and through roof penetrations per Sika Sarnafil warranty detail requirements. All curbs shall be completely roofed in with single ply. Non-Fleece Back Membrane may be used for perimeter and projection flashings, set in V.O.C. Compliant Bonding Adhesive. Secure at top with Termination Bar and caulk with Sika 1A before installing surface / counterflashing metal.
   2. Heat welding of seams:
      a. Wipe both sides of lap with approved solvent.
      b. Adjust welding equipment air temperature prior to start.
      c. Maintain air nozzle temperature and nozzle speed when joining laps together.
      d. Remove lap sample from roof and test lap areas to assure proper bonding. When cool, pull test lap apart. When torn, the reinforcing scrim should become exposed. Patch test areas with new PVC of the same color and style, using a minimum 2" lap area.

B. Roof Drains
   1. Remove and replace roof drains per project requirements with new cast iron with clamping ring, properly tie into existing service line.

3.8 WALKWAYS

A. Install walkway from roof access area to and around service areas on units.

3.9 ROOF HATCH

A. Install new Cal-Osha roof access hatch by Bilco. Properly secure to substrate. Install new CAL OSHA compliant safety rail system on hatch with gate.

3.10 ADJUSTING AND CLEANING

A. Repair of deficiencies:
   1. Installations of details noted as deficient during final inspection must be repaired and corrected by applicator and made ready for re-inspection within five (5) working days.

B. Clean-up:
   1. Immediately upon completion, roof membrane and flashing surfaces shall be cleaned of debris.
   2. Clean job site of debris.

3.11 WALKWAYS

A. Install walkway from roof access area to and around service areas on units

3.12 ADJUSTING AND CLEANING

A. Repair of deficiencies:
   1. Installations of details noted as deficient during final inspection must be repaired and corrected by applicator and made ready for re-inspection within five (5) working days.

B. Clean-up:
   1. Immediately upon completion, roof membrane and flashing surfaces shall be cleaned of debris.
   2. Clean job site of debris.

3.13 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823, OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

C. ALL FLAT ROOFS WILL BE FLOOD TESTED BEFORE CITY ACCEPTS ROOF. Any questions please contact Roofing Building Maintenance Supervisor James (Andre) Hart at 619-525-8554

END OF SECTION 07 6200

SECTION 07 6210 - METAL FLASHING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following sheet metal flashing and trim:
   1. Manufactured reglets.
   2. Formed roof drainage system.
   3. Formed low-slope roof flashing and trim.
   4. Formed wall flashing and trim.
   5. Formed equipment support flashing.
   6. Formed overhead-piping safety pans.

B. All Roofing Flashing to provided by the Single Ply Roofing Manufacturer
   1. See Single Ply Membrane specification for the Intergrated Roof Flashing.
   2. See Details for installation of Roof Flashing

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. Related sections include the following:
   1. SECTION 061000 ROUGH CARPENTRY for wood nailers, curbs, and blocking.
   2. SECTION 076200 SINGLE PLY MEMBRANE for installing sheet metal flashing and trim integral with roofing membrane.
   3. SECTION 079200 JOINT SEALANTS for field-applied sheet metal flashing and trim sealants.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

1.4 FIELD MEASUREMENTS

A. Verify field measurements for shop drawing details.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES

1. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

2. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
   a. Identify material, thickness, weight, and finish for each item and location in Project.
   b. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   c. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
3. Evaluation Reports:
4. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.
5. Warranty: See Paragragh 1.10

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section.
   2. Installer : Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

C. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

D. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply metal flashing materials during inclement weather.

B. Do not apply metal flashing materials to damp or frozen surfaces.

1.8 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in THE WHITEBOOK for Project Management and Coordination."
   1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
   2. Review methods and procedures related to sheet metal flashing and trim.
   3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.9 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
   1. Wind Zone 1: For velocity pressures of 10 to 20 lbf/sq. ft.: 40-lbf/sq. ft. perimeter uplift force, 60-lbf/sq. ft. corner uplift force, and 20-lbf/sq. ft. outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

E. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Furnish [5] year manufacturer warranty for metal components against corrosion with an additional installers warranty for [5] years against fastener failure, water penetration at joints or failure to drain.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 MANUFACTURER

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 SHEET METALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality, mill phosphatized for field painting.
   1. Thickness: 0.0217 inches

2.4 UNDERLAYMENT MATERIALS

A. See details and SECTION 07 6200 for various materials

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   1. Nails for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch minimum and not less than 7/8 inch long, barbed with large head.
   2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory applied coating.
   3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
   4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
   5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Burning Rod for Lead: Same composition as lead sheet.

E. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

F. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

H. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.6 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and welded corners and junctions.

1. Manufacturers:
   a. Cheney Flashing Company, Inc.
   b. Fry Reglet Corporation.
   c. Heckmann Building Products Inc.
   d. Keystone Flashing Company, Inc.

2. Material: Galvanized steel, 0.0229 inch thick. (22 GA)

3. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.

4. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.

5. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.7 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual"

2.8 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
   1. Gutter Style: C w/ continuous leaf screens throughout the gutter system.
   2. Expansion Joints: Lap type.
   3. Accessories: Bronze wire ball downspout strainer and Valley baffles.
   4. Gutters with Girth 21 to 25 Inches: Fabricate from the following material:
      a. Galvanized Steel: 0.0336 inch thick.
   5. Gutters with Girth 26 to 30 Inches: Fabricate from the following material:
      a. Galvanized Steel: 0.040 inch thick.

B. Downspouts: Fabricate round downspouts complete with mitered elbows.

2.9 WALL SHEET METAL FABRICATIONS

A. Openings Flashing in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high end dams. Fabricate from the following material:
   1. Galvanized Steel: 0.0239 inch thick.
   2. Aluminum-Zinc Alloy-Coated Steel: 0.0239 inch thick.
   3. Pre-painted, Metallic-Coated Steel: 0.0239 inch thick.

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:
   1. Galvanized Steel: 0.0276 inch thick.

B. Overhead-Piping Safety Pans: Fabricate from the following material:
   1. Galvanized Steel: 0.0396 inch thick.

2.11 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Provide items and procedures in compliance with THE WHITEBOOK for EXECUTION REQUIREMENTS

B. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Torch cutting of sheet metal flashing and trim is not permitted.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
   1. Coat side of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
   3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

D. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

E. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

F. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

   1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

G. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

H. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
   1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.

I. Seal joints with elastomeric sealant as required for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
   2. Prepare joints and apply sealants to comply with requirements in DIVISION 7 SECTION 07 9200 JOINT SEALANTS.

J. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except where pre-tinned surface would show in finished work.
   1. Do not solder pre-painted, metallic-coated steel sheet.
   2. Pre-tinning is not required for lead.
   3. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
   4. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
   5. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
   1. Fasten gutter spacers to front and back of gutter.
   2. Loosely lock straps to front gutter bead and anchor to roof deck.
   3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inchesapart.
   4. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.

C. Splash Pans: Install where downspouts discharge on low-sloped roofs. Set in asphalt roofing cement compatible with roofing membrane.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.

B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.7 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 07 6210

SECTION 07 7123 - DOWN SPOUTS AND GUTTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Gutters with leaf screens, downspouts, conductor heads, scuppers and overflow scuppers, accessory items including but not limited to gutter anchors, downspout straps and concrete splash blocks,

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. Related sections:
   1. SECTION 06 1000 ROUGH CARPENTRY for attachment

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

1.4 FIELD MEASUREMENTS

A. Verify field measurements for shop drawing details.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
   1. Catalog Data: Manufacturer's product specifications, standard details, installation instructions and general recommendations, as applicable to materials and finishes for each component and their complete installation.
   2. Shop Drawings: Complete shop drawings and erection details showing methods of erection, sections and details, flashings and all other accessories. Interface with all related work of other trades and proposed identification of component parts and finishes.
   3. Samples: One cross sectional sample of guttering and downspout, including clips, fasteners as applicable to project. Submit two color chip samples in color selected by Architect.
   4. Warranty: See Paragragh 1.9

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section.
   2. Installer : Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope materials and components to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply gutter or downspout materials during inclement weather.

B. Do not apply gutter or downspout materials to damp or frozen surfaces.

1.8 QUALITY ASSURANCE

A. Perform work per SMACNA Architectural Sheet Metal Manual and NRCA Roofing and Waterproofing Manual.

1.9 WARRANTY

A. Furnish [5] year manufacturer warranty for metal components against corrosion with an additional installers warranty for [5] years against fastener failure, water penetration at joints or failure to drain.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 MANUFACTURERS

A. Manufacturers:
   1. Metal-Era: Seal-Tite 1G-B Industrial Gutter, 24 ga.
   2. Architectural Products, Co.
   3. Hickman color chocolate brown A-11. (For scupper and conductor hd.)

2.3 SHEET METAL MATERIALS

A. Pre-Finished Galvanized Steel Sheet: ASTM A755 coil coated.
   1. Base Metal: ASTM A653, zinc coating.
   2. Exposed Finish: Silicone polyester or acrylic or electrolytic powder coating.
   3. Unexposed Finish: Manufacturer's standard.
   4. Splash Pads: Precast concrete type, with standard profile indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
   5. Downspout Boots/Shoes: Metal identical to rest of system.

B. Finish
   1. Provide Powder Coated colors to Resident Engineer to be selected from with Various Red Samples.

2.4 PRODUCTS

A. Section includes shop and field formed copper roofing accessories and trim, such as:
   1. Hung gutters with leaf screen
   2. Custom Overflow Rain Scupper to match existing (shape varies by location.)
   3. Downspouts (rain drainage).
   4. Miscellaneous accessories such as downspout strainers and gutter covers.
   5. Fastening.
   6. Precast concrete splash pads at downspout outflows.

2.5 FABRICATION

A. Form sections as indicated in Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate trim, flashing, and other metal components from same material as metal gutter sections. Provide exposed metal surfaces with same finish as exposed face of metal roof panels.

C. Fabricate strap ties of compatible material as gutters, to interlock with gutter.

D. Fabricate connector/expansion clips of same material as gutter that interlock with gutter by mechanical fastener or welding.

E. Form gutter and downspout sections in longest practical lengths or in single length sheets where possible.
   1. Gutters: Rectilinear in cross section unless otherwise indicated.
   2. Concealed where shown as part of canopy system at 1st/2nd floors only.

F. Hem exposed edges on 1/2-inch miter.

G. Provide expansion joints (slip joints) on gutters exceeding 50 feet in length

H. Roof side gutter flange to extend continuously up fascia or wall and terminate under drip edge or gravel stop. Where this is not possible, flange to be lapped with flat sheet metal that begins under edge of roof sheathing or drip edge and laps over the sloped rear gutter flange. The rear gutter flange must be bedded, when applied on plumb fascias, in silicone sealant.

I. Fabricate corners with 18 inch long legs. Weld mitered seam for rigidity, seal with sealant.

J. Install gutter connections per manufacturer's warranty requirements. Connections may be:
   1. Soldered.
   2. Screwed with sealant.
   3. Profile Connectors: Screwed with sealant.

K. Downspout collars on bottom of gutter trough must be screwed and sealed with sealant.

L. Form conductor head per SMAGNA guidelines using 3/A2-12 as a guide for dimensions.

M. Conductor head seams to be fully welded.

2.6 ACCESSORIES

A. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: Per SMACNA requirements.
   2. Gutter Supports: Brackets
   3. Downspout Supports: Brackets
   4. Fabricate gutter and downspout accessories; seal watertight

B. Fasteners: Screws
   1. For installations on wood framed structures through screwing is required with [8]-inch long galvanized or anodized screws within ferrules. Fastening to be at rafter tail locations with screws to penetrate both fascia and rafter tail.
   2. For fastening directly through gutter cross section, use screws of suitable length made of compatible material and finish as gutters and downspouts, with neoprene gaskets.

C. Primer: Zinc molybdate type.

D. Protective Backing Paint: Zinc molybdate alkyd.

E. Solder: ASTM B32, 50/50 type.

2.7 FACTORY FINISHING

A. Class 1 Natural Anodized Finish: AAMA 611, clear anodic coating not less than 0.7 mils thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive gutters and downspouts.

3.2 PREPARATION

A. Powder Coat pre-fabricated scupper and downspouts

B. Paint concealed metal/wood surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil and bed with silicone sealant.

3.3 INSTALLATION

A. Provide items and procedures in compliance with THE WHITEBOOK for EXECUTION REQUIREMENTS

B. Roll Formed Gutter: Join lengths with formed seams mechanically fastened and watertight. Flash and seal gutters to downspouts and accessories.

C. Install per manufacturer's instructions. If there is a conflict between Subcontract documents and manufacturer's instructions, comply with most stringent requirements.

D. Slope gutters 1/8 inch per foot minimum.

E. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

F. Connect downspouts to shoes at 8 inches above grade, seal connection watertight.

G. Install gutters 3/4 inches below slope of roof at outside edge.

H. Attach gutters to structure by both strap ties and by direct fastening through profile. Locate fasteners and strap ties a maximum of 24 inches on center.

I. Locate downspouts per Drawings.

J. Provide "open sided" downspouts to prevent gutter ice build-up.

K. Strap fasten downspouts at maximum 30 inches on center.

L. Do not locate downspouts with outflow creating an icing problem on pedestrian walkways.

M. Set splash pans under downspouts when application puts outflow onto a flat roof below. Secure in place.

N. Set splash pads under downspouts at grade and secure in place with soil or pins. Grade out flow soils to drainage area.

O. Connect downspouts to storm drains as indicated.

3.4 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 07 7123

SECTION 07 7233 - ROOF HATCHES [FS 14 ONLY]

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide factory-fabricated roof hatches for ladder access.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. Related sections:
   1. SECTION 06 1000 ROUGH CARPENTRY for attachment

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

1.4 FIELD MEASUREMENTS

A. Verify field measurements prior to shop fabrication.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
   1. Product Data: Submit manufacturer's product data.
   2. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.
   3. Evaluation Reports:
   4. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.
   5. Warranty: See Paragragh 1.9

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section.
   2. Manufacturer's Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

C. Deliver products in manufacturer's original packaging.

D. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope materials and components to ensure drainage.

E. Prevent contact with materials causing discoloration or staining.

F. Store materials in a dry, protected, well-vented area.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roof hatches during inclement weather.

B. Do not apply roof hatches to damp or frozen surfaces.

1.8 QUALITY ASSURANCE

A. Perform work per SMACNA Architectural Sheet Metal Manual and NRCA Roofing and Waterproofing Manual.

1.9 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

B. Submit executed copy of manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 MANUFACTURERS

A. Basis-of-Design Manufacturer: Type E-50TB Roof Hatch by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-933-8478, Web: www.bilco.com.

B. OR Approved Equal.

2.3 ROOF HATCHES

A. Furnish and install the following 3 hatches where indicated on plans. Metal roof hatch Type E-50TB, preassembled from the manufacturer.
   1. Roof Hatch 1 - size width: 36" (914mm) x length: 30" (914mm). Width denotes hinge side. The roof hatch shall be single leaf. Thermally Broken.
   2. Roof Hatch 2 - size width: 36" (914mm) x length: 30" (914mm). Length denotes hinge side. The roof hatch shall be single leaf, not required to be thermally broken.
   3. Roof Hatch 3 - size width: 24" (914mm) x length: 30" (914mm). Length denotes hinge side. The roof hatch shall be single leaf. , not required to be thermally broken.

B. Performance characteristics:
   1. Cover and curb shall be thermally broken to prevent heat transfer between interior and exterior surfaces.
   2. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m^2) with a maximum deflection of 1/150th of the span or 20 psf (97kg/m^2) wind uplift.
   3. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
   4. Operation of the cover shall not be affected by temperature.
   5. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

C. Cover: Shall be 11 gauge (2.3mm) aluminum with a 5" (127mm) beaded flange with formed reinforcing members. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. Cover shall have a heavy extruded EPDM rubber gasket bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

D. Cover insulation: Shall be 3" (75mm) thick polyisocyanurate with an R-value = 18 (U=0.315 W/m^{2}K), fully covered and protected by an 18 gauge (1mm) aluminum liner.

E. Curb: Shall be 12" (305mm) in height and of 11 gauge (2.3mm) aluminum. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation. The curb shall be formed with a 5-1/2" (140mm) flange with 7/16" (11mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the

corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.

F. Curb insulation: Shall be 3" (75mm) thick polyisocyanurate with an R-value = 18 (U=0.315 W/m^{2}K).

G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.

H. Hardware
   1. Heavy stainless steel pintle hinges shall be provided
   2. Cover shall be equipped with a spring latch with interior and exterior turn handles
   3. Roof hatch shall be equipped with interior and exterior padlock hasps.
   4. The latch strike shall be a stamped component bolted to the curb assembly.c
   5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25mm) diameter red vinyl grip handle to permit easy release for closing.
   6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed. [For installation in highly corrosive environments or when prolonged exposure to hot water or steam is anticipated, specify Type 316 stainless steel hardware].
   7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

I. Finishes: Factory finish shall be mill finish aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Provide items and procedures in compliance with THE WHITEBOOK for EXECUTION REQUIREMENTS

B. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
   1. Test units for proper function and adjust until proper operation is achieved.
   2. Repair finishes damaged during installation.
   3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

3.4 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION **07 7233**

SECTION 07 8400 – FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.
   1. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
   2. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

B. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

C. Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials. at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material shall be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM INTERNATIONAL (ASTM)
      a. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials
      b. ASTM E1399/E1399M Cyclic Movement and Measuring the Min and Max Joint Widths of Architectural Joint Systems
      c. ASTM E1966 Fire-Resistive Joint Systems
      d. ASTM E2174 Standard Practice for On-Site Inspection of Installed Fire Stops
      e. ASTM E2307 Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus

f. ASTM E2393 Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
g. ASTM E699 Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
h. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
i. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials

2. INTERNATIONAL CODE COUNCIL (ICC)
   a. ICC IBC International Building Code

3. UNDERWRITERS LABORATORIES (UL)
   a. UL 1479 Fire Tests of Through-Penetration Firestops
   b. UL 2079 Tests for Fire Resistance of Building Joint Systems
   c. UL 723 Test for Surface Burning Characteristics of Bldg Mat'ls
   d. UL Fire Resistance Fire Resistance Directory

4. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline, 2015.

1.4 FIELD MEASUREMENTS

A. Verify field measurements for installation only.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
   1. Catalog or Product Data:
   2. Shop Drawings: Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.
   3. Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification of compliance with UL 1479.
   4. Warranty: See Paragragh 1.9

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section.
   2. Installer : Submit documentation of training and experience for Installer.
   3. Engage an experienced Installer who is:
      a. FM Research approved in accordance with FM 4991, operating as a UL Certified Firestop Contractor, or
      b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training and experience in the installation of manufacturer's products in accordance with specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. The installer shall obtain from the manufacturer written certification of training,and retain proof of certification for duration of firestop installation.

C. Summary of submittal items:
   1. Shop Drawings: Firestopping Materials:
   2. Test Reports: Inspection
   3. Certificates: Inspector Qualifications
   4. Certificates: Firestopping Materials
   5. Certificates: Installer Qualifications

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name.

C. Store materials off the ground, protected from damage and exposure to elements and temperatures in accordance with manufacturer requirements.

D. Remove damaged or deteriorated materials from the site.

E. Use materials within their indicated shelf life.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply gutter or downspout materials during inclement weather.

B. Do not apply gutter or downspout materials to damp or frozen surfaces.

1.8 QUALITY ASSURANCE

A. Submit inspection report stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

B. Inspector Qualifications
   1. The inspector shall meet the criteria contained in ASTM E699 for agencies involved in quality assurance and shall have experience in construction field inspections of firestopping systems, products, and assemblies. The inspector shall be completely independent of, and divested from, the installer, the manufacturer, and the supplier of any material or item being inspected. The inspector shall not be a competitor of the installer, the contractor, the manufacturer, or supplier of any material or item being inspected. Include in the qualifications submittal a notarized statement assuring compliance with the requirements stated herein.

1.9 WARRANTY

A. Furnish [5] year manufacturer warranty for all components against failure, water penetration.

PART 2 PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 FIRESTOPPING MATERIALS

A. Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

2.3 FIRE HAZARD CLASSIFICATION

A. Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resistance or by a nationally recognized testing laboratory.

2.4. TOXICITY

A. Material shall be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and shall not contain hazardous chemicals or require harmful chemicals to clean material or equipment. Firestop material must be free from Ethylene Glycol, PCB, MEK, or other types of hazardous chemicals.

2.5 FIRE RESISTANCE RATING

A. Firestop systems shall be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems shall also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected. The City of San Diego Fire Marshall shall be consulted to determine further requirements.

2.6 THROUGH-PENETRATIONS

A. Firestopping materials for through-penetrations, as described in paragraph SYSTEM DESCRIPTION, shall provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E814 or UL 1479.

PART 3 EXECUTION

3.1 PREPARATION

A. Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

A. Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 100 mm 4 inches or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:
   1. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
   2. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
   3. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

4. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
5. Construction joints in floors and fire rated walls and partitions.
6. Other locations where required to maintain fire resistance rating of the construction.

B. Insulated Pipes and Ducts - Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

C. Fire Dampers - Install and firestop fire dampers in accordance with SECTION 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

D. Data and Communication Cabling - Cabling for data and communication applications shall be sealed with re-enterable firestopping products and devices.

E. Re-Enterable Devices - Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants; while maintaining "L" rating of <10 cfm/sf measured at ambient temperature and 400* F at 0 percent to 100 percent visual fill.

F. Re-Sealable Products - Provide firestopping pre-manufactured modular products, containing self-sealing intumescent inserts. Firestopping products shall allow for cable moves, additions or changes. Devices shall be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants.

3.3 INSPECTION

A. General Requirements for all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the Resident Engineer. The inspector shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

B. Inspect all firestopping in accordance to ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results to be submitted.

3.4 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 07 8400

SECTION 07 9200 - JOINTS SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes sealants for the following applications, including those specified by reference to this section:
   1. Interior joints in the following vertical surfaces and horizontal non-traffic surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Tile control and expansion joints.
      c. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      d. Other joints as indicated.
   2. Interior joints in the following horizontal traffic surfaces:
      a. Control and expansion joints in tile flooring.
      b. Other joints as indicated.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

1.4 FIELD MEASUREMENTS

A. Verify field measurements for installation only.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
   1. Product Data: For each joint-sealant product indicated.
   2. Shop Drawings:
   3. Evaluation Reports:
   4. Product Test Reports: From a qualified testing agency indicating sealants comply with requirements, based on comprehensive testing of current product formulations
   5. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

6. Samples: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
7. Warranty: See Paragragh 1.9

B. Qualifications
1. Manufacturer: Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

C. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply joint sealants materials during inclement weather.

B. Do not apply joint sealants materials to damp or frozen surfaces.

C. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

D. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
2. When joint substrates are wet.

E. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

F. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 QUALITY ASSURANCE

A. Perform work per SMACNA Architectural Sheet Metal Manual and NRCA Roofing and Waterproofing Manual.

1.9 WARRANTY

A. Furnish [5] year manufacturer warranty for metal components against corrosion with an additional installers warranty for [5] years against fastener failure, water penetration at joints or failure to drain.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

C. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Resident Engineer from manufacturer's full range for this characteristic.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

B. Additional Movement Capability: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

C. Stain-Test-Response Characteristics: Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

2.5 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
   1. Type C: Closed-cell material with a surface skin.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
2. Remove laitance and form-release agents from concrete.
3. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealants from surfaces adjacent to joint.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

ELASTOMERIC JOINT-SEALANT SCHEDULE

A. Low-Modulus Nonacid-Curing Silicone Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
   1. Products: Provide one of the following
      a. 790; Dow Corning.
      b. Silpruf; GE Silicones.
      c. Spectrem 1; Tremco.
   2. Type and Grade: S (single component) and NS (non-sag).
   3. Class: 25.
   4. Additional Movement Capability: 50 percent movement in extension and 50 percent movement in compression for a total of 100 percent movement.
   5. Use Related to Exposure: NT (non-traffic).

   6. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
      a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, masonry, ceramic tile, and wood.

7. Stain-Test-Response Characteristics: Non-staining to porous substrates per ASTM C 1248.
8. Applications:
   a. Interior control and expansion joints.

B. Mildew-Resistant Silicone Sealant: Where joint sealants of this type are indicated, provide products formulated with fungicide that are intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes, and that comply with the following:
1. Products: Provide one of the following
   a. 786 Mildew Resistant; Dow Corning.
   b. 898 Silicone Sanitary Sealant; Pecora Corporation.
   c. Tremsil 600 White; Tremco.
2. Type and Grade: S (single component) and NS (non-sag).
3. Class: 25.
4. Use Related to Exposure: NT (non-traffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
6. Application: Ceramic wall tile. LATEX JOINT-SEALANT SCHEDULE

C. Latex Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
1. Products: Provide one of the following
   a. Chem-Calk 600; Bostik Inc.
   b. Sonolac; Sonneborn Building Products Div., ChemRex, Inc.
   c. Tremflex 834; Tremco.
2. Applications:
   a. Interior non-moving vertical joints.

3.6 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 07 9200

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES [FS 14 ONLY]

PART 1 - GENERAL

1.1 SUMMARY

A. Non-fire-rated steel doors and frames.
   1. Exterior doors only.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. Related sections:
   1. SECTION 08 7100 - FINISH HARDWARE
   2. SECTION 09 9123 - INTERIOR PAINTING

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.
   2. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003. '
   3. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2004).

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.

C. Builders Hardware Manufacturers Association (BHMA)
   1.. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames.

D. National Association of Architectural Metal Manufacturers (NAAMM):
   1. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.

E, THE CITY OF SAN DIEGO FACILITIES DIVISION CONSTRUCTION STANDARDS AND SPECIFICATION GUIDELINE, 2015 - DIVISION 8 Doors and Windows, 1 Doors and Frames

1.4 FIELD MEASUREMENTS

A. Verify field measurements prior to shop fabrication.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES

1. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
2. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
3. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
4. Samples: Submit two samples of metal, 2 x 2 inches in size showing factory finishes, colors, and surface texture.
5. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
6. Warranty: See Paragragh 1.9
7. Maintenance: Provide in writing the quantities to be provided by Paragraph 1.10

B. Qualifications

1. Manufacturer: Company specializing in manufacturing products specified in this section.
2. Installer : Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope materials and components to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

D. Store in accordance with NAAMM HMMA 840.

E. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply door frames materials during inclement weather.

B. Do not apply door frames materials to damp or frozen surfaces.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

C. During submittal and ordering of door and frame verify that all doors and frames are properly prepared to receive the specified hardware.

1.9 WARRANTY

A. Furnish [5] year manufacturer warranty for metal components against corrosion with an additional installers warranty for [5] years against fastener failure, water penetration at joints or failure to drain.

PART 2 PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 MANUFACTURERS

A. Steel Doors and Frames:
   1. Assa Abloy Ceco, Curries, or Fleming: www.assaabloydss.com.
   2. Windsor Republic Doors: www.republicdoor.com.
   3. Steelcraft: www.steelcraft.com.

2.3 STEEL DOORS

A. Doors: Requirements for All Doors:
   1. Door Size: 3'-0" x 6'-8"
   2. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 1, full flush.
   3. Metal Gauge: All exterior door frames to be 16ga
   4. Door Core: Polystyrene Foam.
   5. Door Edge Profile: Beveled Full Edge Seam welded with sealed tops.
   6. Door Texture: Smooth faces.
   7. Finish: Factory primed, for field finishing.
   8. Door Stile: Provide door stile to be wide enough to accommodate heavy-duty mortise type lock.

B. Hardware Preparation:
   1. Frames to receive recessed full mortised hinge.
   2. Hollow metal doors shall be prepared for ANSI strike plates per A115.1-2 (4-7/8" high.)
   3. Hollow metal doors shall be properly prepared and reinforced with a minimum of 16 gauge material for either mortised locks as specified.
   4. Provide additional hardware as noted in SECTION 08 7100 HARDWARE.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.4 STEEL FRAMES

A. General:
   1. Metal Gauge: All exterior door frames to be 14ga
   2. Finish: Galvanized

B. Door Frames: Face welded, seamless with joints filled.

C. Hardware
   1. Frames to receive recessed full mortised hinge.
   2. Hinge preps will be mortised and reinforced with a minimum of 10 gauge reinforcement material.
   3. Provide additional hardware as noted in SECTION 08 7100 HARDWARE.

2.5 ACCESSORY MATERIALS

A. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

B. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

C. Door Head Drip Cap: Provide Drip Cap above door at all new exterior doors. Minimum width of the door x 2" depth.

2.6 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

3.2 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.3 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. Coordinate frame anchor placement with wall construction.

C. Coordinate installation of hardware.

3.4 TOLERANCES

A. Clearances Between Door and Frame: As specified in ANSI A250.8.

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.6 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 08 1113

SECTION 08 3113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Access door and frame units, non-fire-rated, in wall, and ceiling locations, sizes noted on architectural plans and/or as necessary for the mechanical access to new equipment.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. Related sections:
   1. SECTION 09 2900 GYPSUM BOARD for access doors installed in suspended gypsum board ceiling systems.
   2. SECTION 09 9113 EXTERIOR PAINTING Field paint finish
   3. SECTION 09 9123 INTERIOR PAINTING Field paint finish

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

1.4 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
   1. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
   2. Shop Drawings: Indicate exact position of all access door units.
   3. Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work. Project Record Documents: Record actual locations of all access units.
   4. Manufacturer's Installation Instruction s: Indicate installation requirements and rough -in dimensions.
   5. Warranty: See Paragragh 1.8

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope materials and components to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.

B. Size Variations: Obtain Resident Engineer's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.8 WARRANTY

A. Furnish [5] year manufacturer warranty for metal components against corrosion with an additional installers warranty for [5] years against fastener failure, water penetration at joints or failure to drain.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Access Doors:
      a. Acudor Products, Inc
      b. Cesco Products.
      c. Jensen Industries.
      d. J. L. Industries, Inc.

e. Karp Associates, Inc.
f. Larsen's Manufacturing Company.
g. Milcor Limited Partnership.
h. Or equal.

2.3 MATERIALS

A. Door and Frame Units: Formed steel.
1. Frames and flanges: 0.058 inch steel.
2. Door panels: 0.070 inch single thickness steel sheet.
3. Sizes: As noted on plans.
4. Hardware:
   a. Hinge: 175 degree stainless steel piano hinge with removable pin.
   b. Lock: Cylinder lock with latch, two keys for each unit.
5. Finish: Paintable surface

2.4 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.5 FABRICATION

A. General: Provide access door assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

C. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Provide 2 finish coats of paint after primer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.4 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 08 3113

SECTION 08 7100 - FINISH HARDWARE [FS 14 ONLY]

PART 1 -GENERAL

1.1 SUMMARY

A. Door Hardware

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. Related sections:
   1. SECTION 06 1000 ROUGH CARPENTRY for attachment

C, THE CITY OF SAN DIEGO FACILITIES DIVISION CONSTRUCTION STANDARDS AND SPECIFICATION GUIDELINE, 2015 DIVISION 8 Doors and Windows, Hardware Finishes.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

B. American National Standards Institute – ANSI 156.18 – Materials and Finishes.

C. ANSI A117.1 – Specifications for making buildings and facilities usable by physically handicapped people.

D. BHMA – Builders Hardware Manufacturers Association

E. DHI – Door and Hardware Institute

F. NFPA – National Fire Protection Association
   1. NFPA 80 – Fire Doors and Windows
   2. NFPA 101 – Life Safety Code
   3. NFPA 105 – Smoke and Draft Control Door Assemblies
   4. NFPA 252 – Fire Tests of Door Assemblies

G. UL – Underwriters Laboratories
   1. UL10C – Fire Tests of Door Assemblies (Positive Pressure)

H. State of California Building Code

I. SDI – Steel Door Institute

J. NAAM – National Association of Architectural Metal Manufacturers

K. THE CITY OF SAN DIEGO FACILITIES DIVISION CONSTRUCTION STANDARDS AND SPECIFICATION GUIDELINE, 2015 - DIVISION 8 Doors and Windows, 4 Hardware

1.4 FIELD MEASUREMENTS

A. Mandatory - Pre-Installation Meeting(s): Initiate and conduct with supplier, installer and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Convene at least one week prior to ordering material or commencement of related work.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
   1. Product Data:
      a. Type, style, function, size, quantity and finish of hardware items. Use BHMA Finish codes per ANSI A156.18.
      b. Name, part number and manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of hardware set coordinated with floor plans and door schedule.
      e. Explanation of abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for hardware.
      g. Door and frame sizes, materials and degrees of swing.
      h. List of manufacturers used and their nearest representative with address and phone number.
      i. Catalog cuts.
      j. Manufacturer's technical data and installation instructions for electronic hardware.
   2. Warranty: See Paragragh 1.10

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section
   2. Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course Work for project hardware consultation to Owner, Resident Engineer and Contractor. (1) Responsible for detailing, scheduling and ordering of finish hardware.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Hardware: New, free of defects, blemishes and excessive play. Obtain each kind of hardware, latch and locksets, exit devices, hinges and closers, from one manufacturer.

C. Delivery: coordinate delivery to appropriate locations (shop or field).
   1. Permanent keys and cores: secured delivery direct to Owner's representative.

D. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

E. Storage: Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc...

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install finish hardware during inclement weather.

B. Do not install finish hardware to damp or frozen surfaces.

1.8 SEQUENCING AND COORDINATION:

A. Coordinate with concrete.

B. Reinforce walls.

C. Coordinate finish floor materials and floor-mounted hardware.

D. Furnish manufacturer templates to door and frame fabricators.

E. Use hardware consultant to check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
   1. Confirm that door manufacturers furnish necessary UBC-7-2 compliant seal packages.

1.9 QUALITY ASSURANCE

A. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, wiring/riser diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

B. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical as the same operation and quality as type specified, subject to Resident Engineer's approval.

C. Before hardware installation, verify that all doors and frames are properly prepared to receive the specified hardware.

1.10 WARRANTY

A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' warranties:
   1. Closers: Ten years mechanical, two years electrical.
   2. Hinges: Life of Building.
   3. Other Hardware: Two years.

1.11 MAINTENANCE

A. Extra Materials: Additional Keys

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 SCHEDULE OF FINISH HARDWARE

A. See the following schedule for the door hardware required for the two new doors to be installed at the exterior electrical room and interior mechanical closet noted on the plans.

   1. EXTERIOR ELECTRICAL CLOSET - 1 PAIR DOOR
      SIZE: PAIR 3'-0" x 6'-8" x 1-3/4" x HM x WF x NON-RATED
      LOCK SET - BEST 45H-7-D-14-J--626-RH-SH-VT Electrical Room Function
      HINGES - (3) EA DOOR EMTEK 91023TWB SS Non-Removable Pin Type.
      FLUSH BOLTS - (2) TRIMCO 3999SE-626 Top and Bottom
      WALL STOP AND HOLDER (2) TRIMCO 1254-626 One per Door
      KICK PLATES - (2) TRIMCO K0050-626 10"x Door Width
      ASTRAGAL - PEMKO 357SP-600
      DOOR DRIP EDGE - PEMKO 346-626 4"x Opening Width
      SILENCERS IVE SR65 GRY (3) EA DOOR

   2. INTERIOR MECHANICAL CLOSET - 1 SGL DOOR
      SALVAGE AND REUSE EXISTING ALL HARDWARE.

B. Provide hardware items required to complete the work in accordance with these specifications and manufacturers' instructions.
   1. Include items inadvertently omitted from this specification. Note these items in submittal for review.
   2. Where scheduled item is now obsolete, bid and furnish manufacturers updated item at no additional cost to the project.

2.3 HANGING MEANS

A. Conventional Hinges: Hinge open widths minimum, but, of sufficient throw to permit maximum door swing. Stainless steel pins and concealed bearings with stainless steel fasteners.

1. Three hinges per leaf to 7 foot, 6 inch height. Add one for each additional 30 inches in height, or any fraction thereof.

2. Outswinging exterior doors to receive non-ferrous, non-removable pin type hinges with stainless steel pins.
3. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

2.4 LOCKSETS, LATCHSETS, DEADBOLTS:

A. Mortise Locksets: as scheduled.

1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
2. Lever Trim: through-bolted, BEST Filled hollow tube design unacceptable.
3. Doors in the following locations will have locks which are ANSI series 1000 Grade 1 SECURITY and Grade 1 OPERATIONAL. Locks will meet UL 437 requirements. Any exterior door which could be in a remote location or subject to high vandalism.
4. Provide with a minimum 5 year warranty
5. Thumbturns: accessible design not requiring pinching or twisting motions to operate. 6. Deadbolts: stainless steel 1-inch throw.
6. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
7. Scheduled Lock Series and Design: BEST
8. Certifications: a. ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security. b. ANSI A.156.2-2003 Grade 1, UL Listed. c. Approved by the Federal Bureau of Prisons.
9. Cylindrical lock sets may be used only on interior non-high-traffic openings. Locks will have a replaceable sheer lug which when broken will disable the lever. Clutch mechanisms will not be allowed. Cylindrical locks are not to be used on exterior doors.

B. Cylinders

1. Removable interchangeable core.
2. Provide with concealed cylinder.
3. All cylinder and cores must be manufactured by BEST
4. Locks will have 7-pin Best "Patented/Standard"
5. 3 keys per lockset
6. All cores are to be keyed into the existing Best Master key system
7. Provide all locksets and cylinders with construction cores for contractor use Permanent cores provided at project completion.

C. Levers - All levers will be cast solid levers, hollow levers will not be allowed.

2.5 OTHER HARDWARE

A. Flush Bolts: Low operating force design with stainless steel fasteners.

B. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of stainless steel to match other hardware.

C. Door Stops: Provide stops to protect walls, casework or other hardware with stainless steel fasteners.
   1. Seals: Finished to match adjacent frame color.

D. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Provide stainless steel, plated brass or plated bronze fasteners.

2.6 KEYING REQUIREMENTS:

A. All cylinders will be Best 7-pin, interchangeable core and keyed into an existing factory-registered Grand Master key System. All seven pins to be operational.

B. Furnish permanent cores to City Lock shop for final installation unless provided by manufacturer.

C. Temporary cores (construction cores) will be installed by Contractor for security purposes. Temporary cores will be keyed alike and interchangeable with Best cores. Cores provided by manufacturer.

D. Contractor will provide to the City Lock shop copies of Control key and Operating key upon completion.

E. All keys and cores will have visual key control.

F. All keys will be stamped "City of San Diego", and "Do Not duplicate".

G. The Electric Meter Room will have S.D.G.& E. lock installed. The cylinder will be keyed to Schlage key way VTQP AA-10. Three keys are provided with lock. All keys are to be turned over to the City of San Diego Lock shop at completion of the project. The contractor will obtain lock from any contracted S. D.G. & E. Locksmith for installation.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS:

A. Factory trained, certified, and carries a factory-issued card certifying that person as a "Certified Installer". Alternative: can demonstrate suitably equivalent competence and experience.

3.2 PREPARATION:

A. Ensure that walls and frames are square and plumb before hardware installation.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
   1. Notify Resident Engineer of any code conflicts before ordering material.
   2. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.

3.3 INSTALLATION

A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation.
   1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
   2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.

B. Locate floor stops not more than 4 inches from the wall.

C. Drill pilot holes for fasteners in wood doors and/or frames.

D. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

3.4 ADJUSTING

A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
   1. Hardware damaged by improper installation or adjustment methods to be repaired or replaced to Owner's satisfaction.

B. Inspection: Use hardware supplier. Include suppliers with closeout documents.

C. Follow-up inspection: Installer to provide letter of agreement to Owner that approximately 6 months after substantial completion, installer will visit Project with representatives of the manufacturers of the locking devices and door closers to accomplish following:
   1. Re-adjust hardware.
   2. Evaluate maintenance procedures and recommend changes or additions, and instruct Owner's personnel.
   3. Identify items that have deteriorated or failed.
   4. Submit written report identifying problems and likely future problems.
   5. Provide written verification that doors meet accessible code requirements for opening and closing force.

3.5 PROTECTION/CLEANING:

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.

B. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

3.6 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

C. The manufacturer's representative for the locking devices and closing devices must be inspected and approve, in writing, prior to the installation of their product.

D. Hardware installed incorrectly must be reported to the architect prior to the architect final punch list.

E. All keys are to be turned over to the City of San Diego Lock shop at completion of the project. The contractor will obtain lock from any contracted S. D.G. & E. Locksmith for installation. Any Questions, Please Contact Carpenter Supervisor Martin Sorrell 619-525-8550 or Lock shop at 619-525-8552

END OF SECTION 08 7100

SECTION 092400 - STUCCO / CEMENT PLASTER

PART 1 - GENERAL

1.1 SUMMARY

A. Stucco Finishes System
   1. Metal lath and accessories.
   2. Plastic accessories.
   3. Portland cement plaster.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. SECTION 07 2500 ROUGH WEATHER BARRIER

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

1.4 FIELD MEASUREMENTS

A. Verify field measurements for quantities only

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
   1. Product Data for each product specified, including installation and cleanup instructions.
   2. Material Certificates: Submit certificate signed by manufacturer for each kind of plaster aggregate certifying that materials comply with requirements
   3. Samples: Samples for verification in units at least 12 inches square of each type of finish indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
   4. Warranty: See Paragragh 1.9

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Deliver cementitious materials to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.

C. Store materials inside, under cover, and dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Environmental Requirements, General: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.

B. Cold-Weather Requirements: Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.

C. Warm-Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

D. Exterior Plaster Work: Do not apply plaster when ambient temperature is below 40 deg F.

E. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and other provisions necessary to minimize harmful spattering of plaster on other work.

1.8 QUALITY ASSURANCE

A. Perform work per SMACNA Architectural Sheet Metal Manual and NRCA Roofing and Waterproofing Manual.

1.9 WARRANTY

A. Furnish [5] year manufacturer warranty for metal components against corrosion with an additional installers warranty for [5] years against fastener failure, water penetration at joints or failure to drain.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 LATH

A. Expanded-Metal Lath: Comply with ASTM C 847 for material, type, configuration, and other characteristics indicated below.
   1. Material: Fabricate expanded-metal lath from sheet metal conforming to the following:
      a. Galvanized Steel: Structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653, G60 minimum coating designation, unless otherwise indicated.
   2. Diamond-Mesh Lath: Comply with the following requirements:
      a. Configuration: Self-furring.
         1. Weight: 3.4 lb/sq. yd..
   3. Rib Lath: Comply with the following requirements:
      a. Configuration: Rib depth of 3/8-inch.
         1. Weight: 3.4 lb/sq. yd.

2.3 ACCESSORIES

A. General: Comply with material provisions of ASTM C 1063 and the requirements indicated below; coordinate depth of accessories with thicknesses and number of plaster coats required.

   1. Aluminum Components: Alloy, temper, and finish recommended by manufacturer with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for alloy and temper 6063-T5.
   2. Galvanized Steel Components: Fabricated from zinc-coated (galvanized) steel sheet complying with ASTM A 653, G40 minimum coating designation.
   3. Zinc-Alloy Components: ASTM B 69, 99 percent pure zinc.
   4. Plastic Components: ASTM D 4216, high-impact polyvinyl chloride (PVC) for building products.

B. Metal Corner Reinforcement: Expanded, large-mesh, diamond-metal lath fabricated from zinc-alloy or welded-wire mesh fabricated from 0.0475-inch-diameter, zinc-coated (galvanized) wire and specially formed to reinforce external corners of portland cement plaster on exterior exposures while allowing full plaster encasement.

C. Cornerbeads: Small nose cornerbeads fabricated from the following metal, with expanded flanges of large-mesh diamond-metal lath allowing full plaster encasement.
   1. Zinc Alloy: Minimum 0.0207-inch thick.
   2. PVC Plastic: Minimum 0.035-inch thick.
   3. Galvanized Steel: Minimum 0.0172-inch thick.
   4. Aluminum: Minimum 0.050-inch thick.
   5. Material: Any material above.

D. Casing Beads: Square-edged style, with expanded flanges of the following material:
   1. Zinc Alloy: Minimum 0.0207-inch thick.
   2. PVC Plastic: Minimum 0.035-inch thick.
   3. Galvanized Steel: Minimum 0.0172-inch thick.
   4. Aluminum: Minimum 0.050-inch thick.
   5. Material: Any material above.

E. Curved Casing Beads: Square-edged style, fabricated from aluminum coated with clear plastic, preformed into curve of radius indicated.

F. Control Joints: Prefabricated, of material and type indicated below:
   1. Zinc Alloy: Minimum 0.0207-inch thick.
   2. PVC Plastic: Minimum 0.035-inch thick.
   3. Galvanized Steel: Minimum 0.0172-inch thick.
   4. Material: Any material above.
   5. One-Piece: Folded pair of nonperforated screeds in M-shaped configuration, with expanded or perforated flanges.
      a. Provide removable protective tape on plaster face of control joints.

G. Foundation Sill (Weep) Screed: Manufacturer's standard profile designed for use at sill plate line to form plaster stop and prevent plaster from contacting damp earth, fabricated from zinc-coated (galvanized) steel sheet.

H. Lath Attachment Devices: Material and type required by ASTM C 1063 for installations indicated.

I. Channel Screeds and Vented Channel Screed: Aluminum, minimum 0.050-inch thick.

2.4 PLASTER MATERIALS

A. Base-Coat Cements: Type as indicated below:

   1. Portland cement, ASTM C 150, Type I.

B. Stucco Finish Coat: Manufacturer's standard factory-packaged stucco, including Portland cement, aggregate, coloring agent, and other proprietary ingredients.

C. Factory-Prepared Plaster Finish Coat: Manufacturer's standard factory-packaged blend of portland cement, ASTM C 150, Type I or III; hydrated lime, Type S, ASTM C 206 or ASTM C 207; aggregate, ASTM C 897; and compatible with base coat and finish texture indicated; in color indicated below:
   1. White.

D. Lime: Special hydrated lime for finishing purposes, ASTM C 206, Type S; or special hydrated lime for masonry purposes, ASTM C 207, Type S.

E. Sand Aggregate for Base Coats: ASTM C 897.

2.5 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable.

B. Asphalt-Saturated Felt: ASTM D 226, Type I (No. 15), nonperforated.

C. Steel drill screws complying with ASTM C 954 for fastening metal lath to steel members 0.033 to 0.112-inch thick.

D. Exterior Styrofoam Moldings: Provide shapes indicated on drawings at exterior face of stucco as manufacturered by Pacific Coast Foam.

2.6 PLASTER MIXES AND COMPOSITIONS

A. General: Comply with ASTM C 926 for base- and finish-coat mixes as applicable to plaster bases, materials, and other requirements indicated.

B. Base-Coat Mixes and Compositions: Proportion materials for respective base coats in parts by volume per sum of cementitious materials for aggregates to comply with the following requirements for each method of application and plaster base indicated. Adjust mix proportions below within limits specified to attain workability.

C. Three-Coat Work over Metal Lath: Base-coat proportions as indicated below:
   1. Scratch Coat: 1 part portland cement, 0 to 3/4 parts lime, 2-1/2 to 4 parts aggregate.
   2. Brown Coat: 1 part portland cement, 0 to 3/4 parts lime, 3 to 5 parts aggregate.

D. Factory-Prepared Plaster Finish Coats: Add water only; comply with finish coat manufacturer's written instructions.

E. Stucco Finish Coat: Add water only; comply with stucco manufacturer's written instructions.

2.7 MIXING

A. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF LATH, GENERAL

A. Standards: Comply with ML/SFA 920, "Guide Specifications for Metal Lathing and Furring," and with requirements of ASTM C 1063.

B. Install supplementary framing, blocking, and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, handrails, and similar work to comply with details indicated or, if not otherwise indicated, to comply with applicable written instructions of lath manufacturer.

C. Isolation: Where lathing and metal support system abuts building structure horizontally and where partition or wall abuts overhead structure, sufficiently isolate from structural movement to prevent transfer of loading from building structure. Install slip- or cushion type joints to absorb deflections but maintain lateral support.
   1. Frame both sides of control joints independently and do not bridge joints with furring and lathing or accessories.

D. Install additional framing, furring, runners, lath, and beads, as required to form openings and frames for other work as indicated. Coordinate support system for proper support of framed work that is not indicated to be supported independently of metal furring and lathing system.

3.2 LATHING

A. Install metal lath for the following applications where plaster base coats are required. Provide appropriate type, configuration, and weight of metal lath selected from materials indicated that comply with referenced ML/SFA specifications and ASTM lathing installation standards.
   1. Suspended and furred ceilings using 3.4-lb/sq. yd. minimum weight, diamond-mesh lath.
   2. Vertical metal framing and furring using 3.4-lb/sq. yd. minimum weight, diamond mesh lath and cold-rolled channel stud framing.
   3. Exterior sheathed wall surfaces using 3.4-lb/sq. yd. minimum weight, self-furring, diamond-mesh lath.

3.3 PREPARATIONS FOR PLASTERING

A. Clean plaster bases and substrates for direct application of plaster, removing loose material and substances that may impair the Work.

B. Install temporary grounds and screeds to ensure accurate rodding of plaster to true surfaces; coordinate with scratch-coat work.

C. Flashing: Refer to DIVISION 7 SECTION 07 7610 for installing flashing as indicated.

3.4 INSTALLATION OF PLASTERING ACCESSORIES

A. General: Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and in alignment during plastering. Install accessories of type indicated at following locations:
   1. External Corners: Install corner reinforcement at external corners.
   2. Terminations of Plaster: Install casing beads, unless otherwise indicated.
   3. Control Joints: Install at locations indicated or, if not indicated, at locations complying with the following criteria and approved by Contracting Officer:
      a. Where an expansion or contraction joint occurs in surface of construction directly behind plaster membrane.
      b. Distance between Control Joints: Not to exceed 18 feet in either direction or a length-to-width ratio of 2-1/2 to 1.
      c. Wall Areas: Not more than 144 sq. ft..
      d. Horizontal Surfaces: Not more than 100 sq. ft. in area.
      e. Where plaster panel sizes or dimensions change, extend joints full width or height of plaster membrane.
   4. Foam Moldings: Install over brown coat with fastenings and methods approved by molding.

3.5 PLASTER APPLICATION

A. Plaster Application Standard: Apply plaster materials, composition, and mixes to comply with ASTM C 926.

B. Do not use materials that are frozen, caked, lumpy, dirty, or contaminated by foreign materials.

C. Do not use excessive water in mixing and applying plaster materials.

D. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8-inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed at any location on surface.

E. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, and before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches at each jamb anchor.

F. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.

G. Corners: Make internal corners and angles square; finish external corners flush with cornerbeads on interior work, square and true with plaster faces on exterior work.

H. Number of Coats: Apply plaster of composition indicated, to comply with the following requirements:
   1. Three Coats: Over the following plaster base:
      a. Metal lath.

I. Finish Coats: Apply finish coats to comply with the following requirements:
   1. Float Finish: At interior areas, apply finish coat to a minimum thickness of 1/8-inch to completely cover base coat, uniformly floated to a true even plane with fine textured finish.
   2. Prepared Finish: Apply stucco finish coats, according to manufacturer's written instructions. Stucco finish shall be trowel-applied sand pebble texture.

J. Moist-cure plaster base and finish coats to comply with ASTM C 926, including written instructions for time between coats and curing in "Annex A2 Design Considerations."

3.6 CUTTING AND PATCHING

A. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.7 CLEANING AND PROTECTING

A. Remove temporary covering and other provisions made to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows, and other surfaces not to be plastered. Repair surfaces stained, marred or otherwise damaged during plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and engineer to ensure plaster work is without damage or deterioration at the time of Substantial Completion.

3.8 CLOSE-OUT ITEMS

A. Provide items to comply with SECTION 01 7823 OPERATION AND MAINTANCE DATA.

B. Complete procedures for complying with SECTION 01 8200 DEMONSTRATION AND TRAINING.

END OF SECTION 09 2400

SECTION 092900 - GYPSUM WALLBOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Interior Wall Finish
   1. Interior gypsum board.
   2. Texture finishes.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions , DIVISION 1 Specification Sections and the THE WHITEBOOK, apply to this section.

B. Related sections:
   1. SECTION 06 1000 ROUGH CARPENTRY for attachment

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. Comply with ASTM C 840

1.4 FIELD MEASUREMENTS

A. Verify field measurements for installation only.

1.5 SUBMITTALS

A. Submit the following in accordance with THE WHITEBOOK for SUBMITTAL PROCEDURES
   1. Product Data: For each type of product.
   2. Evaluation Reports:
   3. Warranty: See Paragragh 1.9

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope materials and components to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

D. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

1.8 QUALITY ASSURANCE

A. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.9 WARRANTY

A. Furnish [5] year manufacturer warranty for metal components against corrosion with an additional installers warranty for [5] years against fastener failure, water penetration at joints or failure to drain.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
   1. Core: 5/8 inch Type X.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D 3273, score of 10.

2.2 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Gypsum.
   2. CertainTeed Corp.
   3. Georgia-Pacific Gypsum LLC.
   4. National Gypsum Company.
   5. USG Corporation.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. L-Bead: L-shaped; exposed long flange receives joint compound.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   2. Exterior Gypsum Soffit Board: Paper.
   3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type tapingcompound.

D.. Use setting-type compound for installing paper-faced metal trim accessories.
   1. Fill Coat: For second coat, use setting-type, sandable topping compound.
   2. Finish Coat: For third coat, use setting-type, sandable topping compound.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

2.6 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. CertainTeed Corp.; ProRoc Wall and Ceiling Spray Texture.
      b. Georgia-Pacific Gypsum LLC; ToughRock Ceiling Textures/Vermiculite.
      c. USG Corporation; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).
   2. Texture: Shall match existing and adjacent walls.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Wallboard Type: Vertical surfaces unless otherwise indicated.
   2. Type X: Vertical surfaces unless otherwise indicated.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   3. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners.
   2. LC-Bead: Use at exposed panel edges.

3. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   a. Submit Samples on rigid backing, 8 inches square.
   b. Step coats on Samples to show each coat required for system.
   c. Label each coat of each Sample.
   d. Label each Sample for location and application area.
4. Warranty: See Paragragh 1.9
5. Maintenance: Provide in writing the quantities to be provided by Paragraph 1.10
6. Approval: Submittals shall be reviewed and approved by City paint shop or facilities staffs before materials are ordered.

B. Qualifications
   1. Manufacturer: Company specializing in manufacturing products specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle materials in compliance with THE WHITEBOOK for MATERIAL AND EQUIPMENT.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply paint to materials during inclement weather.

B. Do not apply paint to materials to damp or frozen surfaces.

C. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

D. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.8 QUALITY ASSURANCE

A. All work will entail the highest degree of craftsmanship as it pertains to the preparation, and application processes.

1.9 WARRANTY

A. Furnish [1] year manufacturer warranty for metal components against corrosion with an additional installers warranty for [1] years against fastener failure, water penetration at joints or failure to drain.

1.10 MAINTENANCE

A. Extra Materials - Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 PROCEDURES

A. Product procurement, handling and installation shall comply with THE WHITEBOOK for PRODUCT REQUIREMENTS.

B. Submittal of substitutions must comply with THE WHITEBOOK for SUBSTITUTION PROCEDURES.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Behr Process Corporation.
   2. Benjamin Moore & Co.
   3. Dunn-Edwards Corporation.
   4. Sherwin-Williams Company (The).
   5. Vista Paint.

B. Production grade materials are NOT acceptable

2.3 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

2.4 INTERIOR PAINTING SCHEDULE

A. Gypsum Board Finishes
   1. Latex over Alkyd Primer System:
      a. Prime Coat: Acrylic Latex.
         (Apply 2 Coats of Primer)
      b. Topcoat: Acrylic Latex - Finish: Eggshell or match existing.
         (Apply 2 Coats of Finish)
      c. Colors: Match adjacent existing building colors.

B. Metal Substrates: Including doors and access panels
   1. Latex over Alkyd Primer System:
      a. Prime Coat: Acrylic Latex.
         (Apply 2 Coats of Primer)
      b. Topcoat: Acrylic Latex - Finish: Eggshell or match existing.
         (Apply 2 Coats of Finish)
      c. Colors: Match adjacent existing building colors.

2.5 PRIMERS/SEALERS

A. All primers will be of the highest quality and the correct product for the intended application.

B. Coats: All surfaces to be coated will receive no less than two coats of primer.

C. Manufacturers: Subject to compliance with requirements, provide products from the following:
   1. Dunn-Edwards Corporation.
   2. Sherwin-Williams Company (The).
   3. Vista Paint.

2.6 INTERIOR PAINT TOPCOATS

A. Paint Type:
   1. Acrylic/Latex, water base paints
      a. Acrylic resin
      b. Ethylene glycol (EG) free
      c. Tinted with 100% VOC free tints
      d. No less than 35% solids by volume (± 2%) and 57% volume by weight (± 2%).
      e. No less than 20 % prime pigments
      f. All paints will have anti-microbial qualities
      g. Max VOC = 40 g/l

   2. Oil Based enamels
      a. Ethylene Glycol free
      b. Silicone Alkyd resin

c. Tinted with 100% VOC free tints
d. No less than 45% solids by volume (± 2%) and 64% volume by weight (± 2%).
e. No less than 24 % prime pigments
f. Max VOC = 400g/l

B. Coats: All surfaces to be coated will receive no less than two coats of finish.

C. Manufacturers
1. Stucco Finish
a. Vista 8300 Carefree Eggshell
b. or Equal

2. Metal Finishes
a. Vista 4800 Metal Pro Primer
b. or Equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

A. Apply all coats of paint in accordance with all applicable codes and regulations.

B. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

C. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

E. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

F. Apply paint to surfaces as follows:
   Interior Gypsum Wall Board to receive Acrylic/Latex, water base paints
      Ceiling - Flat Finish for or match existing
      Walls - Eggshell/Satin Finish or match existing
   Interior Metal to receive Oil based enamels
      Doors - Semi Gloss Finish

G. All work will entail the highest degree of craftsmanship as it pertains to the preparation, and application processes.

H. Do not paint mechanical and electrical work. Do not paint exposed ducts, pipes, conduits or cable trays.

I. Do not paint items with factory finishes except items that have been factory-primed.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Resident Engineer, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 CLOSE-OUT ITEMS

A. Provide close-out items as stated in the WHITEBOOK.

END OF SECTION 09 9123

SECTION 23 0000 - AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. ACOUSTICAL SOCIETY OF AMERICA (ASA)
   a. ASA S12.51: (2012) Acoustics Determination of Sound Power Levels of Noise Sources using Sound Pressure Precision Method for Reverberation Rooms
2. AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)
   a. ACCA Manual 4: (2001) Installation Techniques for Perimeter Heating and Cooling; 11th Edition
3. AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
   a. AMCA 201: (2002; R 2011) Fans and Systems
   b. AMCA 210: (2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
   c. AMCA 220: (2005) Test Methods for Air Curtain Units
   d. AMCA 300: (2008) Reverberant Room Method for Sound Testing of Fans
   e. AMCA 301: (2006; INT 2007) Methods for Calculating Fan Sound Ratings from Laboratory Test Data
   f. AMCA 500-D: (2012) Laboratory Methods of Testing Dampers for Rating
4. AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)
   a. AHRI 260: (2011) Sound Rating of Ducted Air Moving and Conditioning Equipment
   b. AHRI 410: (2001; Addendum 1 2002; Addendum 2 2005; Addendum 3 2011) Forced-Circulation Air-Cooling and Air-Heating Coils
   c. AHRI DCAACP: (Online) Directory of Certified Applied Air-Conditioning Products
   d. AHRI Guideline D: (1996) Application and Installation of Central Station Air-Handling Units
5. AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)
   a. ABMA 11: (1990; R 2008) Load Ratings and Fatigue Life for Roller Bearings
   b. ABMA 9: (1990; R 2008) Load Ratings and Fatigue Life for Ball Bearings
6. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
   a. ANSI/ASHRAE 15 & 34: (2010; Addenda A, B, C, D, E, F, G, H, I, J, K, L, N and O; Errata 2011; INT 1 2012; Errata 2012; Addenda AD, SD, AE and AF 2013) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants

b. ASHRAE 52.2: (2012) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
c. ASHRAE 62.1: (2010; Errata 2011; INT 3 2012; INT 4 2012; INT 5 2013) Ventilation for Acceptable Indoor Air Quality
d. ASHRAE 68: (1997) Laboratory Method of Testing to Determine the Sound Power In a Duct
e. ASHRAE 70: (2006; R 2011) Method of Testing for Rating the Performance of Air Outlets and Inlets
f. ASHRAE 84: (2008) Method of Testing Air-to-Air Heat Exchangers
g. ASHRAE 90.1 – IP: (2010; Errata 1-3 2011; INT 1-12 2011; Addenda A, B, C, G, H, J, K, O, P, S, Y, Z, BZ, CG, CI and DS 2012; Errata 4-8 2012; INT 13-16 2012; Errata 9-10 2013) Energy Standard for Buildings Except Low-Rise Residential Buildings
h. ASHRAE 90.1 – SI: (2010; Errata 1-2 2011; INT 2-12 2011; Addenda A, B, C, G, H, J, K, O, P, S, Y, Z, BZ, CG, CI and DS 2012; Errata 3-9 2012; INT 13-16 2012; Errata 10-11 2013) Energy Standard for Buildings Except Low-Rise Residential Buildings

7. INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY (IEST)
   a. IEST RP-CC-001: (2009) HEPA and ULPA Filters
8. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
   a. NEMA ICS 6: (1993; R 2011) Enclosures
   b. NEMA MG 1: (2011; Errata 2012) Motors and Generators
   c. NEMA MG 10: (2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
   d. NEMA MG 11: (1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors
9. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
   a. NFPA 70: (2011; Errata 2 2012) National Electrical Code
   b. NFPA 701: (2010) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
   c. NFPA 90A: (2012) Standard for the Installation of Air Conditioning and Ventilating Systems
10. SCIENTIFIC CERTIFICATION SYSTEMS (SCS)
   a. SCS: Scientific Certification Systems (SCS)Indoor Advantage
11. SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)
   a. SMACNA 1403: (2008) Accepted Industry Practice for Industrial Duct Construction, 2nd Edition
   b. SMACNA 1819: (2002) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, 5th Edition
   c. SMACNA 1884: (2003) Fibrous Glass Duct Construction Standards, 7th Edition
   d. SMACNA 1966: (2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

e. SMACNA 1972 CD: (2012) HVAC Air Duct Leakage Test Manual -2nd Edition
f. SMACNA 1981: (2008) Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd Edition

12. U.S. DEPARTMENT OF DEFENSE (DOD)
    a. MIL-STD-101: (1970; Rev B) Color Code for Pipelines & for Compressed Gas Cylinders
    b. UFC 4-010-01: (2012) DoD Minimum Antiterrorism Standards for Buildings
13. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
    a. 40 CFR 82: Protection of Stratospheric Ozone
14. UNDERWRITERS LABORATORIES (UL)
    a. UL 1995: (2011) Heating and Cooling Equipment
    b. UL 555: (2006; Reprint May 2012) Standard for Fire Dampers
    c. UL 555S: (1999; Reprint May 2012) Smoke Dampers
    d. UL 586: (2009) Standard for High-Efficiency Particulate, Air Filter Units
    e. UL 6: (2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
    f. UL 705: (2004; Reprint Mar 2012) Standard for Power Ventilators
    g. UL 723: (2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials
    h. UL 900: (2004; Reprint Feb 2012) Standard for Air Filter Units
    i. UL 94: (1996; Reprint Feb 2013) Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
    j. UL Electrical Construction: (2012) Electrical Construction Equipment Directory
    k. UL Fire Resistance: (2012) Fire Resistance Directory
15. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline.
    a. 2015: Edition

SYSTEM DESCRIPTIONProvide roof top units with new disconnects. Furnish transition ductwork, condensate and natural gas piping, fittings, and accessories as required to provide a complete installation. Contractor shall provide TAB after installation is completed. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

1. Color Coding
    a. Color coding of all piping systems shall be in accordance with ASME A13.1 MIL-STD-101.

2. Service Labeling
    a. Label roof top unit, including exhaust fans, electric panels, etc. with labels made of self-sticking, plastic film designed for permanent installation. Labels shall be in accordance with the typical examples below:

SERVICE	LABEL AND TAG DESIGNATION
Roof Top Unit Number	RTU - [_____]
Exhaust Fan Number	EF - [_____]
Electric Panels	EP - [_____]

SUBMITTALS

A. Submit the following:

1. Shop Drawings
   a. Detail Drawings
2. Product Data
   a. Air Handling Units
   b. Diagrams
3. Test Reports
   a. Performance Tests
4. Certificates
   a. Certification
5. Manufacturer's Instructions
   a. Manufacturer's Installation Instructions
   b. Operation and Maintenance Training
6. Operation and Maintenance Data
   a. Operation and Maintenance Manuals
   b. Roof top units

QUALITY ASSURANCE

A. Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

1. Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 is acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.
2. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.
3. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

B. Prevention of Corrosion

1. Protect metallic materials against corrosion. Manufacturer shall provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A123/A123M for exterior locations and cadmium-plated in conformance with ASTM B766 for interior locations.

C. Asbestos Prohibition

1. Do not use asbestos and asbestos-containing products.

D. Ozone Depleting Substances Used as Refrigerants

1. Minimize releases of Ozone Depleting Substances (ODS) during repair, maintenance, servicing or disposal of appliances containing ODS's by complying with all applicable sections of 40 CFR 82 Part 82 Subpart F. Any person conducting repair, maintenance, servicing or disposal of appliances owned by NASA shall comply with the following:

a. Do not knowingly vent or otherwise release into the environment, Class I or Class II substances used as a refrigerant.
b. Do not open appliances without meeting the requirements of 40 CFR 82 Part 82.156 Subpart F, regarding required practices for evacuation and collection of refrigerant, and 40 CFR 82 Part 82.158 Subpart F, regarding standards of recycling and recovery equipment.
c. Only persons who comply with 40 CFR 82 Part 82.161 Subpart F, regarding technician certification, can conduct work on appliances containing refrigerant.

2. In addition, provide copies of all applicable certifications to the Resident Engineer at least 14 calendar days prior to initiating maintenance, repair, servicing, dismantling or disposal of appliances, including:
   a. Proof of Technician Certification
   b. Proof of Equipment Certification for recovery or recycling equipment.
   c. Proof of availability of certified recovery or recycling equipment.

E. Use of Ozone Depleting Substances, Other than Refrigerants
1. The use of Class I or Class II ODS's listed as nonessential in 40 CFR 82 Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:
   a. Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon
   b. Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon; including liquid packaging, solvent wipes, solvent sprays, and gas sprays.
   c. Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial cabling.
   d. Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR 82 Part 82.66 Subpart C.
2. Request a waiver if a facility requirement dictates that a prohibited material is necessary to achieve project goals. Submit the waiver request in writing to the Resident Engineer. The waiver will be evaluated and dispositioned.

F. Detail Drawings
1. Submit detail drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications. Include any information required to demonstrate that the system has been coordinated and functions properly as a unit on the drawings and show equipment relationship to other parts of the work, including clearances required for operation and maintenance. Submit drawings showing bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Submit function designation of the equipment and any other requirements specified throughout this section with the shop drawings.

G. Test Procedures

1. Submit proposed test procedures and test schedules for the ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

DELIVERY, STORAGE, AND HANDLING

A. Protect stored equipment at the jobsite from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

PART 6 PRODUCTS

6.1 STANDARD PRODUCTS

A. Provide components and equipment that are "standard products" of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. "Standard products" is defined as being in satisfactory commercial or industrial use for 2 years before bid opening, including applications of components and equipment under similar circumstances and of similar size, satisfactorily completed by a product that is sold on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record are acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Provide equipment items that are supported by a service organization. Where applicable, provide equipment that is an ENERGY STAR Qualified product or a Federal Energy Management Program (FEMP) designated product.

6.2 IDENTIFICATION PLATES

A. In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates are to designate the function of the equipment. Submit designation with the shop drawings. Identification plates shall be three layers, black-white-black, engraved to show white letters on black background. Letters shall be upper case. Identification plates 1-1/2-inches high and smaller shall be 1/16-inch thick, with engraved lettering 1/8-inch high; identification plates larger than 1-1/2-inches high shall be 1/8-inch thick, with engraved lettering of suitable height. Identification plates 1-1/2-inches high and larger shall have beveled edges. Install identification plates using a compatible adhesive.

6.3 EQUIPMENT GUARDS AND ACCESS

A. Fully enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact according to OSHA requirements. Properly guard or cover with insulation of a type specified, high

temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard.

6.4 ELECTRICAL WORK

A. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring. Provide manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.

1. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring. Provide manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.
2. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1.
3. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system , and that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Select premium efficiency polyphase motors in accordance with NEMA MG 10.
4. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.
5. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers are allowed to accomplish the same function. Use solid-state variable-speed controllers for motors rated 10 hp or less and adjustable frequency drives for larger motors.

6.5 ANCHOR BOLTS

A. Provide anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts to be of the size and number recommended by the equipment manufacturer

and located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.

6.6 SEISMIC ANCHORAGE

A. Anchor equipment in accordance with applicable seismic criteria for the area and as defined in SMACNA 1981

6.7 PAINTING

A. Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing.

6.8 INDOOR AIR QUALITY

A. Provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein.

6.9 AIR SYSTEMS EQUIPMENT

A. Fans

1. Test and rate fans according to AMCA 210. Calculate system effect on air moving devices in accordance with AMCA 201 where installed ductwork differs from that indicated on drawings. Install air moving devices to minimize fan system effect. Where system effect is unavoidable, determine the most effective way to accommodate the inefficiencies caused by system effect on the installed air moving device. The sound power level of the fans shall not exceed 85 dBA when tested according to AMCA 300 and rated in accordance with AMCA 301. Provide all fans with an AMCA seal. Connect fans to the motors either directly or indirectly with V-belt drive. Use V-belt drives designed for not less than 150 percent of the connected driving capacity. Provide variable pitch motor sheaves for 11 kW 15 hp and below, and fixed pitch as defined by AHRI Guideline D (A fixed-pitch sheave is provided on both the fan shaft and the motor shaft. This is a non-adjustable speed drive.). Select variable pitch sheaves to drive the fan at a speed which can produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, provide a replaceable sheave when needed to achieve system air balance. Provide motors for V-belt drives with adjustable rails or bases. Provide removable metal guards for all exposed V-belt drives, and provide speed-test openings at the center of all rotating shafts. Provide fans with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Provide fan and motor assemblies with vibration-isolation supports or mountings as indicated. Use vibration-isolation units that are standard products with published loading ratings. Select each fan to produce the capacity required at the fan static pressure indicated. Provide sound power level as indicated. Obtain the sound power level values according to AMCA 300. Provide standard AMCA arrangement, rotation, and discharge as indicated. Provide power ventilators that conform to UL 705 and have a UL label.

a. Centrifugal Fans

i. Provide fully enclosed, single-width single-inlet, or double-width double-inlet centrifugal fans, with AMCA Pressure Class I, II, or III as required or indicated for the design system pressure. Provide impeller wheels that are rigidly constructed and accurately balanced both statically and dynamically. Provide fan wheels over 36 inches in diameter with overhung pulleys and a bearing on each side of the wheel. Provide fan wheels 36 inches or less in diameter that have one or more extra long bearings between the fan wheel and the drive. Provide sleeve type, self-aligning and self-oiling bearings with oil reservoirs, or precision self-aligning roller or ball-type with accessible grease fittings or permanently lubricated type. Connect grease fittings to tubing for serviceability from a single accessible point. Provide L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Provide steel, accurately finished fan shafts, with key seats and keys for impeller hubs and fan pulleys. Provide fan outlets of ample proportions, designed for the attachment of angles and bolts for attaching flexible connections. Unless otherwise indicated, provide motors that do not exceed 1800 rpm and have enclosures.

b. In-Line Centrifugal Fans

i. Provide in-line fans with centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Mount fans in a welded tubular casing. Provide a fan that axially flows the air in and out. Streamline inlets with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Enclose and isolate fan bearings and drive shafts from the air stream. Provide precision, self aligning ball or roller type fan bearings that are sealed against dust and dirt and are permanently lubricated. Provide L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Provide motors enclosure.

c. Centrifugal Type Power Roof exhaust fans

i. Provide direct driven centrifugal type fans with backward inclined, non-overloading wheel. Provide hinged or removable and weatherproof motor compartment housing, constructed of heavy gauge aluminum. Provide fans with birdscreen, disconnect switch, gravity dampers. Provide dripproof type motor enclosure. Provide inline centrifugal type kitchen exhaust fans according to UL 705, fitted with V-belt drive, round hood, and windband upblast discharge configuration, integral residue trough and collection device, with motor and power transmission components located in outside positively air ventilated compartment. Use only lubricated bearings.

d. Ceiling Exhaust Fans

i. Provide centrifugal type, direct driven suspended cabinet-type ceiling exhaust fans. Provide fans with acoustically insulated housing. Provide chatter-proof backdraft damper. Provide egg-crate design or louver design integral face grille. Mount fan motors on vibration isolators. Furnish unit with mounting flange for hanging unit from above. Provide U.L. listed fans.

B. Coils

1. Provide fin-and-tube type coils constructed of seamless copper tubes and Aluminum copper fins mechanically bonded or soldered to the tubes. Provide casing and tube support sheets that are not lighter than 16 gauge galvanized steel, formed to provide structural strength. When required, provide multiple tube supports to prevent tube sag. Test each coil at the factory under water at not less than 400 psi air pressure and make suitable for 200 psi working pressure and 300 degrees F operating temperature unless otherwise stated. Mount coils for counterflow service. Rate and certify coils to meet the requirements of AHRI 410.

C. Air Filters

1. Unit shall be provided with a draw-through filter section. The filter SECTION shall be supplied complete with the filter rack as an integral part of the unit.
2. Pre-Filters: Filtration Group model Novapleat HC, 2" thick, MERV 8, pleated, panel filters shall be provided. Filters shall be constructed of 100% synthetic material that does not support microbial growth. Filters shall be of a metal-free construction to reduce its impact when land filled. Filters shall be accessible from both sides of the filter section.
3. Final Filters: Filtration Group model FP Mini-Pleat filters shall be provided. Minimum 12" deep, MERV 15, UL Std. 900. Cartridge filters shall consist of filter media permanently attached to a metal free frame and shall slide into a gasketed, extruded aluminum rack contained within the unit. The filter rack shall have secondary gasketed, hinged end panels to insure proper sealing. Filters shall be accessible from both sides of the filter section.

6.10 Roof top Air handling units

D. Factory-Fabricated Air Handling Units

1. Provide single-zone draw-through type units as indicated. Units shall include fans, coils, airtight insulated casing, prefilters, secondary filter sections, and diffuser sections where indicated, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, mixing box, vibration-isolators, and appurtenances required for specified operation. Provide vibration isolators as indicated. Physical dimensions of each air handling unit shall be suitable to fit space allotted to the unit with the capacity indicated. Provide air handling unit that is rated in accordance with AHRI 430 and AHRI certified for cooling. Provide air handling unit that is rated in accordance with AHRI 340/360 and AHRI certified for cooling.

a. Casings

i. Double-wall construction with 22 gauge solid galvanized steel liners shall be provided throughout, allowing no exposed insulation

within the air stream. All cabinet insulation, except floor panels, shall be a nominal 1" thick, 1 ½ lb. density, R6.5, glass fiber. Floor panels shall be a minimum 1" thick, 3 lb. density, R4.2, glass fiber. All cabinet insulation, except floor panels, shall be a nominal ½" thick, 1 lb. density with neoprene coating on airside.

ii. Exterior surfaces shall be constructed of pre-painted galvanized sheet metal. Paint finish shall include a base primer with a high quality, polyester resin topcoat of a neutral beige color. Finished surface to withstand a minimum 750-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance. Finished surface to withstand a minimum 500-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.

iii. Service doors shall be provided on both sides of each section in order to provide user access to all unit components. Service doors shall be constructed of 17 gauge galvanized steel with a 22 gauge galvanized steel interior liner. All service doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system that is operated by a single, flush mounted handle. Removable panels, or doors secured by multiple, mechanical fasteners are not acceptable.

iv. The unit base shall overhang the roof curb for positive water runoff and shall have a formed recess that seats on the roof curb gasket to provide a positive, weather tight seal. Lifting brackets shall be provided on the unit base with lifting holes to accept cable or chain hooks.

b. Heating and Cooling Coils

i. Provide coils as specified in paragraph AIR SYSTEMS EQUIPMENT.

c. Air Filters

i. Provide air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

d. Fans

i. Provide fans as specified in paragraph AIR SYSTEMS EQUIPMENT.

e. Access sections and Filter/Mixing Boxes

i. Provide access sections where indicated and furnish with access doors as shown. Construct access sections and filter/mixing boxes in a manner identical to the remainder of the unit casing and equip with access doors. Design mixing boxes to minimize air stratification and to promote thorough mixing of the air streams.

f. Diffuser Sections

i. Furnish diffuser sections between the discharge of all housed supply fans and cooling coils of blow-through single zone units and filter sections of those units with high efficiency filters located immediately downstream of the air handling unit fan section. Provide diffuser sections that are fabricated by the unit manufacturer in a manner identical to the remainder of the unit casing, designed to be airtight under positive static pressures, with an access door on each side for inspection purposes.

6.11 FACTORY PAINTING

A. Factory paint new equipment, which are not of galvanized construction. Paint with a corrosion resisting paint finish according to ASTM A123/A123M or ASTM A924/A924M. Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to ASTM B117, ASTM D1654, and ASTM D3359. Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 1/8 inch. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to ASTM D520 Type I.

B. Factory painting that has been damaged shall be field painted prior to acceptance by the Resident Engineer.

1. Field painting shall consist of cleaning, touching-up abraded shop prime coats, and applying prime. Body and finish coats to materials and equipment shall be equivalent to factory finished product.

6.12 SUPPLEMENTAL COMPONENTS/SERVICES

A. Condensate Drain Lines
   1. Provide and install condensate drainage for each item of equipment that generates condensate. Provide "U" trap for condensate drain piping. Provide minimum of ¾" inch copper piping for condensate drain.

B. Controls
   1. The requirements for controls are specified in SECTION 23 0923 DIRECT DIGITAL CONTROL SYSTEM SPECIFICATION.

PART 3 EXECUTIONS

3.1 EXAMINATION

A. After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Resident Engineer of any discrepancy before performing the work.

3.2 INSTALLATION

A. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.
   1. Condensate Drain Lines
      a. Provide water seals in the condensate drain from all units. Provide a depth of each seal of 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting.
   2. Equipment and Installation
      a. Provide frames and supports for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports.
   3. Flexible Duct
      a. Install pre-insulated flexible duct at transition between new unit and exiting supply and return main duct in ceiling space in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the duct, of the type recommended by the duct manufacturer and set at the intervals recommended.

3.3 EQUIPMENT PADS

A. Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 3-inch margin around the equipment and supports. Allow equipment bases and foundations, when constructed of concrete or grout, to cure a minimum of 14 calendar days before being loaded.

3.4 CLEANING

B. Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks. When the work area is in an occupied space such as office, laboratory or warehouse protect all furniture and equipment from dirt and debris. Incorporate housekeeping for field construction work which leaves all furniture and equipment in the affected area free of construction generated dust and debris; and, all floor surfaces vacuum-swept clean

3.5 PENETRATIONS

A. Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 15 inches and smaller. Build framed, prepared openings for round duct larger than 15 inches and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide one inch clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming with ASTM C553, Type 1, Class B-2.

1. Sleeves: Fabricate sleeves, except as otherwise specified or indicated, from 20 gauge thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with ASTM A53/A53M, Schedule 20.

2. Framed Prepared Openings: Fabricate framed prepared openings from 20 gauge galvanized steel, unless otherwise indicated.

3. Closure Collars: Provide closure collars of a minimum 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed.

   a. Install collar tight against the surface and fit snugly around the duct or insulation. Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 15 inches in diameter or less from 20 gauge galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 15 inches from 18 gauge galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 15 inches or less from 20 gauge galvanized steel. Install collars with fasteners a maximum of 6 inches on center. Attach to collars a minimum of 4 fasteners where the opening is 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 20 inches in diameter or less.

4. Firestopping: Where ducts pass through fire-rated walls, fire partitions, and fire rated chase walls, seal the penetration with fire stopping materials as specified in SECTION 07 8400 FIRESTOPPING.

3.6 TESTING, ADJUSTING, AND BALANCING

A. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.6 OPERATION AND MAINTENANCE

A. Operation and Maintenance Manuals
   1. Submit six manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in SECTION 01 7823 OPERATION AND MAINTENANCE DATA. Submit Data Package for the items/units listed under SD-10 Operation and Maintenance Data

B. Operation And Maintenance Training
   1. Conduct a training course for the members of the operating staff as 1designated by the Resident Engineer. Conduct field instruction that covers all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Submit the proposed On-site Training schedule concurrently with the Operation and Maintenance Manuals and at least 14 days prior to conducting the training course.

END OF SECTION 23 0000

SECTION 23 0511 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this section applies to all sections of DIVISION 23.

B. Definitions:
   1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
   2. Option or optional: Contractor's choice of an alternate material or method.

1.2 QUALITY ASSURANCE

A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC or steam boiler plant construction, as applicable.

B. Flow Rate Tolerance for HVAC Equipment: SECTION 23 0593, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

C. Equipment Vibration Tolerance:
   1. Refer to SECTION 23 0541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Equipment shall be factory-balanced to this tolerance and re-balanced on site, as necessary.
   2. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

D. Products Criteria:
   1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. The design, model and size of each item shall have been in satisfactory and efficient operation on recent past installations. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record. See other specification sections for any exceptions.
   2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.

3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent, then those specified. Refer any conflicts to the Resident Engineer.
4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
7. Asbestos products or equipment or materials containing asbestos shall not be used.

E. Equipment Service Organizations:
1. HVAC: Products and systems shall be supported by service organizations that maintain a complete inventory of repair parts and are located reasonably close to the site.

F. HVAC Mechanical Systems Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", SECTION IX, "Welding and Brazing Qualifications".
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

G. Execution (Installation, Construction) Quality:
1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Engineer of Record or Contracting Officer for resolution. Provide written hard copies or computer files of manufacturer's installation instructions to the Engineer of Record or Contracting Officer at least two weeks prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations is a cause for rejection of the material.
2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters, control devices. Prior to commencing installation work, refer conflicts between this requirement and contract drawings to the Engineer of Record or Resident Engineer for resolution.
3. Provide complete layout drawings required by Paragraph, SUBMITTALS. Do not commence construction work on any system until the layout drawings have been approved.

SUBMITTALS

A. Submit in accordance with WHITEBOOK and with requirements in the individual specification section, shop drawings, product data and samples.

B. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.

C. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

D. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

E. Upon request by City of San Diego, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

F. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

G. Samples: Samples will not be required.

H. Layout Drawings:
   1. Submit complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. Refer to the GENERAL CONDITIONS.
   2. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed layout drawings of all piping and duct systems.
   3. Do not install equipment or piping until layout drawings have been approved. Reuse existing equipment curbs if possible.
      4. In addition, for HVAC systems, provide details of the following:
      a. Mechanical equipment roof plan.
      b. Ceiling space.
      c. Hangers, inserts, supports, and bracing.
      d. Pipe sleeves.
      e. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

I. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.

1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the Engineer of Record or Contracting Officer.
2. Submit electric motor data and variable speed drive data with the driven equipment.
3. Equipment and materials identification.
4. Fire-stopping materials.
5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
6. Wall, floor, and ceiling plates.

J. HVAC Maintenance Data and Operating Instructions:
   1. Maintenance and operating manuals.
   2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

K. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
   1. Air Conditioning and Refrigeration Institute (ARI)
      a. 430-99: Central Station Air-Handling Units
   2. American National Standard Institute (ANSI)
      a. B31.1-2004: Power Piping
   3. Rubber Manufacturers Association (ANSI/RMA)
      a. IP-20-2007: Drives Using Classical V-Belts and Sheaves
      b. IP-21-1991 (1997): Drives Using Double-V (Hexagonal) Belts
      c. IP-22-2007: Drives Using Narrow V-Belts and Sheaves
   4. Air Movement and Control Association (AMCA)
      a. 410-96: Recommended Safety Practices for Air Moving Devices
   5. American Society for Testing and Materials (ASTM)
      a. A36/A36M-05: Carbon Structural Steel
      b. A575-96(2002): Steel Bars, Carbon, Merchant Quality, M-Grades R (2002)
      c. E84-07: Standard Test Method for Burning Characteristics of Building Materials
      d. E119-07: Standard Test Method for Fire Tests of Building Construction and Materials
   6. National Electrical Manufacturers Association (NEMA)
      a. MG-1-2006: Motors and Generators

7. National Fire Protection Association (NFPA)
   a. 54-06: National Fuel Gas Code
   b. 70-08: National Electrical Code
   c. 85-07: Boiler and Combustion Systems Hazard Code
   d. 90A-02: Installation of Air Conditioning and Ventilating Systems
   e. 101-06: Life Safety Code
8. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline.
   a. 2015: Edition

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
   1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the City of San Diego has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
   2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Engineer of Record or Contracting Officer. Such repair or replacement shall be at no additional cost to the City of San Diego.
   3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
   4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:
   1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
   2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
   3. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
   1. All components of an assembled unit need not be products of same manufacturer.
   2. Constituent parts that are alike shall be products of a single manufacturer.

3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 BELT DRIVES

A. Type: ANSI/RMA standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, rating and selection standards: ANSI/RMA IP-20 and IP-21.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ANSI/RMA service factor (not less than 20 percent) in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 25 m/s (5000 feet per minute).

E. Adjustment Provisions: For alignment and ANSI/RMA standard allowances for installation and take-up.

F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.

G. Multiple Belts: Matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:
2. Material: Pressed steel, or close grained cast iron.
3. Bore: Fixed or bushing type for securing to shaft with keys.
4. Balanced: Statically and dynamically.
5. Groove spacing for driving and driven pulleys shall be the same.

6. Minimum Diameter of V-Belt Sheaves (ANSI/RMA recommendations)in millimeters and inches:

Fractional Horsepower		Standard		High Capacity	
Cross Section	Min. od mm (in)	Cross Section	Min. od mm (in)	Cross Section	Min. od mm (in)
2L	20 (0.8)	A	83 (3.25)	3V	67 (2.65)
3L	38 (1.5)	B	146 (5.75)	4V	180 (7.10)
4L	64 (2.5)	C	239 (9.40)	5V	318 (12.50)
5L	89 (3.5)	D	345 (13.60)		
		E	554 (21.80)		

I. Drive Types, Based on ARI 435:
   1. Provide adjustable-pitch or fixed-pitch drive as follows:
      a. Fan speeds up to 1800 RPM: 7.5 kW (10 horsepower) and smaller.
      b. Fan speeds over 1800 RPM: 2.2 kW (3 horsepower) and smaller.
   2. Provide fixed-pitch drives for drives larger than those listed above.
   3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

2.4 DRIVE GUARDS

A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.

B. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 6 mm (1/4-inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

C. V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gage sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (one-inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.

D. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.

E. Access for Speed Measurement: 25 mm (One inch) diameter hole at each shaft center.

2.5 LIFTING ATTACHMENTS

A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.6 ELECTRIC MOTORS

A. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements.

B. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).

C. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

D. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 40 degrees centigrade (104 degrees F); minimum horsepower as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.

E. Special Requirements:
   1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the City of San Diego.
   2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
   3. Wire and cable materials specified in the electrical DIVISION of the specifications shall be modified as follows:
      a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket.
      b. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
   4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment.
   5. Motors utilized with variable frequency drives shall be rated "inverter-ready" per NEMA Standard, MG1, Part 31.4.4.2. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

F. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.7 VARIABLE SPEED MOTOR CONTROLLERS

A. The combination of controller and motor shall be provided by the manufacturer of the driven equipment, such as pumps and fans, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. air handlers, fans, pumps, shall be product of a single manufacturer.

B. Motors shall be energy efficient type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.

C. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.

2.8 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking.

B. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.

C. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

2.9 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Vibration Isolators: Refer to SECTION 23 0541, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

B. Supports for Roof Mounted Items:
   1. Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory installed 50 mm by 100 mm (2 by 4) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 280 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.
   2. Pipe/duct pedestals: Provide a galvanized Unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

C. Attachment to Concrete Building Construction:
   1. Concrete insert: MSS SP-58, Type 18.
   2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (four inches) thick when approved by the Engineer of Record or Contracting Officer for each job condition.
   3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Engineer of Record or Contracting Officer for each job condition.

D. Attachment to Steel Building Construction:
   1. Welded attachment: MSS SP-58, Type 22.
   2. Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23mm (7/8-inch) outside diameter.

E. Attachment to Wood Construction: Wood screws or lag bolts.

F. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

G. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.
   1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
   2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

2.10 SPECIAL TOOLS AND LUBRICANTS

A. Furnish, and turn over to the Engineer of Record or Contracting Officer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: Hardwood or metal, permanently identified for in tended service and mounted, or located, where directed by the Engineer of Record or Contracting Officer.

D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.11 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.12 ASBESTOS

A. Materials containing asbestos are not permitted.

PART 3 EXECUTIONS

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Coordinate location of hangers, ductwork and equipment. Locate hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access. Submit the drawings for review as required by Part 1. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Equipment Support: Coordinate structural systems necessary for equipment support with equipment locations to permit proper installation.

C. Cutting Holes:
   1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by Engineer of Record or Contracting Officer where working area space is limited.
   2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by Engineer of Record or Contracting Officer. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to Engineer of Record or Contracting Officer for approval.
   3. Do not penetrate membrane waterproofing.
   4. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.

5. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
6. Protection and Cleaning:
7. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Engineer of Record or Contracting Officer. Damaged or defective items in the opinion of the Engineer of Record or Contracting Officer, shall be replaced.

D. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

E. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily. Servicing shall not require dismantling adjacent equipment or pipe work.

F. Inaccessible Equipment:
1. Where the City of San Diego determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the City of San Diego.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by City of San Diego under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for City of San Diego operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.

E. Contractor shall check all clearances and weight limitations. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Rigging plan and methods shall be referred to Engineer of Record or Contracting Officer for evaluation prior to actual work.

G. Restore building to original condition upon completion of rigging work.

3.3 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Engineer of Record or Contracting Officer.

B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.

D. HVAC Horizontal Pipe Support Spacing: Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:
   1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
   2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.

F. Overhead Supports:
   1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.

2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems shall be supported in channel troughs.

3.4 MECHANICAL DEMOLITION

A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor after approval for structural integrity by the Engineer of Record or Contracting Officer. Such access shall be provided without additional cost or time to the City of San Diego. Where work is in an operating fire station, provide approved protection from dust and debris at all times for the safety of fire station personnel and maintenance of fire station operation and environment of the fire station.\

B. In an operating fire station, maintain the operation, cleanliness and safety. City of San Diego personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and fire station operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of fire station operation. Perform all flame cutting to maintain the fire safety integrity of this fire station. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the City of San Diego, and Contractor shall follow all directives of the Engineer of Record or Contracting Officer with regard to rigging, safety, fire safety, and maintenance of operations.

C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain City of San Diego property and shall be removed and delivered to Engineer of Record or Contracting Officer and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from City of San Diego property expeditiously and shall not be allowed to accumulate.

3.5 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the City of San Diego, the plant facilities, equipment and systems shall be thoroughly cleaned and painted.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. Material And Equipment Not To Be Painted Includes:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.
   h. Valve stems and rotating shafts.
   i. Pressure gauges and thermometers.
   j. Glass.
   k. Name plates.
3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
5. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.6 IDENTIFICATION SIGNS

A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.

C. Pipe Identification

3.7 MOTOR AND DRIVE ALIGNMENT

A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.8 LUBRICATION

A. Lubricate all devices requiring lubrication prior to initial operation. Field-check all devices for proper lubrication.

B. Equip all devices with required lubrication fittings or devices. Provide a minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to Engineer of Record or Contracting Officer in unopened containers that are properly identified as to application.

C. Provide a separate grease gun with attachments for applicable fittings for each type of grease applied.

D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

3.9 STARTUP

A. Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation.

3.10 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests and submit the test reports and records to the Engineer of Record or Contracting Officer.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the City of San Diego.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.11 DEMONSTRATIONS AND TESTS

A. Test prior to placing in service.

B. Demonstrate to Engineer of Record or Contracting Officer R the proper operation of all equipment, instruments, operating and safety controls, and devices.

END OF SECTION 23 0511

SECTION 23 0541 - NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Noise criteria, seismic restraints for equipment, vibration tolerance and vibration isolation for HVAC and plumbing work.

1.2 QUALITY ASSURANCE

A. Refer to article, QUALITY ASSURANCE in specification SECTION 23 0511, COMMON WORK RESULTS FOR HVAC.

B. Noise Criteria:

1. Noise levels in all 8 octave bands due to equipment and duct systems shall not exceed following NC levels:

TYPE OF ROOM	NC LEVEL
Bathrooms and Toilet Rooms	40
Corridors	40
Dining Rooms, Food Services/ Serving	35
Exercise Rooms	50
Kitchens	50
Lobbies, Waiting Areas	40
Offices	35
Dormitory Rooms	30
Lounge/Recreation Rooms	50
Shops	50
Apparatus/Warehouse	50

2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the fore-going noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE Fundamentals Handbook, Chapter 7, Sound and Vibration.
3. An allowance, not to exceed 5db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.

4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

C. Seismic Restraint Requirements:
   1. Equipment:
      a. All mechanical equipment not supported with isolators external to the unit shall be securely anchored to the structure. Such mechanical equipment shall be properly supported to resist a horizontal force of 50 percent of the weight of the equipment furnished.
      b. All mechanical equipment mounted on vibration isolators shall be provided with seismic restraints capable of resisting a horizontal force of 100 percent of the weight of the equipment furnished.
   2. Piping: Refer to specification SECTION 23 0511, COMMON WORK RESULTS FOR HVAC.

D. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

1.3 SUBMITTALS

A. Submit SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's Literature and Data:
   1. Vibration isolators:
      a. Floor mountings
      b. Hangers
      c. Snubbers
      d. Thrust restraints
   2. Bases.
   3. Seismic restraint provisions and bolting.
   4. Acoustical enclosures.
C. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.

D. Seismic Requirements: Submittals are required for all equipment anchors, supports and seismic restraints. Submittals shall include weights, dimensions, standard connections, and manufacturer's certification that all specified equipment will withstand seismic Lateral Force requirements as shown on drawings,

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

1. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)

   a. 2005: Fundamentals Handbook, Chapter 7, Sound and Vibration

2. American Society for Testing and Materials (ASTM)

   a. A123/A123M-02: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

   b. A307-04: Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

   c. D2240-05: Standard Test Method for Rubber Property - Durometer Hardness

3. Manufacturers Standardization (MSS)

   a. SP-58-02: Pipe Hangers and Supports-Materials, Design and Manufacture

4. Occupational Safety and Health Administration (OSHA)

   a. 29 CFR 1910.95: Occupational Noise Exposure

5. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline.

   a. 2015: Edition

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Type of isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer but subject to minimum requirements indicated herein and in the schedule on the drawings.

B. Elastometric Isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.

C. Exposure to weather: Isolators, including springs, exposed to weather shall be hot dip galvanized after fabrication. Hot-dip zinc coating shall not be less than 609 grams per square meter (two ounces per square foot) by weight complying with ASTM A123.In addition provide limit stops to resist wind velocity. Comply with the design wind velocity of 70 mph (113 kph).

D. Uniform Loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.

E. Color code isolators by type and size for easy identification of capacity.

2.2 SEISMIC RESTRAINT REQUIREMENTS FOR EQUIPMENTS

A. Bolt pad mounted equipment, without vibration isolators, to the floor or other support using ASTM A307 standard bolting material.

B. Floor mounted equipment, with vibration Isolators: Type SS. Where Type N isolators are used provide channel frame base horizontal restraints bolted to the floor, or other support, on all sides of the equipment Size and material required for the base shall be as recommended by the isolator manufacturer.

C. On all sided of suspended equipment, provide bracing for rigid supports and provide restraints for resiliently supported equipment. The slack cable restraint method, Mason Industries, or equal, is acceptable.

2.3 VIBRATION ISOLATORS

A. Floor Mountings:

1. Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.

2. Spring Isolators (Type S): Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.

3. Captive Spring Mount for Seismic Restraint (Type SS):

   a. Design mounts to resiliently resist seismic forces in all directions. Snubbing shall take place in all modes with adjustment to limit upward, downward, and horizontal travel to a maximum of 6 mm (1/4-inch) before contacting snubbers. Mountings shall have a minimum rating of one G coefficient of gravity as calculated and certified by a registered structural engineer.

   b. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection. Mountings shall have ports for spring inspection. Provide an all directional neoprene cushion collar around the equipment bolt.

4. Spring Isolators with Vertical Limit Stops (Type SP): Similar to spring isolators noted above, except include a vertical limit stop to limit upward travel if weight is removed and also to reduce movement and spring extension due to wind loads. Provide clearance around restraining bolts to prevent mechanical short circuiting. Isolators shall have a minimum seismic rating of one G.

5. Seismic Pad (Type DS): Pads shall be felt, cork neoprene waffle, neoprene and cork sandwich, neoprene and fiberglass, neoprene and steel waffle, or reinforced duck and neoprene, with steel top plate and drilled for an anchor bolt. Washers

and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).

B. Hangers: Shall be combination neoprene and springs unless otherwise noted and shall allow for expansion of pipe.

1. Combination Neoprene and Spring (Type H): Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.

2. Spring Position Hanger (Type HP): Similar to combination neoprene and spring hanger except hanger shall hold piping at a fixed elevation during installation and include a secondary adjustment feature to transfer load to spring while maintaining same position.

3. Neoprene (Type HN): Vibration hanger shall contain a double deflection type neoprene isolation element. Hanger rod shall be separated from contact with hanger bracket by a neoprene grommet.

4. Spring (Type HS): Vibration hanger shall contain a coiled steel spring in series with a neoprene grommet. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.

5. Hanger supports for piping 50 mm (2 inches) and larger shall have a pointer and scale deflection indicator.

C. Snubbers: Each spring mounted base shall have a minimum of four all-directional or eight two directional (two per side) seismic snubbers that are double acting. Elastomeric materials shall be shock absorbent neoprene bridge quality bearing pads, maximum 60 durometer, replaceable and have a minimum thickness of 6 mm (1/4 inch). Air gap between hard and resilient material shall be not less than 3 mm (1/8 inch) nor more than 6 mm (1/4 inch). Restraints shall be capable of withstanding design load without permanent deformation.

D. Thrust Restraints (Type THR): Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow a maximum movement of 6 mm (1/4 inch) when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Vibration Isolation:

1. No metal-to-metal contact will be permitted between fixed and floating parts.
2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports.
3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
4. Provide heat shields where elastomers are subject to temperatures over 38 degrees C (l00 degrees F).
5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
6. Non-rotating equipment such as heat exchangers and convertors shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.

B. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

3.2 ADJUSTING

A. Adjust vibration isolators after piping systems are filled and equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4inch (6-mm) movement during start and stop.

D. Adjust active height of spring isolators.

E. Adjust snubbers according to manufacturer's recommendations.

F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

G. Torque anchor bolts according to equipment manufacturer's recommendations to resist seismic forces.

SELECTION GUIDE FOR VIBRATION ISOLATORS

		ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
EQUIPMENT		BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
REFRIGERATION MACHINES																
ABSORPTION		---	D	0.3	---	SP	1.0	---	SP	1.0	---	SP	1.7	---	SP	1.7
PACKAGED HERMETIC		---	D	0.3	---	SP	1.0	---	SP	1.7	---	SP	1.7	R	SP	2.5
OPEN CENTRIFUGAL		B	D	0.3	B	SP	1.0	---	SP	1.7	B	SP	1.7	B	SP	2.5
ROTARY-SCREW		---	N	0.3	---	SP	1.0	---	SP	1.7	---	SP	1.7	---	N	2.5
Reciprocating:	500 - 750 RPM	---	N	0.3	---	SP	1.7	R	SP	2.5	R	SP	2.5	R	SP	3.5
	751 RPM & OVER	---	N	0.3	---	SP	1.0	---	---	1.7	R	SP	2.5	R	SP	2.5
COMPRESSORS AND VACUUM PUMPS																
UP THROUGH 1-1/2 HP		---	D,L,W	0.3	---	D,L,W	0.3	---	D,L,W	0.3	---	D,L,W	0.3	---	D,L,W	0.3
2 HP AND OVER:	500 - 750 RPM	---	D	0.3	---	S	1.7	---	S	2.5	---	S	2.5	---	S	2.5
	750 RPM & OVER	---	D	0.3	---	S	1.0	---	S	1.7	---	S	2.5	---	S	2.5

EQUIPMENT		ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
		BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
PUMPS																
CLOSE COUPLED	UP TO 1-1/2 HP	---	D,L,W	0.3	---	D,L,W	0.3	---	D,L,W	0.3	---	D,L,W	0.3	---	D,L,W	0.3
	2 HP & OVER	---	D,L,W	0.3	I	S	1.0	I	S	1.0	I	S	1.7	I	S	1.7
BASE MOUNTED	UP TO 10 HP	---	---	---	I	S	1.0	I	S	1.0	I	S	1.7	I	S	1.7
	15 HP THRU 40 HP	I	S	1.0	I	S	1.0	I	S	1.7	I	S	1.7	I	S	1.7
	50-125 HP	I	S	1.0	I	S	1.0	I	S	1.7	I	S	2.5	I	S	2.5
	150 HP & OVER	I	S	1.0	I	S	1.7	I	S	2.5	I	S	2.5	I	S	3.5
ROOF VENTILATORS, ABOVE OCCUPIED AREAS:																
5 HP & OVER		---	---	---	CB	S	1.0	CB	S	1.7	CB	S	1.7	CB	S	2.5

EQUIPMENT		ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
		BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
CENTRIFUGAL BLOWERS																
UP TO 50 HP	UP TO 200 RPM	B	N	0.3	B	S	2.5	B	S	2.5	B	S	3.5	B	S	3.5
	201 - 300 RPM	B	N	0.3	B	S	1.7	B	S	2.5	B	S	2.5	B	S	3.5
	301 - 500 RPM	B	N	0.3	B	S	1.7	B	S	1.7	B	S	2.5	B	S	3.5
	501 RPM & OVER	B	N	0.3	B	S	1.0	B	S	1.0	B	S	1.7	B	S	2.5
60 HP & OVER	UP TO 300 RPM	B	S	1.7	I	S	2.5	I	S	3.5	I	S	3.5	I	S	3.5
	301 - 500 RPM	B	S	1.7	I	S	1.7	I	S	2.5	I	S	3.5	I	S	3.5
	501 RPM & OVER	B	S	1.0	I	S	1.7	I	S	1.7	I	S	2.5	I	S	2.5
COOLING TOWERS																
UP TO 300 RPM		---	D	0.3	---	SP	3.5	---	SP	3.5	---	SP	3.5	---	SP	4.5
301 TO 500 RPM		---	D	0.3	---	SP	2.5	---	SP	2.5	---	SP	2.5	---	SP	3.5
501 RPM & OVER		---	D	0.3	---	SP	1.0	---	SP	1.0	---	SP	1.7	---	SP	2.5

EQUIPMENT		ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
		BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
INTERNAL COMBUSTION ENGINES																
UP TO 25 HP		I	N	0.3	I	N	1.0	I	S	1.7	I	S	2.5	I	S	2.5
30 THRU 100 HP		I	N	0.3	I	N	1.7	I	S	2.5	I	S	3.5	I	S	3.5
125 HP & OVER		I	N	0.3	I	N	2.5	I	S	3.5	I	S	4.5	I	S	4.5
AIR HANDLING UNIT PACKAGES, SUSPENDED:																
UP THRU 5 HP		---	---	---	---	H	1.0	---	H	1.0	---	H	1.0	---	H	1.0
7-1/2 HP & OVER:	UP TO 500 RPM	---	---	---	---	H,THR	1.7	---	H,THR	1.7	---	H,THR	1.7	---	H,THR	1.7
	501 RPM & OVER	---	---	---	---	H,THR	1.0	---	H,THR	1.0	---	H,THR	1.7	---	H,THR	1.7
AIR HANDLING UNIT PACKAGES, FLOOR MOUNTED:																
UP THRU 5 HP		---	D	---	---	S	1.0	---	S	1.0	---	S	1.0	---	S	1.0
7-1/2 HP & OVER:	UP TO 500 RPM	---	D	---	R	S,THR	1.7	R	S,THR	1.7	R	S,THR	1.7	R	S,THR	1.7
	501 RPM & OVER	---	D	---	---	S,THR	1.0	---	S,THR	1.0	R	S,THR	1.7	R	S,THR	1.7

EQUIPMENT		ON GRADE			20FT FLOOR SPAN			30FT FLOOR SPAN			40FT FLOOR SPAN			50FT FLOOR SPAN		
		BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL	BASE TYPE	ISOL TYPE	MIN DEFL
IN-LINE CENTRIFUGAL AND VANE AXIAL FANS, FLOOR MOUNTED: (APR 9)																
UP TO 50 HP	UP TO 300 RPM	—	D	—	R	S	2.5	R	S	2.5	R	S	2.5	R	S	3.5
	301 - 500 RPM	—	D	—	R	S	1.7	R	S	1.7	R	S	2.5	R	S	2.5
	501 - & OVER	—	D	—	—	S	1.0	—	S	1.0	R	S	1.7	R	S	2.5
60 HP & OVER	301 - 500 RPM	R	S	1.0	R	S	1.7	R	S	1.7	R	S	2.5	R	S	3.5
	501 RPM & OVER	R	S	1.0	R	S	1.7	R	S	1.7	R	S	1.7	R	S	2.5
CONDENSING UNITS:																
ALL		—	D	0.3	—	SP	1.0	—	SP	1.7	—	SP	1.7	—	SP	2.5
PACKAGED AC UNITS:																
UP TO 10 TON		—	D	0.3	—	SP	1.0	—	SP	1.7	—	SP	1.7	—	SP	2.5
15 TON & UP	UP TO 300 RPM	—	D	0.3	—	SP	3.5	—	SP	3.5	—	SP	3.5	—	SP	4.5
	301 – 500 RPM	—	D	0.3	—	SP	2.5	—	SP	2.5	—	SP	2.5	—	SP	3.5
	501 RPM & OVER	—	D	0.3	—	SP	1.5	—	SP	1.5	—	SP	1.5	—	SP	2.5

NOTES:

1. Edit the Table above to suit where isolator, other than those shown, are used, such as for seismic restraints and position limit stops.
2. For suspended floors lighter than 100 mm (4 inch) thick concrete, select deflection requirements from next higher span.
3. For separate chiller building on grade, pump isolators may be omitted.
4. Direct bolt fire pumps to concrete base. Provide pads (D) for domestic water booster pump package.
5. For projects in seismic areas, use only SS & DS type isolators and snubbers.
6. For floor mounted in-line centrifugal blowers (ARR 1): use "B" type in lieu of "R" type base.
7. Suspended: Use "H" isolators of same deflection as floor mounted.

END OF SECTION 23 0541

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 DESCRIPTION

A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:

1. Planning systematic TAB procedures.
2. Design Review Report.
3. Systems Inspection report.
4. Duct Air Leakage test report.
5. Systems Readiness Report.
6. Balancing air distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
7. Vibration and sound measurements.
8. Recording and reporting results.

B. Definitions:

1. Basic TAB used in this SECTION: Chapter 37, "Testing, Adjusting and Balancing" of ASHRAE Handbook, "HVAC Applications".
2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
3. AABC: Associated Air Balance Council.
4. NEBB: National Environmental Balancing Bureau.
5. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
6. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

A. SECTION 23 05 11, COMMON WORK RESULTS FOR HVAC

1.3 QUALITY ASSURANCE

A. Refer to Articles, Quality Assurance and Submittals, in SECTION 23 0511, COMMON WORK RESULTS FOR HVAC.

B. Qualifications:

1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.

2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Engineer of Record or Contracting Officer and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this section and in other related sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.

3. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Engineer of Record or Contracting Officer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this section and in other related sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.

4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Engineer of Record or Contracting Officer. The responsibilities would specifically include:

    a. Shall directly supervise all TAB work.

    b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.

    c. Would follow all TAB work through its satisfactory completion.

    d. Shall provide final markings of settings of all HVAC adjustment devices.

    e. Permanently mark location of duct test ports.

5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing.

C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.

D. Tab Criteria:
   1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports.
   2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 90 percent of final values for pre-filters and after-filters.
      a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0 percent to plus l0 percent.
      b. Air terminal units (maximum values): Minus 2 percent to plus l0 percent.
      c. Exhaust hoods/cabinets: 0 percent to plus l0 percent.
      d. Minimum outside air: 0 percent to plus 10 percent.
      e. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 2 percent to plus l0 percent except if the air to a space is 100 CFM or less the tolerance would be 0 to plus 5 percent.
   3. Systems shall be adjusted for energy efficient operation as described in PART- 3.
   4. Typical TAB procedures and results shall be demonstrated to the Engineer of Record or Contracting Officer for one air distribution system (including all fans, three terminal units, three rooms) as follows:
      a. When field TAB work begins.
      b. During each partial final inspection and the final inspection for the project if requested by Engineer of Record or Contracting Officer.

1.4 SUBMITTALS

A. Submit in accordance with THE WHITEBOOK for SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.

C. For use by the Engineer of Record or Contracting Officer staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.

D. Submit Following for Review and Approval:
   1. Design Review Report within 90 days after the system layout on air side is completed by the Contractor.
   2. Systems inspection report on equipment and installation for conformance with design.

3. Duct Air Leakage Test Report.
4. Systems Readiness Report.
5. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
6. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

1.5 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.
   1. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)
      a. 2011: HVAC Applications ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing and Chapter 47, Sound and Vibration Control
   2. Associated Air Balance Council (AABC)
      a. 2002: AABC National Standards for Total System Balance
   3. National Environmental Balancing Bureau (NEBB)
      a. 7th Edition 2005: Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems
      b. 2nd Edition 2006: Procedural Standards for the Measurement of Sound and Vibration
   4. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
      a. 3rd Edition 2002: HVAC SYSTEMS-Testing, Adjusting and Balancing
      b. 2nd Edition 2012: HVAC Air Duct Leakage Test Manual
   5. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline.
      a. 2015: Edition

PART 2 PRODUCTS

2.1 PLUGS

A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

A. See SECTION 23 0711 HVAC AND PLUMBING INSULATION. Provide for repair of insulation removed or damaged for TAB work.

PART 3 EXECUTION

3.1 GENERAL

A. Refer to TAB Criteria in Article, Quality Assurance.

B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

A. The TAB Specialist shall review the Contract Plans and specifications and advise the Engineer of Record or Contracting Officer of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

A. Inspect equipment and installation for conformance with design.

B. The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

C. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.4 SYSTEM READINESS REPORT

A. Inspect each System to ensure that it is complete including installation and operation of controls.

B. Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Engineer of Record or Contracting Officer.

3.5 TAB REPORTS

A. Submit an intermediate report for 50 percent of systems and equipment tested and balanced to establish satisfactory test results.

B. The TAB contractor shall provide raw data immediately in writing to the Engineer of Record or Contracting Officer if there is a problem in achieving intended results before submitting a formal report.

C. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval.

D. Do not proceed with the remaining systems until intermediate report is approved by the Engineer of Record or Contracting Officer.

3.6 TAB PROCEDURES

A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.

B. General: During TAB all related system components shall be in full operation. Fan rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls of distribution systems to simulate design operation of systems for test and balance work.

C. Coordinate TAB procedures with construction completion requirements for the project. Provide TAB reports for the project prior to partial final inspections of the project.

D. Allow sufficient time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.

E. Air Balance and Equipment Test: Include air handling units, fans, room diffusers/outlets/inlets.

1. Artificially load air filters by partial blanking to produce air pressure drop of at least 90 percent of the design final pressure drop.

2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in SECTION 23 0511 COMMON WORK RESULTS FOR HVAC.

3. Test and balance systems in all specified modes of operation, including economizer mode. Verify that dampers and other controls function properly.

4. Constant air volume (CAV) systems:

a. Coordinate TAB, including system volumetric controls, with SECTION 23 7333 HEATING VENTILATING, AND AIR CONDITIONING.

5. Record final measurements for air handling equipment performance data sheets.

3.7 VIBRATION TESTING

A. Furnish instruments and perform vibration measurements as specified in SECTION 23 0541 NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Field vibration balancing is specified in SECTION 23 0511 COMMON WORK RESULTS FOR HVAC. Provide measurements for all rotating HVAC equipment of 373 watts (1/2 horsepower) and larger, including fans and motors.

B. Record initial measurements for each unit of equipment on test forms and submit a report to the Engineer of Record or Contracting Officer. Where vibration readings exceed the allowable tolerance Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the Engineer of Record or Contracting Officer.

3.8 SOUND TESTING

A. Perform and record required sound measurements in accordance with Paragraph, QUALITY ASSURANCE in SECTION 23 0541 NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
   1. Take readings in rooms all rooms. The Engineer of Record or Contracting Officer may designate the specific rooms to be tested.

B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.

C. Sound reference levels, formulas and coefficients shall be according to ASHRAE Handbook, "HVAC Applications", Chapter 47, SOUND AND VIBRATION CONTROL.

D. Determine compliance with specifications as follows:
   1. When sound pressure levels are specified, including the NC Criteria in SECTION 23 0541 NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT:
   a. Reduce the background noise as much as possible by shutting off unrelated audible equipment.
   b. Measure octave band sound pressure levels with specified equipment "off."
   c. Measure octave band sound pressure levels with specified equipment "on."
   d. Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

DIFFERENCE:	0	1	2	3	4	5 to 9	10 or More
FACTOR:	10	7	4	3	2	1	0

      i. Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.

   e. Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.

2. When sound power levels are specified:
   a. Perform steps 1.a. thru 1.d., as above.
   b. For indoor equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level. Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.
   c. For outdoor equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be the sum of sound pressure level due to equipment plus the distance factor. Use 16 meters (50 feet)for sound level location.
3. Where sound pressure levels are specified in terms of dB(A) measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.

E. Where measured sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the Engineer of Record or Contracting Officer and the necessary sound tests shall be repeated.

3.9 MARKING OF SETTINGS

A. Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Engineer of Record or Contracting Officer.

3.10 IDENTIFICATION OF TEST PORTS

A. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

END OF SECTION 23 0593

SECTION 23 0711 - HVAC and PLUMBING INSULATION

PART 1 GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for

1. HVAC PIPING, DUCTWORK AND EQUIPMENT.

B. Definitions

1. ASJ: All service jacket, white finish facing or jacket.
2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
4. Concealed: Ductwork and piping above ceilings and in chases.
5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
6. FSK: Foil-scrim-kraft facing.
7. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F);HVAC equipment or piping handling media above 41 degrees C (105 degrees F).
8. Density: kg/m^3 - kilograms per cubic meter (PCF - pounds per cubic foot).
9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
10. Thermal conductance: Heat flow rate through materials.

a. Flat surface: Watt per square meter (BTU per hour per square foot).
b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).

11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
12. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. SECTION 07 8400 FIRESTOPPING: Mineral fiber and bond breaker behind sealant.

B. SECTION 23 0511 COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one SECTION of DIVISION 23.

1.3 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, in SECTION 23 0511 COMMON WORK RESULTS FOR HVAC.

B. Criteria:

1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6 and 5.4.6.4, parts of which are quoted as follows:
   a. 4.3.3.1 Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems, unless otherwise provided for in 4.3.3.1.2 or 4.3.3.1.3, shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.
   b. 4.3.3.1.1 Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. *(See 4.2.4.2.)*
   c. 4.3.3.1.2 The flame spread and smoke developed index requirements of 4.3.3.1.1 shall not apply to air duct weatherproof coverings where they are located entirely outside of a building, do not penetrate a wall or roof, and do not create an exposure hazard.
   d. 4.3.3.1.3 Smoke detectors required by 6.4.4 shall not be required to meet flame spread index or smoke developed index requirements
   e. 4.3.3.2 Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, Standard for Safety Factory-Made Air Ducts and Air Connectors, shall have been tested, listed, and used in accordance with the conditions of their listings, in accordance with one of the following:
      i. UL 181A, Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors
      ii. UL 181B, Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors
   f. 4.3.3.3 Air duct, panel, and plenum coverings and linings, and pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.
   g. 4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).
   h. 4.3.3.4 Air duct coverings shall not extend through walls or floors that are required to be fire stopped or required to have a fire resistance rating, unless such coverings meet the requirements of 5.4.6.4.
   i. 4.3.3.5 Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.
   j. 4.3.3.6 Air duct coverings shall not be installed so as to conceal or prevent the use of any service opening.

k. 4.3.10.2.6 - Materials exposed to the airflow shall be noncombustible or limited combustible and have a maximum smoke developed index of 50 or comply with the following:

i. 4.3.10.2.6.1 - Electrical wires and cables and optical fiber cables shall be listed as noncombustible or limited combustible and have a maximum smoke developed index of 50 or shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

ii. 4.3.10.2.6.2 - Pneumatic tubing for control systems shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1820, Standard for Safety Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics.

iii. 4.3.10.2.6.3 - Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

iv. 4.3.10.2.6.4 - Optical-fiber and communication raceways shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2024, Standard for Safety Optical-Fiber Cable Raceway.

v. 4.3.10.2.6.5 - Loudspeakers and recessed lighting fixtures, including their assemblies and accessories, shall be permitted in the ceiling cavity plenum where listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less when tested in accordance with UL 2043, Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

vi. 4.3.10.2.6.6 - Supplementary materials for air distribution systems shall be permitted when complying with the provisions of 4.3.3.

vii. 4.3.10.2.6.7 - Smoke detectors shall not be required to meet the provisions of this section.

l. 5.4.6.4 Where air ducts pass through walls, floors, or partitions that are required to have a fire resistance rating and where fire dampers are not required, the opening in the construction around the air duct shall be as follows:

i. Not exceeding a 25.4 mm (1 in.) average clearance on all sides

ii. Filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the time-temperature fire conditions required for fire barrier penetration as specified in NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials.*

2. Test methods: ASTM E84, UL 723, or NFPA 255.

3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.

4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

A. Submit SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.

a. Insulation materials: Specify each type used and state surface burning characteristics.

b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.

c. Insulation accessory materials: Each type used.

d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.

e. Make reference to applicable specification paragraph numbers for coordination.

C. Samples:

1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/ blanket; 150 mm (6 inches) long, full diameter for round types.

2. Each type of facing and jacket: Minimum size 100 mm (4 inches square).

3. Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives / cement / mastic.

1.5 STORAGE AND HANDLING OF MATERIAL

A. Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

1. American Society for Testing and Materials (ASTM)
   a. A167-99: Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
   b. B209-04: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
   c. C411-97: Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation
   d. C449-00: Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
   e. C534-05: Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
   f. C547-06: Standard Specification for Mineral Fiber pipe Insulation
   g. C552-03: Standard Specification for Cellular Glass Thermal Insulation
   h. C553-02: Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
   i. C1136-06: Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
   j. D1668-97a (2006): Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
   k. E84-06: Standard Test Method for Surface Burning Characteristics of Building Materials
   l. E119-08: Standard Test Method for Fire Tests of Building Construction and Materials
   m. E136-09: Standard Test Methods for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C (1380 F)

2. National Fire Protection Association (NFPA):

   a. 90A-02: Installation of Air Conditioning and Ventilating Systems

   b. 101-06: Life Safety Code

   c. 251-06: Standard methods of Tests of Fire Endurance of Building Construction Materials

   d. 255-06: Standard Method of tests of Surface Burning Characteristics of Building Materials

3. Underwriters Laboratories, Inc (UL):

   a. UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 08/03

4. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS):

   a. SP58-2002: Pipe Hangers and Supports Materials, Design, and Manufacture

5. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline.

   a. 2015: Edition

PART 3 PRODUCTS

2.1 MINERAL FIBER

A. ASTM C553 (Blanket, Flexible) Type I, Class B-5, Density 32 kg/m^3 (2 pcf), k = 0.04 (0.27), for use at temperatures up to 204 degrees C (400 degrees F)

2.2 Mineral wool or refractory fiber

A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

2.3 CELLULAR GLASS closed-cell

A. Comply with Standard ASTM C177, C518, density 120 kg/m3 (7.5 pcf) nominal, k = 0.033 (0.29) at 0 degrees C (75 degrees F).

B. Pipe insulation for temperatures up to 200 degrees C (400 degrees F).

2.4 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

A. ASTM C177, C518, k = 0.039 Watt per meter, per degree C (0.27), at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

2.5 DUCT WRAP FOR KITCHEN HOOD GREASE DUCTS

A. Light weight, high temperature mineral fiber or ceramic fiber insulating material with low thermal conductivity K value of 0.060 W/m2 degrees C (0.417 Btu in/hr ft² degrees F) at mean temperature of 260 degrees C (500 degrees F).

B. Material shall be fully encapsulated by UL classified aluminum foil and tested to ASTM E84 standard.

C. Material shall be UL tested for internal grease fire to 1093 degrees C (2,000 degrees F) with zero clearance and for through-penetration firestop.

D. Material shall be UL classified for 2 hour fire rating for grease duct enclosure, and meet NFPA 96 requirements for direct applied insulating material to grease ducts with zero clearance.

E. Material flame spread and smoke developed ratings shall not be higher than 5, as per ASTM E 84/UL 723 Flammability Test.

2.6 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.

B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 5 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 100 mm (4 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.

D. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

E. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.

2.7 ADHESIVE, MASTIC, CEMENT

A. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.

B. Other: Insulation manufacturers' published recommendations.

2.8 MECHANICAL FASTENERS

A. Pins, anchors: Welded pins, or metal or nylon anchors with tin-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.

B. Staples: Outward clinching monel or stainless steel.

C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.

D. Bands: 20 mm (3/4 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.9 REINFORCEMENT AND FINISHES

A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).

B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.

C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.

D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

2.10 FLAME AND SMOKE

A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

PART 4 EXECUTION

3.7 GENERAL REQUIREMENTS

A. Required pressure tests of duct and connections shall be completed and the work approved by the Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions, insulate entire specified equipment and duct systems. Insulate each duct individually. Do not use scrap pieces of insulation where a full length section will fit.

C. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

D. Install vapor stops at all insulation terminations on either side of equipment.

E. Insulation on hot equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.

F. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

G. HVAC work not to be insulated:

1. Internally insulated ductwork and air handling units.
2. Relief air ducts (Economizer cycle exhaust air).
3. Exhaust air ducts and plenums, and ventilation exhaust air shafts.

H. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

I. Firestop Pipe and Duct insulation:
1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed.
2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
   a. Pipe risers through floors
   b. Pipe or duct chase walls and floors
   c. Smoke partitions
   d. Fire partitions

J. Provide metal jackets over insulation as follows:
1. All piping and ducts exposed to outdoor weather.
2. Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
3. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

3.8 INSULATION INSTALLATION

A. Flexible Mineral Fiber Blanket:

1. Adhere insulation to metal with 100 mm (4 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
3. Concealed supply air ductwork.
   a. Above ceilings at a roof level: 50 mm (2 inch) thick insulation faced with FSK.
   b. Above ceilings for other than roof level: 40 mm (1 ½ inch) thick insulation faced with FSK.
4. Concealed return air duct above ceilings at a roof level, unconditioned areas, and in chases with external wall or containing steam piping; 40 mm (1-1/2 inch) thick, insulation faced with FSK. Concealed return air ductwork in other locations need not be insulated.
5. Return air duct in interstitial spaces: 40 mm (1-1/2 inch thick insulation faced with FSK.
6. Concealed outside air duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.
7. Exhaust air branch duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.
8. Condensation control insulation: Minimum 20 mm (0.75 inch) thick for all pipe sizes.
   a. HVAC: Cooling coil condensation piping to waste piping fixture or drain inlet. Omit insulation on plastic piping in mechanical rooms.

B. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
   a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
   b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.

c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.

d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).

3. Nominal thickness in millimeters and inches specified in table below, for piping above ground:

Nominal Thickness of Molded Mineral Fiber Insulation		
Nominal Pipe Size, millimeters (inches):	25 (1) & below	32- 75 (1-1/4- 3)
a. Domestic hot water supply and return	15 (0.5)	20 (0.75)

C. Flexible Elastomeric Cellular Thermal Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
2. Pipe and tubing insulation:
   a. Use proper size material. Do not stretch or strain insulation.
   b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under SECTION 23 0511 COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.
   c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in table below for piping above ground:

Nominal Thickness of Flexible Elastomeric Cellular Insulation		
Nominal Pipe Size millimeters (inches)	25 (1) & below	32-75 (1 1/4-3)
1. 4-16 degrees C (40-60 degrees F) (CHS, CHR)	25 (1.0)	40 (1.5)
a. Runouts to fan coil units/ cooling coil condensate piping	20 (0.75)	40 (1.5)
2. Domestic hot water supply and return	15 (0.50)	20 (0.75)

5. Minimum 20 mm (0.75 inch) thick insulation for pneumatic control lines for a minimum distance of 6 m (20 feet) from discharge side of the refrigerated dryer.
6. Use Class S (Sheet), 20 mm (3/4 inch) thick for the following:
   a. Chilled water pumps
   b. Chillers, insulate any cold chiller surfaces subject to condensation which has not been factory insulated.

D. Duct Wrap for Kitchen Hood Grease Ducts:
1. The insulation thickness, layers and installation method shall be as per recommendations of the manufacturer to maintain the fire integrity and performance rating.
2. Provide stainless steel jacket for all exterior and exposed interior ductwork.

E. Installation:
1. Insulation shall be firmly applied, joints butted tightly, mechanically fastened by stainless steel wires on 300 mm (12 inch) centers.
2. At support points, fill and thoroughly pack space between pipe covering protective saddle bearing area.
3. Terminate insulation and jacket hard and tight at anchor points.
4. On mineral fiber systems, insulate welded and threaded fittings more than 50 mm (2 inches) in diameter with compressed blanket insulation (minimum 2/1) and finish with jacket or PVC cover.
5. Insulate fittings 50 mm (2 inches) and smaller with mastic finishing material and cover with jacket.
6. Install jacket smooth, tight and neatly finish all edges. Over wrap ASJ butt strips by 50 percent. Secure aluminum jacket with stainless steel bands 300 mm (12 inches) on center or aluminum screws on 200 mm (4 inch) centers.
7. Do not insulate basket removal flanges on strainers.

END OF SECTION 23 0711

SECTION 23 0800 - COMMISSIONING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
   1. Associated Air Balance Council (AABC) Commissioning Group – (ACG)
      a. ACG: (2005) Commissioning Guideline
   2. National Environmental Balancing Bureau (NEBB)
      a. NEBB Commissioning Standard: (2009) Procedural Standards for Whole Building Systems Commissioning of New Construction; 3rd Edition
   3. Sheet Metal And Air Conditioning Contractors' National Association (SMACNA)
      a. SMACNA 1429: (1994) HVAC Systems Commissioning Manual 1st Edition
   4. U.S. Green Building Council (USGBC)
      a. LEED BD+C: (2009; R 2010) Leadership in Energy and Environmental Design(tm) Building Design and Construction (LEED-NC)
   5. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline.
      a. 2015: Edition

1.2 DEFINITIONS

A. In some instances, terminology differs between the Contract and the Commissioning Standard primarily because the intent of this section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results. The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding ACG, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS			
Contract Term	ACG	NEBB	TABB
Commissioning Standard	ACG Commissioning Guideline	Procedural Standards for Building Systems Commissioning	SMACNA HVAC Commissioning Guideline
Commissioning Specialist	ACG Certified Commissioning Agent	NEBB Qualified Commissioning Administrator	TABB Certified Commissioning Supervisor

1.3 SYSTEM DESCRIPTION

A. General

1. Perform Commissioning in accordance with the requirements of the standard under which the Commissioning Firm's or Contractor's qualifications are approved, i.e., ACG Commissioning Guideline, NEBB Commissioning Standard, or SMACNA 1429 unless otherwise stated herein.
   a. Consider mandatory all recommendations and suggested practices contained in the Commissioning Standard. Use the Commissioning Standard for all aspects of Commissioning, including qualifications for the Commissioning Firm and Specialist and calibration of Commissioning instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the Commissioning Standard, the manufacturer's recommendations shall be adhered to. All quality assurance provisions of the Commissioning Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the Commissioning Standard, Commissioning procedures shall be developed by the Commissioning Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the Commissioning Standard used (ACG, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.
   b. The checklist provided in Appendix A is not complete for all HVAC Systems. The Contractor shall utilize the checklist requirements of the standard under which the Commissioning Contractor's qualifications are approved.

1.4 COMMISSIONING FIRM

A. Submit certification of the proposed Commissioning Firm's qualifications to perform the duties specified herein and in other related sections, no later than 21 days after the Notice to Proceed. Include in the documentation the date that the Certification was initially granted and the date when the current Certification expires. The firm is either a member of ACG or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications. Any lapses in Certification of the proposed Commissioning Firm or disciplinary action taken by ACG, NEBB, or TABB against the proposed Commissioning Firm shall be described in detail. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, immediately notify the Contracting Officer and submit another Commissioning Firm for approval.

B. Any firm that has been the subject of disciplinary action by the ACG, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including Commissioning. All work specified in this section and in other related sections to be performed by the Commissioning Firm shall be considered invalid if the Commissioning Firm loses its certification prior to Contract completion and must be performed by an approved successor. These Commissioning services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The Commissioning Firm shall be a subcontractor of the prime Contractor and shall be financially and corporately independent of all other sub-Contractors. The Commissioning Firm shall report to and be paid by the prime Contractor.

1.5 COMMISSIONING SPECIALIST

A. General

1. Submit certification of the proposed Commissioning Specialist's qualifications to perform the duties specified herein and in other related sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date when the current Certification expires. The Commissioning Specialist shall be an ACG Certified Commissioning Agent, a NEBB Qualified Commissioning Administrator, or a TABB Certified Commissioning Supervisor and shall be an employee of the approved Commissioning Firm. Any lapses in Certification of the proposed Commissioning Specialist or disciplinary action taken by ACG, NEBB, or TABB against the proposed Commissioning Specialist shall be described in detail.
2. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Commissioning Specialist loses subject certification during this period, immediately notify the Contracting Officer and submit another Commissioning Specialist for approval. Any individual that has been the subject of disciplinary action by the ACG, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including Commissioning. All work specified in this section and in other related sections performed by the Commissioning Specialist shall be considered invalid if the Commissioning Specialist loses certification prior to Contract completion and must be performed by the approved successor.

B. Responsibilities

1. Perform all Commissioning work specified herein and in related sections under the direct guidance of the Commissioning Specialist. The Commissioning Specialist shall prepare, no later than 28 days after the approval of the Commissioning Specialist, the Commissioning Plan which will be a comprehensive schedule and will include all submittal requirements for procedures, notifications, reports and the Commissioning Report. After approval of the Commissioning Plan, revise the Contract NAS schedule to reflect the schedule requirements in the Commissioning Plan.

1.6 SEQUENCING AND SCHEDULING

A. Begin the work described in this section only after all work required in related sections has been successfully completed, and all test and inspection reports and operation and maintenance manuals required in these sections have been submitted and approved. Pre-Functional Performance Test Checklists shall be performed at appropriate times during the construction phase of the Contract.

PART 2 PRODUCTS

2.1 Not Used

PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND TEST FORMS AND CHECKLISTS

A. Designate Contractor team members to participate in the Pre-Functional Performance Test Checklists and the Functional Performance Tests specified herein. The team members shall be as follows:

DESIGNATION	FUNCTION
A	Contractor's Commissioning Specialist
M	Contractor's Mechanical Representative
E	Contractor's Electrical Representative
T	Contractor's Testing, Adjusting, and Balancing (TAB) Specialist
C	Contractor's Controls Representative
O	City of San Diego Representative

B. Appendix A shall be completed by the commissioning team. Acceptance by each commissioning team member of each Pre- Functional Performance Test Checklist item shall be indicated by initials and date unless an "X" is shown indicating that participation by that individual is not required. Acceptance by each commissioning team member of each functional performance test item shall be indicated by signature and date.

3.2 TESTS

A. Perform the pre-functional performance test checklists and functional performance tests in a manner that essentially duplicates the checking, testing, and inspection methods established in the related sections. Where checking, testing, and inspection methods are not specified in other sections, establish methods which will provide the information required. Testing and verification required by this section shall be performed during the Commissioning phase. Requirements in related sections are independent from the requirements of this section and shall not be used to satisfy any of the requirements specified in this section. Provide all materials, services, and labor required to perform the pre- functional performance tests checks and functional performance tests. A functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating non-City commissioning team member of which participation is specified is not present for the test.

B. Pre-Functional Performance Test Checklists
   1. Perform Pre-Functional Performance Test Checklists, for the items indicated in Appendix A, at least 28 days prior to the start of Pre-Functional Performance Test Checks. Correct and re-inspect deficiencies discovered during these checks in accordance with the applicable contract requirements. Submit the schedule for the test checks at least 14 days prior to the start of Pre-Functional Performance Test Checks.

C. Functional Performance Tests
   1. Submit test procedures at least 28 days prior to the start of Functional Performance Tests. Submit the schedule for the tests at least 14 days prior to the start of Functional Performance Tests. Tests shall prove all modes of the sequences of operation, and shall verify all other relevant contract requirements. Begin Tests with equipment or components and progress through subsystems to complete systems. Upon failure of any Functional Performance Test item, correct all deficiencies in accordance with the applicable contract requirements. The item shall then be retested until it has been completed with no errors.

3.3 COMMISSIONING REPORT

A. Submit the Commissioning Report, no later than 14 days after completion of Functional Performance Tests, consisting of completed Pre- Functional Performance Test Checklists and completed Functional Performance Tests organized by system and by subsystem and submitted as one package.

B. The Commissioning Report shall also include all HVAC systems test reports, inspection reports (Preparatory, Initial and Follow-up inspections), start-up reports, TAB report, TAB verification report, Controls start-up test reports and Controls Performance Verification Test (PVT) report. The results of failed tests shall be included along with a description of the corrective action taken.

APPENDIX A

PRE-FUNCTIONAL PERFORMANCE TEST CHECKLISTS

Pre-Functional Performance Test Checklist - Exhaust Fan

For Exhaust Fan: [_____]

Checklist Item

Installation	A	M	E	T	C	O
a. Fan belt adjusted.		X		X		
Electrical	**A**	**M**	**E**	**T**	**C**	**O**
a. Power available to fan disconnect.		X				
b. Proper motor rotation verified.			X			
c. Verify that power disconnect is located within sight of the unit it controls.		X				
Controls	**A**	**M**	**E**	**T**	**C**	**O**
a. Control interlocks properly installed.		X				
b. Control interlocks operable.		X				
c. Dampers and Motor operated dampers /actuators properly installed.	X					
d. Dampers and Motor operated dampers /actuators operable.	X					
e. Verify proper location and installation of thermostat.	X					

Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
a. TAB Report approved.		X		X		

Pre-Functional Performance Test Checklist - HVAC System Controls

For HVAC System: [_____]

Checklist Item

Installation	A	M	E	T	C	O
a. Layout of control panel matches drawings.		X	X			
b. Framed instructions mounted in or near control panel.		X	X			
c. Components properly labeled (on inside and outside of panel).		X	X			
d. Control components piped and/or wired to each labeled terminal strip.		X	X			
e. EMCS connection made to each labeled terminal strip as shown.		X	X			
f. Control wiring and tubing labeled at all terminations, splices, and junctions.		X	X			

Main Power and Control Air	A	M	E	T	C	O
a. 120 volt AC power available to panel.		X				
b. 138 kPa gauge20 psig compressed air available to panel.		X				

Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
a. TAB Report submitted.		X		X		

Pre-Functional Performance Test Checklist - Single Zone Air Handling Unit

For Air Handling Unit: [_____]

Checklist Item

Installation	A	M	E	T	C	O
a. Inspection and access doors are operable and sealed.		X		X		
b. Condensate drainage is unobstructed.		X	X	X		
c. Fan belt adjusted.		X		X		

Electrical	A	M	E	T	C	O
a. Power available to unit disconnect.			X	X		
b. Power available to unit control panel.		X				
c. Proper motor rotation verified.			X			
d. Verify that power disconnect is located within sight of the unit it controls.		X				
e. Power available to electric heating coil.		X				

Coils	A	M	E	T	C	O
a. Refrigerant piping properly connected.		X	X	X		

Controls	A	M	E	T	C	O
a. Control valves/actuators properly installed.	X					
b. Control valves/actuators operable.	X					
c. Dampers and Motor operated dampers/actuators properly installed.	X					
d. Dampers and Motor operated dampers/actuators operable.	X					
e. Verify proper location and installation of thermostat	X					

Testing, Adjusting, and Balancing (TAB)	A	M	E	T	C	O
a. TAB Report approved.		X		X		

FUNCTIONAL PERFORMANCE TEST

Functional Performance Test Checklist - Air Handling Unit

For Air Handling Unit: [_____]

1. Functional Performance Test: Contractor shall verify operation of air handling unit in accordance with specification including the following:

2. Ensure that a slight negative pressure exists on inboard side of the outside air dampers throughout the operation of the dampers. Modulate OA, RA, and EA dampers from fully open to fully closed positions.

   a. The following shall be verified when the supply and return fans operating mode is initiated:

      (1) All dampers in normal position prior to fan start_____.

      (2) All valves in normal position prior to fan start_____.

      (3) System safeties allow start if safety conditions are met._____

   b. Occupied mode of operation - economizer de-energized._____

      (1) Outside air damper at minimum position._____

      (2) Return air damper open._____

      (3) Relief air damper at minimum position._____

   c. Occupied mode of operation - economizer energized.

      (1) Outside air damper modulated to maintain mixed air temperature set point.

      Setpoint_____deg F Actual_____deg F

      O/A damper position_____%

      Return Air Temperature_____deg F

      Outside Air Temperature_____deg F

      (2) Relief air damper modulates with outside air damper according to sequence of operation. Relief air damper position _____%

   d. Unoccupied mode of operation.

      (1) Observe fan starts when space temperature calls for heating/cooling____.

      (2) All dampers in normal position____.

      (3) Verify low limit space temperature is maintained as specified in sequence of operation____.

Functional Performance Test Checklist (cont) - Air Handling Unit

e. The following shall be verified when the supply and return fans off:

(1) All dampers in normal position._____

(2) All valves in normal position._____

(3) Fan de-energizes._____

f. Verify cooling coil and heating coil operation by varying thermostat set point from cooling set point to heating set point and returning to cooling set point_____.

g. Verify safety shut down initiated by low temperature protection thermostat____.

h. Verify occupancy schedule is programmed into time clock/UMCS_____.

3. Certification:_____We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
City of San Diego Representative	_____

Functional Performance Test Checklist - HVAC Controls

For HVAC System: [_____]

The Contracting Officer will select HVAC control systems to undergo functional performance testing. The number of systems shall not exceed 10 percent. Perform this test simultaneously with FPT for AHU or other controlled equipment.

1. Functional Performance Test: Contractor shall verify operation of HVAC controls by performing the Performance Verification Test (PVT) test for that system. Contractor to provide blank PVT test procedures previously done by the controls Contractor.

2. Verify interlock with UMCS system_____.

3. Verify all required I/O points function from the UMCS system_____.

4. Certification: We the undersigned have witnessed the Performance Verification Test and certify that the item tested has met the performance requirements in this section of the specifications.

	Signature and Date
Contractor's Commissioning Specialist	_____
Contractor's Mechanical Representative	_____
Contractor's Electrical Representative	_____
Contractor's TAB Representative	_____
Contractor's Controls Representative	_____
City of San Diego Representative	_____

END OF SECTION 23 0800

SECTION 23 0923 - DIRECT DIGITAL CONTROL SYSTEM SPECIFICATION

PART 1 GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. Air Movement and Control Association, Inc. (AMCA)
   a. AMCA 500: (1991) Louvers, Dampers and Shutters
2. American National Standards Institute (ANSI)
   a. ANSI B16.18: (1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
   b. ANSI C12.10: (1987) Electromechanical Watt-hour Meters
   c. ANSI C57.13: (1978; R 1987) Instrument Transformers
3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE)
   a. ASHRAE 3: (1996) Reducing Emission of Fully Halogenated Chlorofluorocarbon (CFC) Refrigerants in Refrigeration and Air-Conditioning Equipment and Applications
4. American Society of Mechanical Engineers (ASME)
   a. ASME/ANSI B16.5: (1996) Pipe Flanges and Flanged Fittings
   b. ASME/ANSI B16.34: (1996) Valves - Flanged, Threaded, and Welding End
5. American Society for Testing And Materials (ASTM)
   a. ASTM A 126: (1995) Gray Iron Castings for Valves, Flanges, and Pipe Fittings
6. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
   a. NFPA 70: (1998) National Electrical Code
   b. NFPA 90A: (1996) Installation of Air Conditioning and Ventilating Systems
7. Sheet Metal & Air Conditioning Contractors National Association, inc. (SMACNA)
   a. SMACNA DCS: (1985) HVAC Duct Construction Standards - Metal and Flexible
   b. SMACNA HVACTAB: (1993) HVAC Systems Testing, Adjusting and Balancing
8. Underwriters Laboratories Inc. (UL)
   a. UL 506: (1994; R 1997, Bul. 1997) Specialty Transformers
   b. UL 555S: (1996) Leakage Rated Dampers for Use in Smoke Control Systems
   c. UL 1449: (1996) Transient Voltage Surge Suppressors
9. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline.
   a. 2015: Edition

1.2 DEFINITIONS

A. Extended Application and Data Servers (ADXs)

1. Server class computers that manages the collection, presentation, and long-term storage of trend data, event messages, operator transactions, graphic displays and system configuration data. The ADX servers communicate with the Building Network Controllers on the network. In addition, the user interface of the ADX servers provides system navigation, viewing of graphic displays, comprehensive alarm management, trend analysis and summary reporting capabilities.

B. Building Level Network

1. The communication network within a building that connects Digital Controllers and Field Equipment Controllers to a Building Network Controller. The Building Level Network utilizes existing Ethernet, Carrier OPEN BACnet Network (OPN), and RS-485 that connects Digital Controllers to a Building Network Controller in a daisy-chain configuration.

C. Building Network Controller

1. A microprocessor-based device that is connected to and supervises Digital Controllers and Field Equipment Control Devices over a Building Level Network. The Building Network Controller provides monitoring, control, alarm and event management, data exchange, trending, scheduling and data storage of the ancillary controllers associated with it. The Building Network Controller also has interfaces for communicating with Portable Workstation Laptop Computers as well communicating with the ADX servers via the network.

D. Device

1. Any control system component, usually a sensor, switch, relay, or actuator, that provides an input or receives an output from a Digital Controller.

E. Digital Controller

1. A microprocessor based electronic controller, with integral programming logic and digital and analog input/output capability to perform closed loop control functions in a stand-alone capacity.
   a. Universal Programmable Controller
      i. A Digital Controller that processes analog, digital, and software inputs though user-defined programming logic (via multi-purpose programmable function modules, software implemented Programmable Logic Controller (PLC) modules, time schedule modules, optimal start/stop modules, etc) to produce required outputs and operating parameters.
   b. Application Specific Controller (ASC)
      i. A Digital Controller that processes analog, digital and software inputs though pre-defined programming logic in the firmware of the controller to produce required outputs and operating parameters.

c. Network Communication Capable Thermostat

i. An equipment-specific Digital Controller with an internal programmable time clock that provides the functionality of a thermostat as well as processing analog, digital, and software inputs though pre-defined programming logic in the firmware of the controller to produce required outputs and operating parameters.

F. Direct Digital Control (DDC)

1. Digital Controllers performing control logic. The controller directly senses physical values, makes control decisions based on internal programs, and provides output control signals that directly operate devices such as relays, valve and damper actuators, variable frequency drives, etc.

G. DDC System

1. A building level network of Digital Controllers and Field Equipment Control Device that communicates with a Building Network Controller. The DDC system includes the sensors, actuators, relays, software, programming, graphic displays "graphics", system database and any other component, parameters, and attributes of the devices used in measuring inputs or controlling outputs. The DDC system may also include a local desktop Operator Workstation or a Portable Workstation Laptop Computer.

H. Distributed Control

1. Controllers located near the equipment being controlled, with physical input and output points that allows distributed processing at each standalone Digital Controller. Individual system or equipment control is not split between controllers, and the failure of any single Digital Controller does not cause any other Digital Controller to fail. See also "Stand-Alone Control ".

I. Dynamic Control

1. A process that optimizes operation of HVAC systems (air handling units, converters, chillers, and boilers) by increasing and decreasing setpoints or starting and stopping equipment in response to heating and cooling needs of downstream equipment. A requirement of dynamic control is knowing the heating/cooling demand status of downstream equipment, therefore dynamic control requires Digital Controllers be connected in a communications network.

J. Field Equipment Control Device

1. A microprocessor-based electronic controller (such as a Variable Frequency Drive, Chiller Controller, or Lighting Controller), designed to control a specific piece of equipment (such as a motor, chiller, or lighting system) that can communicate directly on the Building Level Network.

K. Firmware

1. Firmware is software programmed into read only memory (ROM) and erasable programmable read only memory (EPROM) chips. Software may not be changed without physically altering the chip.

L. Graphic Displays (Graphics)

1. Graphical schematic displays on an operator workstation of the hardware and software points on a DDC system. Graphic displays give a visual representation of HVAC systems that allow the operational status to be monitored and controlled.

M. Hand-Held Terminal

1. A portable device which can be connected directly to a communications port on a Digital Controller through which the Digital Controller can be interrogated and, in some cases, programmed.

N. Input/Output (I/O)

1. Physical inputs and outputs to and from a Digital Controller including analog inputs (AI), digital inputs (DI), analog outputs (AO), and digital outputs (DO). Inputs are from analog sensors (such as temperature, pressure, flow, humidity) and digital sensors (such as motor status, flow switches, switch position, and pulse output devices). Outputs operate modulating and on/off control devices. The term also encompasses software, or "virtual" I/O in a digital controller. (In regards to I/O, throughout this document, the terms software and virtual will be used interchangeably.) Software/Virtual points typically reside within the programming of the Digital Controller or the Building Network Controller and typically are used as set points or to provide the status or run time of a device for use in the execution of a control loop or program logic.

O. Internet Protocol (IP, TCP/IP, UDP/IP)

1. A protocol for communication between computers, used as a standard for transmitting data over networks and as the basis for standard Internet protocols, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying and routing packets of information over various LAN media. Two other protocols are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

P. I/O Expansion Unit

1. An I/O expansion unit provides local additional point capacity to a Digital Controller within the Digital Controller enclosure.

Q. IP Address

1. A numeric identifier for a computer or Building Network Controller on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination. The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be zero to 255. For example, 1.160.10.240 could be an IP address.

R. IP Subnet

1. Internet protocol (IP) identifies individual devices with a 32-bit number divided into four groups from 0 to 255. Devices are often grouped and share some portion of this number. For example, one device has IP address 209.185.47.68 and another device has IP address 209.185.47.82. These two devices share Class C subnet 209.185.47.

S. DDC Communications Protocols

1. In order to achieve the maximum savings, benefits and permit sharing of global information making it possible to apply network-wide control strategies (such as peak demand limiting, coordinated alarm gathering and response, remote monitoring, and remote programming of building network controllers and digital controllers), the various components must be able to seamlessly communicate. The new expanded system utilizes Transmission Control Protocol/Internet Protocol (TCP/IP) and Hypertext Transfer Protocol (HTTP) to communicate with Building Network Controllers via Ethernet. Similar, the BACnet Network is extended to enable the Owner to utilize existing software and hardware for programming the Digital Controllers and monitoring/controlling devices.

T. Local Area Network (LAN)

1. A communication network that spans a finite geographic area and uses the same basic communication technology throughout.

U. Microprocessor

1. A microprocessor refers to the central processing unit (CPU) that contains all the registers and logic circuitry that make it possible for Digital Controllers to do computing.

V. Operator Workstation (OWS)

1. A desktop computer that allows the hardware and software I/Os of the DDC system to be viewed in both a text based and graphic format. The Operator Workstation is equipped with software that allows setup and collection of trends, as well as allowing the storage, creation, modification and downloading of Building Network Controller and Digital Controller programming.

W. Optimum Start/Stop

1. Optimum Start/Stop utilizes prediction software to determine the minimum time of HVAC system operation needed to satisfy space environmental requirements at the start of the occupied cycle, and determine the earliest time for stopping equipment at the day's end without exceeding space environmental requirements.

X. Peer-to-Peer

1. A network of Digital Controllers that act independently as equals and communicate with each other to pass information which facilitate control.

Y. PID

1. PID refers to proportional, integral, and derivative control; the three types of actions that are used in controlling modulating equipment to maintain a set point.

Z. Point Name

1. A standard name that is assigned to any software or hardware I/O.

AA. Portable Workstation Laptop Computer

1. A laptop computer that allows the hardware and software I/Os of the DDC system to be viewed in both a text based and graphic format by direct connection to the Building Network Controller or Digital Controller. The Portable Workstation Laptop Computer is equipped with software that allows setup and collection of

trends, creation of graphic displays, as well as allowing the storage, creation, modification and downloading of Building Network Controller and Digital Controller programming.

BB. Stand-Alone Control

1. The ability of a Digital Controller being to perform required climate control, and energy management functions without connection to another Digital Controller or central site computer. Digital Controller requirements for stand-alone control are a time clock, a microprocessor, microchip resident control programs, PID control, a communications port for interfacing with and programming the controller, firmware for interrogation and programming, and I/O for sensing and effecting control of its control environment.

CC. Wide Area Network (WAN)

1. A communication network that spans a relatively large geographic area, or two or more geographically disparate areas. Typically, a WAN consists of two or more local-area networks (LANs) to form a single network.

1.3 DDC SYSTEM PROJECT DESCRIPTION

A. Provide a DDC system to maintain stable temperature control and all other conditions as indicated. The end-to-end accuracy of the system, including temperature sensor error, wiring error, A/D conversion, and display, shall be 1 deg F for space, duct, and outside air temperatures, 3% for relative humidity; 2% of range for pressure; and 3% of range for flow.

B. SYSTEM INTERFACES

1. Description: Operator Interface Via Local Touch Screen Display
   a. The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and a stand-alone i-Vu System Touch, local touch screen interface. The i-Vu System Touch interface will allow for graphical navigation of each controller on the MS/TP network through a 4.3", 480 x 272 color pixel touchscreen display.
2. I-Vu System Touch Interaction
   a. The display shall allow for viewing the status of all Carrier OPEN rooftop, bypass, and zone controllers. Changes to the schedules, setpoints, and trends shall be managed through the local interface.
   b. The "Snapshot" screen shall show operating conditions for each piece of equipment in the building.
   c. Alarms: The user shall be able to view, acknowledge, and delete system alarms from a single screen.
3. Description: Operator Interface Via Web Browser
   a. The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and a stand alone Web Server. The stand alone Web server shall be a compact device capable of routing peer to peer communications of devices on the RS-485 network to an Ethernet LAN. The Web Server shall be capable of storing all system device definitions within the Web server and shall not require an external system manager, computer, or controller to define or access system control devices. The Web Server will allow users to interface with the

network via dynamic color graphics served over the Intranet or Internet via a standard Web Browser. The Web server shall be capable of tabular and graphic displays of mechanical systems, building floor plans, or control devices depicted by point-and-click graphics.

4. Operator Interface
   a. Furnish one compact i-Vu Web server interface as shown on the system drawings. Operators shall be able to access all necessary operational information in the system via personal computer utilizing standard Web browser software. Computer and Web browsing software shall not be furnished under this section. The Web server shall reside on the same Peer-to-Peer network as the Building Controllers.
   b. Web Server shall connect via Ethernet to a LAN and be able to serve up controller information to simultaneous operators connected via the Ethernet or telephone with standard Web Browsers. Each standard browser connected to server shall be able to access all system information.
5. Web Server Hardware:
   a. Furnish one compact i-Vu Web server router with ethernet port for operator computer access. The web server shall have an integrated RS-485 port for connection to the peer to peer controller network. The web server shall not require a permanent keyboard or monitor, however shall have an integrated terminal port for connecting a terminal and keyboard during installation and configuration. The Web server shall allow file transfer of files from another system for use as graphics backgrounds or custom displays.
6. Web Browser Interaction
   a. The Web server shall be capable of providing the operator, at a Web Browser, with both tabular or graphical pages of controller data. An operator with the proper password level shall be able to change setpoint and occupancy schedules or override points and remove overrides. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.
   b. Custom Graphics: Custom graphic files may be created with the use of a graphics generation package. Graphics may be downloaded to the Web server to use as graphical backgrounds for Dynamic data sent to a Web browser.
   c. Graphics Library: Furnish a library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. The library shall be furnished in a file format compatible with the graphics generation package program. Upon connection to the controls system the Web Server shall have the capability to learn the controls system and automatically present default web pages for each controller found.
   d. Alarms. An operator shall be able to access a tabular listing of the systems most recent alarm messages from a standard Web browser. This listing shall allow the operator to manage the alarms and acknowledge, print, delete and hyperlink to trouble areas.
   e. Display Information. An operator shall have the capability to perform setup of the Web Server from a standard Web browser. Setup shall include learning new controllers that are added to the controls system,

setting the time in controllers and changing the display units of the data presented between Metric and Imperial units.

7. Performance Standards:
   a. System shall conform to the following minimum standards over network connections.
      i. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
      ii. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 10 sec. and shall automatically refresh every 15 sec.
      iii. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 10 sec.
      iv. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
      v. Alarm Response Time. An object that goes into alarm shall be annunciated at the web browser within 15 sec.

C. ROOFTOP & SPLIT SYSTEM CONTROLLERS
1. FIELD INSTALLED SENSORS
   a. Temperature Sensors
      i. Type. Temperature sensors shall be nominal 10K ohm thermistor type.
      ii. Duct Sensors. Duct sensors shall be single point.
      iii. Space Sensors. Space sensors shall have setpoint adjustment, override switch, occupancy LED, RNET communication and local access port as shown.
      iv. IDF Space Sensors shall have 10K ohm thermistor sensor with override switch for monitoring only.
   b. Status Indication
      i. Status indication for fans shall be provided by a current sensing sensor. The sensor shall be installed at the motor starter or motor to provide load indication. The unit shall consist of a current transformer, a solid state current sensing circuit (with adjustable set point) and a solid state switch. A red light emitting diode (LED) shall indicate the on off status of the unit. The switch shall provide a N.O. contact for wiring back to the Field Installed Controller.
2. CONTROLLER SOFTWARE
   a. General.
      i. A building and energy management application software shall reside and operate in system controllers. Applications shall be configurable through the operator workstation, web browser interface, or engineering workstation.
   b. Memory and System Time.
      i. All controllers shall have a Non-Volatile Memory providing indefinite storage of application and configuration data. The system must have an ability to maintain time, and automatically correct for daylight savings time and leap year adjustments. In the event of power failure or user generated power cycle, all system

components must automatically updated with current time and date from a network Time Sync device. The controller shall also have the capability of changing occupancy mode by reading a set of discrete, dry contacts controlled by an external time clock.

c. Stand alone capability.
   i. All controllers shall be capable of providing all control functions of the HVAC system without the use of a computer. The controllers shall include the inherent capability to access the system control selections as well as to monitor system performance by means of a communicating network with a PC and EMS software program.

d. Remote Communication.
   i. System shall automatically contact operator workstation or server on receipt of critical alarms.

e. PID Control.
   i. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs.

f. Staggered Start.
   i. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

g. Anti-Short Cycling.
   i. Binary output objects shall be protected from short cycling by means of preconfigured minimum on-time and off-time settings, customized for the specific requirements of the application.

h. On and Off Control with Differential.
   i. System shall provide direct- and reverse-acting on and off algorithms with adjustable differential to cycle a binary output based on a controlled variable and setpoint.

i. Zoning system compatible with constant volume air source (Variable Volume/Variable Temperature) (VVT).
   i. The zoning system shall be compatible with constant volume air source and consist of programmable, multiple communicating Zone Controllers and a Bypass Controller. The system shall also include a complete array of input and output devices. The system shall provide full control of HVAC heating and cooling equipment in a multiple zone application. The zoning system shall be capable of operating as a stand-alone system or networked with multiple systems to communicating air source controllers.
   ii. Zone control.
      1. Each zone shall be capable of monitoring space conditions and providing the correct amount of conditioned air to satisfy the space load. Each zone shall be capable of the following:
      2. Space temperatures control. To maintain individual heating and cooling set points.
      3. Relative Humidity/Air Quality (DCV). Each zone shall be capable of maintaining space relative humidity set point or

air quality set point (zone level demand control ventilation) as defined in ASHRAE 62-1989 (including Addendum 62a-1990).

4. Demand coordination. Each zone shall be capable of zone demand data coordination with other zones in the system.

iii. Static pressure control.

1. The zoning system shall be capable of maintaining a user adjustable supply air duct static pressure set point.
2. The Bypass controller shall additionally provide the capability to increase system airflow during conditions when the temperature of the supply air from the equipment is approaching the limits of operation. In these cases, the Bypass controller shall raise the static pressure setpoint to a user configurable maximum limit in order to increase the system airflow during these conditions.
3. The Bypass control shall contain the ability to monitor the bypass damper movement (or VFD speed) and automatically adjust the setpoint control band and/or hysteresis in order to provide stability and prevent premature actuator failure.

iv. Air source control.

1. Air source control shall control all associated HVAC rooftop equipment functions, and be capable of stand-alone or networked operation. The resident algorithms shall use error reduction logic as designated in ASHRAE standard 90.1 to provide temperature control and lower energy usage. The Air source shall be capable of zone demand data coordination with the associated zones.

v. System Terminal Modes.

1. Each air terminal mode shall be based on the current air source mode, terminal type, space temperature, and the current temperature set points.
2. Off: All terminal dampers will maintain a 65% open position. Fans shall be disabled.
3. Off: If the zone requirement is heating, all single duct terminals shall maintain their damper position at 65%. Any zone controller servicing a parallel box shall fully close their dampers while the fan is operating. If local heat is available, the parallel fans shall start and local heat shall be enabled to maintain its unoccupied heating set point. The damper shall be modulated open to 65% after heating is no longer required.
4. Cooling and Night Time Free Cooling (NTFC): If the zone requirement is none, then the zone controllers shall modulate their dampers to maintain their minimum cooling damper position or damper ventilation position if the supply air temp is between 65 and 75 F. During the NTFC mode the zone controller shall control between its occupied heating and cooling set points. During the cooling mode, the zone controller shall modulate its damper to its appropriate (occupied or unoccupied) cooling set point.

5. Cooling and Night Time Free Cooling (NTFC): If the zone requirement is cooling, then the zone controllers shall modulate their air dampers between their minimum and maximum cooling damper position to maintain their cooling set point. Parallel fans shall be disabled unless the damper has closed below the user adjustable fan-on minimum position (optional). In that case, the fan shall be energized to mix return air with the cold primary air in order to prevent "cold air dumping" from the diffusers.
6. Cooling and Night Time Free Cooling (NTFC): If the zone requirement is heating, then the zone controllers shall modulate their dampers to maintain their minimum cooling damper position. Any zone controllers servicing single duct units with reheat capability shall maintain the greater of either the minimum cooling damper position or the specified reheat damper position. Zone controllers servicing parallel units shall enable their fans while the damper shall maintain its minimum cooling damper position.
7. Vent: If the air source equipment is operating in a fan only mode to provide ventilation without mechanical heating or cooling, then the zone controllers shall maintain the user configured ventilation damper position.
8. Heat: If the zone requirement is none, then the zone controller shall maintain its minimum heating damper position. Parallel fans shall be disabled and their air damper shall be modulated to maintain their minimum heating damper position.
9. Heat: If the zone requirement is cooling, then the zone controller shall modulate its damper to maintain its minimum heating damper position. Parallel fans shall be disabled.
10. Heat: If the zone requirement is heating, then the zone controllers shall modulate their air dampers between their minimum and maximum heating damper position to maintain their heating set point.
11. Pressurization: If the zone requirement is none or cooling, then the zone controller shall maintain its maximum cooling damper position. Parallel fans shall be disabled.
12. Pressurization: If the zone requirement is heating, and the zone controller has been enabled to provide local heating, then the zone controller shall modulate its damper to its maximum cooling damper position and enable its auxiliary heat. If local heat is not available, the damper shall still be modulated to maintain its maximum cooling damper position.
13. Evacuation: During the Evacuation mode all terminal fans shall be disabled and all dampers shall close.

vi. Air source interface. The zoning system shall be capable of zone demand data coordination with a communicating rooftop. Setpoint and zone temperature information from the zones shall be shared with the rooftop controller so that the rooftop controller's error reduction calculations can determine the proper number of heating or cooling stages to operate in order to satisfy the system load.

1. The zoning system shall have the capability of linking up to 32 zones to a single air source and determining system heating and cooling requirements.
2. The zoning system shall be capable of providing a communication check of all associated controls and display device type as well as error conditions.
3. The zoning system shall coordinate and exchange the following data as minimum:

Zone System Data	
3a	Average zone temperature
3b	Average occupied zone temperature
3c	Average occupied and unoccupied heat/cool set points
3d	Occupancy status

4. Space temperature and space temperature set points for use by the air source controller shall include a weighted factor, proportional to the size of the zone.
5. Only those zones with valid temperature readings shall be included.
6. The zoning system shall provide periodic updates to the air source.
7. The zoning system shall obtain and support the following air source modes as a minimum:

Zone System Air Srource Modes	
7a	Off
7b	Cooling
7c	Heating
7d	Night Time Free Cooling
7e	Ventilation
7f	Pressurization
7g	Evacuation

8. The air source controller shall, through the Air Distribution System, bias its occupancy time schedules to provide optimization routines and occupant override.

9. For those zoning systems that do not include inherent air source interface capacity, each zone shall independently determine the operational mode of the equipment through its associated duct temperature sensor mounted in the supply ductwork. If there is air source controller, then the system will assumed to be always on.

vii. HVAC Equipment Protection.

1. The air sources controller shall be capable of monitoring the leaving air temperature to control stages in both the heating and cooling modes. It shall have the capability to shut down stages based on a rise or fall in leaving air temperature above or below adjustable or calculated values. Calculated supply air temperature requirements shall be based on error reduction calculations from reference zone data to determine the optimum supply air temperature to satisfy space requirements. The system shall provide protection from short cycling of heating and cooling by utilizing time guards and minimum run time configurations.

viii. Energy Conservation.

1. Load balancing from error reduction calculations that optimize staging.
2. The locking out of mechanical heating or cooling modes based on configurable outside air temperature limits.
3. Staggered start. The system shall intelligently start all equipment in a stagger start manner after a transition from unoccupied to occupied modes as well as power failure to reduce high peak power consumption on start-up.
4. Peak Demand Limiting. Controllers in the system shall have the capability of being overridden by separate heating and cooling Peak Demand Limiting signals. Option/General purpose controller existing on the communications bus shall be able to send a demand limiting broadcast to reduce overall energy consumption and control on and off peak time kW usage
5. Temperature compensated start. The zone controller shall be capable of supporting temperature compensated start with the air source. Prior to occupancy the zone controllers and Air Source shall work together to provide zone-by-zone temperature compensated conditioning. The air source will track the time required for recovery report the optimal start bias time to the zones prior to each occupied period so that the zone can start conditioning the space prior to occupancy.

ix. Demand Control Ventilation (DCV).

1. The zone shall be capable of reading an analog signal from a CO2 sensor or other sensor measuring volatile contaminants, or relative humidity and provide DCV at the zone by calculating a DCV damper position and participate in system DCV operation with the air source
2. System DCV (System Level).The zoning system shall have the ability to collect the DCV value from any or all of the zone controllers in the system. These values may be the average or the highest sensor value which will be transmitted to an air source controller's analog DCV sensor input. The air sources configured DCV routine may perform the appropriate actions to reduce CO2 concentration at the reporting zones. The system shall be capable of maintaining a ventilation setpoint through a DCV algorithm in conjunction with zone to fulfill the requirements of ASHRAE standard, 62-1989 "Ventilation For Acceptable Indoor Air Quality" (including Addendum 62a-1990).
3. Local DCV (Zone Level). Each zone shall be capable of reading an analog signal from a CO2 sensor or other sensors measuring volatile contaminants and maintaining a ventilation setpoint through a DCV algorithm in conjunction with system controller to fulfill the requirements of ASHRAE standard, 62-1989 "Ventilation for Acceptable Indoor Air Quality" (including Addendum 62a-1990). The zone shall calculate a DCV damper position for the zone based on an error reduction calculation. When the DCV damper position value is greater than temperature control damper position the DCV damper position shall be used to position the damper. System heating and cooling and zone supplemental heat shall be allowed to operate.

x. Abnormal Conditions.

1. The proposed system shall include the ability to detect abnormal conditions, and to react to them automatically. A return to normal conditions shall also generate a return to normal notification and the system shall revert back to its original control scheme before the abnormal condition existed. The following abnormal terminal conditions shall automatically generate an alarm and the system shall take the following actions:
2. If a space temperature sensor is determined by the zone controller to be invalid, the zone controller shall generate an alarm. During this condition, the zone damper will be positioned to either the minimum heating, minimum cooling or the configured ventilation damper position, based on the air source equipment operating mode.
3. If a relative humidity sensor is determined by the zone controller to be invalid, the zone controller shall generate an alarm.

4. If an indoor air quality sensor is determined by the zone controller to be invalid, the zone controller shall generate an alarm, and disable its IAQ algorithm.
5. System level demand coordination. If an air source controller is participating in demand coordination with other zones and loses communication with the associated zones, it shall generate an alarm. Likewise, any zone detecting a communication failure will generate an alarm.
6. Zone level demand coordination. If the system looses communication with one of the zones associated with that system the zoning system shall remove that zone temperature from its weighted averages. The zone controller shall continue to operate in a stand-alone mode.
7. If the zoning system if configured to interface with the air source for zone demand data coordination and that communication is broken, each zone controller shall determine the equipment operating mode based on the temperature of the primary air. The air source will be assumed to be always on.

3. CONTROLLERS
   a. General.
      i. The control system shall be available as a complete package with the required input sensors and devices readily available. Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), and Sensors (SEN) as required to achieve performance specified in Paragraph 2.4.
      ii. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135-2004, BACnet, Annex L. unless otherwise specified.
      iii. BACnet.
         1. Building Controllers (BCs). Each BC shall conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-BC in the BACnet Testing Laboratories (BTL) Product Listing.
         2. Advanced Application Controllers (AACs). Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.
         3. Application Specific Controllers (ASCs). Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.

iv. BACnet Communication.

1. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing.
2. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.
3. Each AAC shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using the MS/TP Data Link/Physical layer protocol.
4. Each ASC shall reside on a BACnet network using the MS/TP Data Link/Physical layer protocol.

v. Communication.

1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.
2. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
3. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.
4. Stand-Alone Operation. Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

vi. Environment.

1. Controller hardware shall be suitable for anticipated ambient conditions.
2. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).
3. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

vii. Keypad.

1. Where specified provide a local keypad and display for each BC and ASC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not normally provide a keypad and display for each BC and ASC, provide the software and any interface cabling needed to use a laptop computer as a Portable Operator's Terminal for the system

viii. Serviceability.

1. Controllers shall have diagnostic LEDs for power, communication, and processor.
2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.
3. All controllers in the system shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

ix. Memory.

1. Controller memory shall support operating system, database, and programming requirements.
2. Each controller in the system shall use nonvolatile memory providing indefinite storage of BIOS, application programming, and all configuration data in the event of power loss.

x. Immunity to Power and Noise.

1. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

xi. Zone Controller (ZC).

1. Defined as Application Specific Controllers (ASC) shall be capable of independent zone control or function as part of the zoning system to achieve performance as specified for zone control in Paragraph 2.4.
2. Input and output devices shall be wired to "quick-connect plug type" terminals to facilitate removal of the module without disconnecting wiring from the plug type terminal.
3. ZC shall have an integrated brushless actuator and be capable of operating zone dampers as well as parallel fan powered terminal boxes.
4. ZC shall be capable of controlling supplemental heat or auxiliary heat sources, including fan control, when required at the zone level.
5. The zone controller shall have the capability to support adjustable minimum and maximum damper positions.
6. ZC shall be capable of reading an analog signal from a CO2 sensor or other sensor measuring volatile contaminants, or relative humidity and provide DCV at the zone by calculating a DCV damper position and participate in system DCV operation with the air source.

xii. Bypass Controller.

1. Defined as Application Specific Controllers (ASC) it shall be capable of reading supply static pressure and controlling the bypass damper (or a VFD speed control output) to maintain the supply static set point. This operation shall be provided when operating within a zoning system application, as specified for bypass control in Paragraph 2.4 or in a stand-alone mode.
2. Input and output devices shall be wired to "quick-connect plug type" terminals to facilitate removal of the module without disconnecting wiring from the plug type terminal.
3. The controller shall contain an onboard pressure sensor to measure duct static pressure. The sensor measuring range shall be from 0.0 to 2.0 inches H2O.
4. Bypass Controller shall have an integrated brushless actuator providing a minimum of 35 in/lbs of torque and be capable of operating a bypass damper. The direction of rotation shall be reversible in the field to accommodate field supplied bypass damper assemblies.
5. Bypass Controller shall provide an analog output signal for an external actuator or to control the speed of a variable frequency drive (VFD).

xiii. Rooftop Unit Controller (RTC).

1. Defined as Application Specific Controllers (ASC), shall control all associated HVAC Constant Volume rooftop equipment functions, this operation shall be provided when operating within a zoning system application, as specified for an air source control, in Paragraph 2.4 or in a stand-alone mode. The resident algorithms shall use error reduction logic as designated in ASHRAE standard 90.1 to provide temperature control and energy usage.
2. Capacity control shall be based on the use of a conventional thermostat, or programmable thermostat, or alternatively, a constant volume unit may utilize its own internal time clock and setpoints (cooling and heating) coupled with a room (wired or network communicating) sensor for capacity control. The controls shall provide separate occupied and unoccupied cooling and heating setpoints – except if a conventional thermostat is used.
3. RTC shall feature and maintain a 365-day Real-Time Clock/Calendar with holiday functions.
4. RTC shall be capable of stand-alone or networked operation.
5. In the stand alone mode, each RTC shall establish occupancy scheduling based on its own local occupancy schedule, the closure of a contact connected to an external time clock or EMS system, or by a timed override request (1 to 24 hours) through its space temperature sensor override button.

6. When networked, RTC occupancy may be established by user interface or occupancy signal from other controller located in network.
7. RTC shall utilize fan control, 2 stages of cooling, and up to 3 stages of heating to maintain zone temperature at setpoint.
8. RTC shall provide analog output signal for economizer control.
9. All RTC controllers shall be mounted in a NEMA 3R enclosure.

1.4 SUBMITTALS

A. Submit detailed and annotated manufacturer's data, drawings, and specification sheets for each item, that clearly show compliance with the project specifications.
   1. Submittals:
      a. See 2015 GREENBOOK and 2015 City of San Diego Supplement (WHITEBOOK), SECTION 2-5.3 for Shop Drawings and Submittals.
   2. Substitutions:
      a. See 2015 GREENBOOK and 2015 City of San Diego Supplement (WHITEBOOK) and Supplementary Special Provisions (SSP) SECTION 4-1.6 for Substitutions.

B. MANUFACTURERS
   1. Carrier OPEN Controls. No substitutions will be accepted.
   2. Controls installation will be by a Carrier Controls Expert Dealer, or approved equal.
      a. Contractors' Qualifications
         i. Submit documentation certifying the controls contractor performing the work has completed DDC systems installations of a similar design to this project, and programmed similar sequence of operation.
   3. Manufacturer's Product Specification Data
      a. Submit Manufacturers' Product Specification Data sheets for every product that is to be installed in the DDC system to show compliance of the product with the design drawings and the specifications. If information on multiple products is provided on the Manufacturers' Product Specification Data sheets, highlight the specific product (or products) of relevance, and indicate the specification paragraph number that the item is in compliance with. Submit sufficient manufacturers' information to allow verification of compliance by the Owner. Equipment and software, for which Manufacturers' Product Specification Data shall be submitted, should include but not be limited to the following:
         i. DDC hardware
            1. Digital Controllers
            2. Building Network Controller
            3. Field Equipment Control Devices
            4. LAN devices including media converters, routers, hubs, bridges, and switches

ii. DDC Programming Software
    1. Programming software for Digital Controllers
    2. Programming software for Building Network Controllers
    3. Software for creating Graphics
    4. Software used on Internet based workstations & laptops
iii. Input devices
    1. Temperature Sensors
    2. Flow Sensors/Switches
    3. Current Sensors/switches
    4. Damper & Valve position
iv. Output Devices
    1. Damper and Valve actuators
    2. Control Relays/motor starter contactors
v. Surge and transient protection
    1. Power line conditioners
    2. Network surge protectors
vi. Operator Workstation Software
vii. Portable Workstation Laptop computer Software
viii. Hand-held terminal

b. Any piece of equipment to be installed as part of the DDC system shall have a data sheet provided. For each submitted Manufacturers' Product Specification Data sheet, highlight in a reproducible form each unique piece of equipment and reference each item to the relevant specification paragraph number. Submit sufficient manufacturers' information to allow verification of compliance by the owner.

4. Shop Drawings

a. Show all information in the descriptions listed below on the drawings. Due are to be developed during the design stage and presented for review by Owner. Drawings labeled as (Shop Drawings) maybe submitted after 100% Design Review is accomplished. Obtain the signature of the Owner prior to commencement of the control system installation work.
    i. Control System Drawing Title Sheet
    ii. Building Level Network Communication Architecture Schematic
    iii. Control System Schematics
    iv. Control System Components List
    v. Table of I/O Points
    vi. HVAC Equipment Electrical Ladder Diagrams
    vii. Component Wiring Diagrams (Shop Drawing)
    viii. Terminal Strip Diagrams (Shop Drawing)
    ix. AC Power Table (Shop Drawing)
    x. Floor Plan Hardware Location Drawings

b. Control System Drawing Title Sheet
    i. Provide a title sheet for the control system drawing set. Include the project title, project location, contract number, the controls contractor preparing the drawings, an index of the control drawings in the set and a legend of the symbols and abbreviations used throughout the control systems drawings

c. Building Level Network Communication Architecture Schematic
   i. Provide a schematic showing the architecture of the DDC system's entire Building Level Network, including the locations in the building (with room numbers) of all Digital Controllers, Field Equipment Control Devices (such as VFDs, factory chiller control panels, etc.), Building Network Controllers, Operator Workstation, and LAN devices including media converters, routers, hubs, bridges, and switches. In addition, provide notation on the schematic of the addressing of the Digital Controllers, Expansion Modules, Field Equipment Control Devices LON and RS/485 communications links, and the IP Addressing of the Building Network Controllers.

d. Control System Schematics
   i. Provide a control system schematic for each Digital Controller and Building Network Controllers. Typical schematics for multiple pieces of exactly identical equipment with exactly identical sequences of operation are allowed unless otherwise requested in design or contract criteria. For similar pieces of equipment where a typical schematic is to be submitted, if the sequence of operation is the same, but there is only a slight deviation in the quantity or type of I/Os, indicate on the drawing the points that deviate from the standard and what digital controller(s)/piece(s) of equipment the deviation is applicable to. Include the following:
      1. Location of each input and output device
      2. Flow diagram for each piece of HVAC equipment
      3. Point *Name* for each control system component, such as SA-T for a Supply Air Temperature sensor.
      4. Setpoints, with differential or proportional band values
      5. Written sequence of operation for the HVAC equipment
      6. Valve and Damper Schedules, with normal (power fail) position

e. Control System Components List
   i. Also known as a Bill of Materials, provide a complete list of control system components installed on this project. Include for each controller and device: control system schematic name, control system schematic designation, device description, manufacturer, and manufacturer part number. For sensors, include point name, sensor range, and operating limits. For valves, include body style, Cv, design flow rate, pressure drop, valve characteristic (linear or equal percentage), and pipe connection size. For actuators, include point name, spring return, modulating or two-position action, normal (power fail) position, nominal control signal operating range (0-10 volts DC or 4-20 milliamps), and operating limits.

f. Table of I/O Points
   i. Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Digital Output (DO), or Digital Input (DI)), point sensor range, point actuator range, point address, and point connection terminal number, the controller address, controller type, controller location (with room number), and the associated Control System Schematic drawing. Typical schedules for multiple pieces of exactly identical equipment with exactly identical sequences of operation are allowed unless otherwise requested in design or contract criteria. For similar pieces of equipment where a typical schematic is to be submitted, if there is only a slight deviation in the quantity or type of I/Os, indicate on the schedule the points that deviate from the standard and what digital controller(s)/piece(s) of equipment the deviation is applicable to.
g. HVAC Equipment Electrical Ladder Diagrams
   i. Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks, including voltages and currents.
h. Component Wiring Diagrams
   i. Provide a wiring diagram for each type of input device and each type of output device. Diagram shall show how the device is wired and powered; showing typical connections at the Digital Controller and each power supply, as well as at the device itself. Show for all field connected devices, including, but not limited to, control relays, motor starters, electric or electronic actuators, and temperature, pressure, flow, and proof sensors and transmitters.
i. Terminal Strip Diagrams
   i. Provide a diagram of each terminal strip, including Digital Controller terminal strips, terminal strip location, termination numbers and the associated point names.
j. AC Power Table
   i. Provide a table listing each controller and the circuit breaker number, panel box number, and physical location of each controller's source of AC power.
k. Floor Plan Hardware Location Drawings
   i. Provide architectural floor plan drawings indicating the physical location of the Building Network Controller, Digital controllers, NETWORK repeaters, NETWORK bus wiring paths, outside air temperature sensor, room sensors/thermostats, duct static/differential pressure sensors, and each building network and digital controller's source of AC power. (i.e. transformer locations). In addition, indicate the electrical panel location and circuit breaker number providing power to the building network and Digital Controllers.

5. Contractor Field Test Report
   a. Provide a Contractor Field Test Report showing results of the testing in accordance with paragraph 'Contractor's Field Testing'. Documentation shall consist of calibration of sensors, expected/actual response of sensors, actuators, and controllers, trend logs/graphs proving control loop stability and accuracy, as well as proper execution of temperature control

programs (sequence of operation), and proper operation of equipment interlocks.

6. Performance Verification Test Report
   a. At the conclusion of the execution of the Performance Verification Test, a report documenting the results of the testing shall be provided in accordance with paragraph 3.3 E. 'Performance Verification Test (PVT)'.
7. Final Shop Drawings
   a. Provide a complete set of Final Shop Drawings, also known as 'As-built' drawings that incorporate all information, details, or data (such as the Building Network Controller IP address) that may not have been available to be documented on the SD-03 submittals. Also incorporate any changes, modifications, or revisions from the SD-03 submittals that occurred in the installation of the controls system so that the final shop drawings reflect an accurate as-built condition of the controls system. Permanently affix a complete set of laminated Final Shop drawings in each Building Network Controller cabinet. In addition, for each Digital Controller, permanently affix laminated copies of the Control System Schematic, Control System Component List, Table of I/O Points, Component Wiring Diagrams, & AC power table associated with the controller, in the Digital Controller cabinet.
8. Operations and Maintenance Manuals
   a. Provide six copies of the Operations and Maintenance Manual for the DDC system in printed and CD format. Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the prime, mechanical and controls contractor's names, address', and telephone numbers. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. The manual contents shall be specifically applicable to the project, written to reflect actual project conditions, and shall provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all user operation requirements at each level of the HVAC and control system. The manuals shall include the following parts:
      i. PART 1. DDC and HVAC Systems Operator's Manual
      ii. PART 2. DDC Manufacturer's Hardware and Software Manuals
      iii. PART 3. VFD Manufacturer's Service Manual
   b. PART 1- DDC and HVAC Systems Operator's Manual
   c. This manual is designed to document the design, installation, and operation of the HVAC systems and the associated DDC system. Construct this manual with a minimum of the following 7 sections. Use tabs to divide each section.
      i. SECTION 1 Description of HVAC Systems: Provide a listing and description of each HVAC system component and their associated Digital Controllers.
      ii. SECTION 2 Mechanical Design Drawings: Provide a set of the project's final mechanical design drawings, which incorporate all changes, modifications, or revisions that occurred in the installation of the HVAC systems, such that the drawings reflect an accurate 'As-built' condition of the HVAC systems.

iii. SECTION 3 Controls Drawings: Provide a set of final shop drawings that incorporate all changes, modifications or revisions that occurred during the installation of the controls system. The final shop drawings shall reflect an accurate 'As-built' condition of the controls system as specified in Paragraph "SD-06 Final Shop Drawings".

iv. SECTION 4 Performance Verification Test Report: Provide a copy of the approved Performance Verification Test Report.

v. SECTION 5 Test, Adjust, and Balance Report: Provide a copy of the approved Test, Adjust, and Balance Report.

vi. SECTION 6 Control Equipment Cut Sheets: Provide cut sheets of all controller hardware and accessories. Include temperature versus resistance charts for temperature sensors, and calibration charts for pressure transducers.

vii. SECTION 7 Backup of Control Program: Provide a soft copy of the control programs on CD ROM.

d. PART 2-DDC Manufacturer's Hardware and Software Manuals

e. Provide the following manuals. Use tabs to divide each SECTION.

i. SECTION 1 Installation and Technical Manuals for all Digital Controller and Field Equipment Controller hardware.

ii. SECTION 2 Operators Manuals for all Digital Controllers

iii. SECTION 3 Operators Manuals for Building Network Controller

iv. SECTION 4 Programming Manuals for all Digital Controllers

v. SECTION 5 Programming Manuals for Building Network Controller

vi. SECTION 6 Installation and Technical Manuals for the Operator Workstation.

vii. SECTION 7 Programming Manuals for the Operator Workstation software.

f. PART 3-VFD Manufacturer's Service Manual

i. Provide a complete set of the VFD manufacturer's Operators Manuals that specifically cite the data and control words formats. Also included shall be any VFD communication interfaces to the DDC.

9. Training Documentation

a. Submit schedule, syllabus, and training materials in accordance with the paragraph 'Training'.

10. Project Closeout Documentation

a. Provide administrative and closeout submittals:

i. Training course documentation

ii. Service organization

iii. Contractor certification

b. Training Course Documentation

i. Training course documentation shall include a manual for each trainee plus two additional copies and two copies of audiovisual training aids, if used. Documentation shall include an agenda, defined objectives for each lesson and detailed description of the subject matter of each lesson.

c. Service Organization
   i. Qualified service organization list, within 50 miles of the jobsite, that shall include the names and telephone numbers of organizations qualified to service the HVAC control systems.
d. Contractor Certification
   i. Provide certification that the installation of the control system is complete and the technical requirements of this SECTION have been met.

1.5 QUALITY ASSURANCE

A. Standard Products
   1. Provide material and equipment that are standard products of manufacturers regularly engaged in the manufacturing of such product, using similar materials, design and workmanship. The standard products shall have been in commercial or industrial use for 2 years prior to bid opening, unless otherwise approved by the City. The 2-year use shall include applications of similarly sized equipment and materials used under similar circumstances. The 2-year experience must be satisfactorily completed by a product which has been sold on the commercial market through advertisements, manufacturers' catalogs, or brochures.
   2. Provide materials and equipment that are manufacturer's products currently in production, and supported by a local service organization.

B. Storage
   1. Stored products shall be protected from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage condition limits published by the equipment manufacturer.

C. Verification of Dimensions
   1. The contractor shall become familiar with all details of the work, shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

D. Drawings
   1. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, and shall furnish all work necessary to meet such conditions.

E. Contractor's Qualifications
   1. Controls installation will be by a Carrier Controls Expert Dealer.

F. Support
   1. Certified local technical support shall exist within 50 miles of the site.

PART 2 PRODUCTS

2.1 DDC SYSTEM

A. In addition to the scope of work shown on the drawings, the scope of work shall include the following:

1. Provide the quantity and type of Digital Controllers and Field Equipment Control Devices indicated on the mechanical design drawings, that will perform the required climate control, energy management, and alarm functions. The quantity of controllers shall be no less than the number shown on design drawings. The DDC system shall consist of Digital Controllers and Field Equipment Control Devices communicating via communications networks that allows the sharing of common data amongst the Digital Controllers and Field Equipment Control Devices, as well as communication with the Building Network Controller(s) and Operator Workstation.
2. Provide an operator programmable system with all of the necessary programming to perform closed-loop, modulating control that will execute the sequences of operations indicated on the mechanical design drawings, for all of the building's HVAC equipment. Provide a database/interface in both a text based format and graphic display format for viewing the operation of the DDC system. The database shall be created using the latest revision of software available at the time construction begins.

B. Distributed Control

1. Apply Digital Controllers in a distributed control manner. Provide repeaters on the communication link per manufactures instructions.

C. I/O Point Limitation

1. Total number of I/O hardware points connected to a single stand-alone Digital Controller shall not exceed 64. I/O expansion units are not permitted unless all the required type of I/Os are exhausted on the digital controller. Place I/O expansion units in the same Controller Cabinet as the Digital Controller it is associated with. Multiplexing of I/O is not permitted.

D. Environmental Operating Limits

1. Provide Digital Controllers that operate in environmental conditions between 32 and 120 degrees F. Controllers shall be suitable for, and placed in protective enclosures suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

E. Stand-Alone Control

1. Provide stand-alone Digital Controllers. All I/O points specified in the mechanical design drawings for a single piece of equipment or system (such as a chiller plant or boiler plant) shall be integral to one controller and its associated I/O expansion units. Control of a single piece of equipment or system shall not be split between two controllers. Failure of any single controller shall not cause a failure with any other controllers.

F. Internal Clock

1. Provide an internal clock for the Building Network Controller, accurate within 2 seconds per day. The Building Network Controller shall have its clock backed up by a battery or capacitor with sufficient capacity to maintain clock operation for a minimum of 72 hours during a line power outage. When connectivity of the Building Network Controller has been established, automatic synchronization of the clock will be made from an operator-designated point of reference. The system shall automatically adjust for daylight savings time.

G. Memory

1. Provide sufficient memory for each Digital Controller and Building Network Controller to support required control, communication, trend, alarm, and messaging functions.
2. Memory Protection: Programs residing in memory shall be protected either by using EEPROM or by an uninterruptible power source (battery or uninterruptible power supply (UPS)). The backup power source shall have sufficient capacity to maintain volatile memory in event of an AC power failure. Where the uninterruptible power source is rechargeable (a rechargeable battery), provide sufficient capacity for a minimum of seventy-two hours back up. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long. The rechargeable power source shall be constantly charged by charging circuitry while the controller is operating under normal line power. If a non-rechargeable power source is used, the non-rechargeable power source shall be capable of providing a backup power supply for not less than a two years period. Batteries shall be designed to allow replacement without soldering.

H. Immunity to Power Fluctuations and Noise

1. Controllers shall operate at 90% to 110% nominal voltage rating. Protect against electrical noise of 5 to 120Hz and from keyed radios up to 5 watts at 3 ft.

I. Wiring Terminations

1. Use screw terminal wiring terminations for all controllers. Provision of field removable modular terminal strips is required for all controllers, except controllers integral to terminal units (like VAV controllers with an integral damper actuator) or Network Communication Capable Thermostats, unless specified otherwise.

J. Input and Output Interface

1. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage. Provide hard-wired input and output interface for all controllers as follows:

2. Inputs
   a. Provide input function integral to the direct digital controller. Provide input type as required by the DDC design.
      i. Analog Inputs: Allowable input types are 4 to 20 mA signals, or 0-10 VDC signals. Direct RTD inputs must have appropriate conversion curves stored in controller software or firmware. Analog to digital (A/D) conversion shall be a minimum of 10-bit resolution.
      ii. Space Temperature Sensors shall be 5,000 or 10,000 ohm thermistor with wall plate adapter and blank cover assembly. The sensor shall include an integral occupancy override button. Space Temperature Sensors shall include space temperature adjustment slides where shown on the plans. The Space Temperature Sensors shall be mounted approximately 48" above the floor.
      iii. Digital Inputs: Digital inputs shall sense open/close, on/off, or other two state indications.
      iv. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to the binary input requirements and accumulate a minimum of 2 pulses per second for Application Specific Controllers, and up to 10 pulses per second for Universal Programmable Controllers.
3. Outputs
   a. Provide output function integral to the direct digital controller. Provide output type as required by the DDC design.
      i. Analog Outputs: Provide controllers with a minimum output resolution of 8 bits. Analog Outputs shall send modulating 0-10 VDC or 4 to 20 MA signals to control output devices. Feedback shall be integral to the output function.
      ii. Digital Outputs: Binary outputs shall send a pulsed low-voltage signal for pulse-width-modulation control, or provide a maintained open-closed position for on-off control. Provide contact closure with contacts rated at a minimum of 1 ampere at 24 volts. For HVAC equipment, provide for manual overrides, either with three-position (hand-off-auto) override switches and status lights, or with an adjacent operator display and interface.
      iii. Tri-State Outputs: Tri-State outputs (floating point control outputs) are strictly prohibited.

K. PID Control
   1. Provide controllers with proportional, proportional plus integral, and proportional plus integral plus derivative control capability. Application Specific Controllers and Network Communication Capable Thermostat controllers are not required to have the derivative component.

L. Communications Ports

1. Controller-to-Controller Communications Ports: Digital Controllers shall be equipped with a communication port that allows the controllers to be connected in a daisy chained to form a Building Level Network. Building Network Controllers shall have a communication port for connectivity to the Building Level Network. The Building Level Network shall permit sharing of common data amongst the Digital Controllers. Minimum baud rate for the Building Level Network shall be 9600 Baud per second. Communication ports shall be provided including required hardware and software for all Controllers installed on the following pieces of equipment:
   a. Single Zone Air Handling Units
      i. The controls contractor shall provide, install and establish communications between the communication ports of all Digital Controllers, Field Equipment Control Devices, and the Building Network Controller
2. Digital Controller On-Site Interface Ports: Provide a communications port for each Digital Controller that allows direct connection of a computer or hand held terminal through which the controller may be fully interrogated. Controller access may also be by Internet.
3. Building level controllers shall use Transmission Control Protocol/Internet Protocol (TCP/IP) and Hypertext Transfer Protocol (HTTP) to communicate with Building Network Controllers via the various communication links. Provide a communications port on the Building Network Controller, that when connected to the Ethernet switch will provide communications, or when connected to a Portable Workstation Laptop Computer will allow every controller in the direct digital control system to be fully interrogated and programmed. When the Building Network Controller is connected the following operations shall be available: creation, modification, downloading and uploading control programs; creation and modification of graphics and program data base; and creating and collecting of trend reports, status reports, messages, and alarms.
4. Whenever available as an OEM standard option, provide Field Equipment Control Devices with a communication port that allows the controllers to be connected to the Building Level Network in a daisy chained manner. Typical Field Equipment Control Devices equipped with communication ports include, but are not limited to, boilers, chillers, lighting control panels, and variable frequency motor drives.

M. Controller Cabinets

1. Controls shall be factory installed and integrated into the associated HVAC Units.
   a. Main Power Switch
      i. Provide every power transformer or DC Power Supply with a fused main power switch or circuit breaker for isolation from AC power.. The switch shall be protected from tampering by being located within the Controller Cabinet.
   b. Wire & Conduit Routing
      i. Contractor shall utilize the existing conduit system to the maximum extent feasible.

ii. Contractor shall route new thermostat wiring using the present routing for the pneumatic tubing. This will minimize exposure to Asbestos which is present.

iii. Contractor shall route new MS/TP wire, CAT-5 Ethernet, and Power cabling as required to power the Extended DDC system

2.2 DDC SOFTWARE

A. Software resides in the Digital Controllers and performs control sequences.

1. Provide a complete, clear, and concise written sequence of operation for the HVAC equipment. Include all conventional control operations, time event operations, energy management functions (night setback, reset schedules, optimum start, enthalpy economizer control); demand limiting, safeties, and emergency conditions. Put the sequence of operation on the design drawings, not in the specifications.

B. Programming

1. Provide Factory engineered programs and software configuration to execute the sequence of operation indicated in the DDC design. Provide all programming and tools to configure and program all controllers. Provide programming routines in simple, easy-to-follow logic with detailed text comments describing what the logic does and how it corresponds to the project's written sequence of operation.
   a. Graphic-based programming shall use a library of function blocks made from pre-programmed code objects designed for direct digital control. Function blocks or objects shall be assembled with interconnecting lines, depicting the control sequence in a flowchart. Graphic programs shall be viewable in real time showing present values and logical results from each function block or objects. Graphical HAND-AUTO-OFF icons shall be provided to control all active equipment.
   b. Menu-based programming shall be done by entering parameters, definitions, conditions, requirements, and constraints.
   c. For line-by-line and text-based programming, declare variable types (local, global, real, integer, etc.) at the beginning of the program. Use descriptive comments frequently to describe the programming.
   d. Provide a means for detecting program errors and testing software strategies with a program compiler and/or digital simulation tool prior to downloading programming into the Digital Controllers.
2. Optimum Start/Stop Program
   a. This program shall start and stop equipment as specified for the scheduled start-stop program, but shall include a sliding schedule based on indoor and outdoor air conditions. The program shall take into account the thermal characteristics of the structure, and indoor and outdoor air conditions, using prediction software to determine the minimum time of HVAC system operation needed to satisfy space environmental requirements at the start of the occupied cycle, and determine the earliest time for stopping equipment at the day's end without exceeding space environmental requirements.
      i. Program Inputs
         1. Day of week/holiday.
         2. Time of day.
         3. Cooling or heating mode of operation.

4. Equipment status.
5. Cooling and heating building occupancy schedules.
6. Space temperature(s).
7. Building heating constant (operator adjustable and automatically optimized).
8. Building cooling constant (operator adjustable and automatically optimized).
9. OA temperature.
10. Required space temperature at occupancy (heating).
11. Required space temperature at occupancy (cooling).
12. Equipment constraints.
13. Cooling and heating high-low alarm limits.

ii. Program Outputs:
1. Start/stop signal.

3. Electrical Power Demand Limiting
   a. The EMS shall be able to receive commands from the existing City SEMMS system via BACnet/IP. The EMS shall monitor and limit the electrical demand at individual installations using a demand minimization program and a time of day demand limiting program. The demand minimization program shall be activated manually by an operator who will be advised when a utility wide peak is expected, as well as the duration of the peak period. The time of day demand limiting program shall be active at all times in accordance with the re-established seasonal schedules and peak demand limits. The time of day demand limiting program shall use installation electric utility meters and predict an electrical peak demand. When the predicted demand exceeds a preset value, the demand limiting programs shall change equipment operating set points and shed loads on a pre-scheduled step basis to reduce the connected load before the actual electrical demand peak exceeds the target peak demand value.
4. Economizer Program
   a. The software shall reduce the HVAC system cooling requirements when weather conditions allow the use of outside air for cooling. Ambient air conditions shall be monitored by the DDC through the outside air temperature (OA-T) sensor and the outside enthalpy (OA-E) sensor. The economizer program shall be inhibited if the enthalpy of the outside air exceeds an operator selectable value or the enthalpy of the return air. When outside air conditions are favorable for economizer operation, based on a comparison of the enthalpy of the outside air to the enthalpy of the return air], the Digital Controller shall enable economizer operation. When the economizer operation is enabled, the OA, return air, and exhaust air dampers shall be positioned to maintain the required temperature. When economizer operation is disabled; the OA dampers, return air dampers, and relief air dampers shall be positioned to provide minimum required OA.

i. Program Input
   1. Changeover conditions.
   2. OA dry bulb temperature.
   3. Return/Space dry bulb temperature.
   4. Maximum allowable OA air dry bulb temperature.
   5. OA enthalpy and RA enthalpy
   6. OA Damper position feedback

ii. Program Output:
   1. Damper actuator/cooling control signal.

5. Ventilation-Recirculation Program

a. The software shall reduce the HVAC system thermal load for two modes of operation as follows:

i. Ventilation mode:
   1. In this mode, the system shall pre-cool the space prior to building occupancy. When the outside air temperature is lower than the space temperature, the outside air damper and exhaust air damper shall open to their maximum positions and the return air damper shall close to its minimum position.

ii. Recirculation mode:
   1. In this mode, the system shall preheat the space prior to building occupancy. When the outside air temperature is lower than the space temperature, the outside air damper and the exhaust air damper shall close to their minimum positions and, the return air damper shall open to its maximum position.
   2. The outside air damper and the exhaust air damper shall be closed at all other times during unoccupied periods, except for economizer operation during day/night setback periods. For systems without mechanical cooling, this program shall, in addition to the above requirements, act as an economizer. The EMS shall modulate the outside, return, and exhaust air dampers to maintain the required mixed air temperature setpoint. When this program is released, the outside and exhaust air dampers shall return to their minimum positions, and the return air damper shall return to its maximum position.

iii. Program Inputs
   1. Day of week.
   2. Time of day.
   3. Cooling or heating mode of operation.
   4. Equipment status.
   5. Cooling and heating occupancy schedules.
   6. OA dry bulb temperature.
   7. Space temperature.
   8. Equipment constraints.

iv. Program Output:
   1. Damper actuator control signal.

6. Timed Local Override for Temporary Occupancy Program
   a. Thermostats and wall mounted temperature sensors shall have a means for a temporary manual override of the program schedule, with automatic program restoration after the scheduled interval. Interval shall be adjustable, at an initial interval of one hour. Provide programming for a timed local override of the program schedule of each HVAC system via its system designated temporary occupancy pushbutton (either a standalone pushbutton that is labeled as to its function or a pushbutton integral to a thermostat or wall mounted temperature sensor), with automatic program restoration after a user defined time interval. Timed local overrides are to be disabled during occupancy periods. For systems such variable air volume systems, the timed local override shall not only enable the VAV box for the zone in which the button was pushed, but shall also enable all other associated pieces of equipment (the air handler, chiller, boiler, etc.) allowing the zone to be conditioned to the normal occupied set points.

C. Database Modification
1. All setpoints, software points, writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable regardless of programming methods used to create the applications. Database modification shall be accomplished through a network connected OWS, local OWS, Portable workstation laptop computer, hand held terminal, or through a keypad integral to the controller. When the control program is of the line-by-line type, or block programming language, database parameters shall require assignment of variable names so parameters can be changed without modifying the programming. The following shall be modifiable in this way:
   a. Setpoints
   b. Dead band limits and spans
   c. Reset schedules
   d. Switchover points
   e. PID gains and time between control output changes
   f. Time
   g. Timed local override time
   h. Occupancy schedules
   i. Holidays
   j. Alarm points, alarm limits, and alarm messages
   k. Point definition database
   l. Point enable, disable, and override
   m. Trend points, trend intervals, trend reports
   n. Analog input default values
   o. Passwords
   p. Communications parameters including network and telephone communications setups

D. Short Cycling Prevention
1. Where equipment is started and stopped or opened and closed in response to some analog input such as temperature, or pressure, include a differential or an appropriate minimum off time delay for the control loop to prevent short cycling of equipment.

E. Motor and Flow Status Delay

1. Provide an adjustable delay between when a motor is commanded on or off and when the control program looks to the motor or flow status input for confirmation of successful execution of the command.

F. Runtime Accumulation

1. Provide resettable run time accumulation for each Binary Output connected to mechanical loads greater than 1HP, electrical loads greater than 10KW, or wherever else specified.

G. Time Programs

1. Provide programming to automatically adjust for leap years, allow operator time adjustments, and make daylight savings time and standard time adjustments.

H. Scheduling

1. Each control output point shall be schedulable and its operation based on time of day, day of week, and day of year. Output points may be associated into groups. Each group may be associated with a different schedule. Changing the schedule of a group shall change the schedule of each point in the group. Points may be added to and deleted from groups. Groups may be created and deleted by the operator.
2. Provide capability that will allow current schedules to be viewed and modified in a seven-day week format. When control program does not automatically compute holidays, provide capability to allow holiday schedules to be entered one full year at a time.

I. Point Override

1. I/O and virtual points shall be able to accept overrides in the software and be commanded to any valid value from a hand held terminal, through a keypad integral to a Digital Controller, any OWS, or a Portable Workstation Laptop Computer connected to the Building Network Controller or direct connected to a Digital Controller. When documented, exceptions to these requirements are allowed for life, machine, and process safeties.

J. Alarming

1. I/O points and virtual points shall be alarmable. Alarms may be enabled and disabled for every point. Alarm limits shall be adjustable on analog points. Building Network Controllers connected to the network shall download alarms and alarm messages to the data servers when an alarm occurs. Otherwise alarms will be stored at the Building Network Controller until connected to a Portable Workstation Laptop Computer and retrieved. When a Building Network Controller is not connected to the network, and the memory on the Building Network Controller becomes full, the most recent data shall overwrite the oldest data. Provide alarming in accordance with the point schedule, sequence of operation, and any other notation in the design drawings. At a minimum the following conditions shall generate alarms including alarms defined in prior section of this document:
   a. Motor is commanded on or off but the motor status input indicates no change
   b. Room temperature or pressure strays outside selectable limits
   c. An analog input takes a value indicating sensor failure

d. A module is "dead" to the LAN
e. A power outage occurs
f. Damper is commanded open or closed but the limit switch status or positional status has not changed
g. Hand-Off-Auto switch has been placed in the Hand or Off position
h. Smoke detectors sense smoke condition; fire alarms
i. Filter differential pressure
j. Supply fan high limit switch
k. Tank levels outside limits
l. Equipment safeties (chiller, boiler, VFD, etc.)
m. Emergency shutoff switch (Demand Limit Step 3)

K. Messages
1. Messages shall be operator defined and assigned to alarm points. Messages shall be sent via email or text message.

L. Trending
1. DDC system shall have the capability to trend I/O and virtual points. Points may be associated into groups. A trend report may be set up for each group. The period between logging consecutive trend values shall range from one minute to 60 minutes at a minimum. Trend data type shall be selectable as either averages over the logging period or instantaneous values at the time of logging. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, the most recent data shall overwrite the oldest data. Trend data shall be capable of being uploaded to computer. Trend data shall be available on a real time basis; trend data shall appear either numerically or graphically on a connected computer's screen as the data is being processed from the DDC system data environment. Trend reports shall be capable of being uploaded to computer disc and archived.

M. Status Display
1. Current status of I/O and virtual points shall be displayed on command. Points shall be associated into functional groups, such as all the I/O and virtual points associated with control of a single air handling unit, and displayed as a group, so the status of a single mechanical system can be readily checked. A group shall be selectable from a menu of groups having meaningful names; such as AHU-4, Second Floor, Chiller System, and other such names.

N. Diagnostics
1. Each controller shall perform self-diagnostic routines and provide messages to an operator when errors are detected. DDC system shall be capable of recognizing a non-responsive module on a LAN. The remaining, responsive modules on a LAN shall not operate in a degraded mode.

O. Power Loss
1. In event of a power outage, each controller shall assume a disabled status and outputs shall go to a user definable state. Upon restoration of power, DDC system shall perform an orderly restart, with sequencing of outputs, and restoration of control.

P. Program Transfer

1. Every Digital Controller in the DDC system shall be capable of being downloaded and uploaded to through the Building Network Controller.

Q. Password Protection

1. Provide at least three levels of password protection to the DDC system permitting different levels of access to the system.

2.3 Workstation

A. Workstation Software

1. Workstation software shall be recommended and supported by the DDC system manufacturer and configured to operate according to the DDC system manufacturer's specifications. Workstation software shall be resident in the workstation computer. Workstation software shall permit monitoring, modification, and troubleshooting of the DDC system. Workstation software shall permit modification of the controller database and control programs for any Building Network Controller or Digital Controller on the network. Operations shall be menu selected. Menu selections shall be made with a mouse.
   a. Menu System: Menu system shall allow an operator to select a particular function or access a particular screen through successive menu penetration.
   b. Controller Data Base Modification: The workstation software shall be an interface for performing capabilities specified in paragraph entitled "DDC Software" and available through direct connection of a computer to a digital controller. Database modification shall require only that an operator "fill in the blank" for that parameter on a screen requesting the information in plain language. Database modifications shall be automatically downloaded to the appropriate controllers at operator request.
   c. Program modification: For systems using a line-by-line programming language, provide an off-line text editor, similar to a BASIC program editor, permitting modification of controller resident control programs, For systems using block or object programming languages provide a capability for linking blocks/objects together to create new programs or modify existing programs. Program modifications shall be automatically downloaded to the appropriate controllers at operator request.

2.4 SENSORS AND INPUT HARDWARE

A. Resistance Temperature Detectors (RTDs)

1. Field Installed sensors shall be provided by unit manufacturer to assure compatibility with factory installed controls.

a. Wiring:
   i. Provide 20 gage twisted and shielded pair cable for direct connected RTDs.
   ii. Provide 20 gage twisted and shielded pair cable for RTDs using 4 to 20 milliampere transmitters.

b. Transmitters: Provide 4 to 20 milliampere transmitters for RTDs where:
   i. Digital Controllers do not support direct connection of RTDs to controllers; and
   ii. Digital Controllers do not meet temperature resolution requirement of 0.25 degree F.

B. Transmitters
1. Provide transmitters with 4 to 20 mA or 0 to 10 VDC output linearly scaled to the temperature, pressure, or flow range being sensed. Transmitter shall be matched to the sensor, factory calibrated, and sealed. Total error shall not exceed 0.1 percent of 20 milliampere (0.02 milliampere) at any point across the 4 to 20-ma span. Supply voltage shall be 24 volts ac or dc. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter stability shall not exceed 0.05 degrees C a year.
   a. Spans and Ranges
      i. Transmitter spans or ranges shall be the following and shall be suitable for the application:
      ii. Temperature:
         1. 50 degrees F span: Room, chilled water, cooling coil discharge air, return air sensors
         2. 100 degrees F span: Outside air, hot water, heating coil discharge air, mixed air sensors
         3. 200 degrees F span: High temperature hot water, heating hot water, chilled/hot water system sensors.
      iii. Pressure:
         1. 0.25 to 0.25 inches water differential range: Room static pressure
         2. 0 to 5 inches water differential range: Duct static pressure
         3. 0 to 50 PSI differential: Water differential pressure
         4. 0 to 2.5 inches water differential range: Filter differential pressure
   b. Relative Humidity Transmitters
      i. Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90% scale, and less than one percent drift per year. Sensing elements shall be the polymer type.
   c. Pressure Transmitters
      i. Provide integral pressure transducer and transmitter. Output of pressure instrument shall be a 0 – 10 VDC signal proportional to the pressure span. Span shall be as specified. Accuracy shall be 1.0 percent. Linearity shall be 0.1 percent. Supply voltage shall be 24 V dc. Transmitter shall meet specified requirements.

C. Current Transducers
1. Provide current transducers to monitor the amperage of each motor or compressor. For chillers with multiple compressors provide a current transducer at the incoming power to the chiller unless otherwise specified. Current Sense Relays shall be used on motors of 3 HP or less.

D. Timed Local Override for Temporary Occupancy

1. Provide every HVAC system (unless otherwise noted) with a momentary contact temporary occupancy timers (either a standalone pushbutton that is labeled as to its function or a pushbutton integral to a thermostats or wall mounted temperature sensor) with override time set in controller software. Provide to override DDC time of day program and activate occupancy program for assigned units. Upon expiration of override time, the control system shall return to time-of-day program. Time interval for the length of operation shall be software adjustable and shall expire unless reset.

E. Occupancy Sensors/Timers

1. Occupancy Timers shall be provided that are identical to those presently used. New timers shall be installed in existing locations.

2.5 OUTPUT HARDWARE

A. Show all control dampers on the control drawings. Indicate the blade configuration (parallel or opposed-blade), the actuator normal position, and whether it's two-position or modulating. Provide damper position feedback to indicate the damper status/position.

1. Dampers
   a. Damper already exist on the HVAC units.
2. Actuators
   a. Provide electric motor type spring return actuators on all control dampers and all control valves (so that, in the event of power failure, actuators shall fail safe in either the normally open or normally closed position as specified) except terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Provide a minimum of one actuator for each damper.
   b. Show on drawings the normal position of each actuator without power or control signal. Select normal position considering power loss, freezing, moisture damage, and smoke or fire transmission. Indicate power return actuators where necessary for actuator timing and process requirements. Indicate spring return for actuators where normal position, but not timing, is important. Spring return closed is often desirable for steam valves and outside air intake dampers. Whenever possible provide electric actuators for reduced maintenance, quality control, and DDC integration. However, pneumatic actuators may be preferable in unusual circumstances like explosion-proof areas. Existing pneumatic actuators may also have to remain in retrofits where costs prevent actuator replacement.
      i. Electric Actuators
         1. Provide direct drive electric actuators for all valve and damper control applications. Where pneumatics exists, replace at central and zone levels and where possible, remove all associated pneumatic piping. Otherwise, remove pneumatic piping as far back as possible (either to the nearest wall that the tubing is running through or against, or no less than 5 feet back from the device that the tubing was connected to) and permanently plug the pneumatic tubing. When operated at rated voltage, each actuator shall be capable of delivering the torque required

for continuous uniform movement of the valve or damper and shall have internal end switches to limit travel, or shall withstand continuous stalling without damage. Actuators shall be quiet operating and function properly with range of 85 to 110 percent of line voltage. Provide gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch pounds. Provide hardened steel running shafts in sleeve bearing of copper alloy, hardened steel, nylon, or ball bearing. Provide proportioning actuators capable of stopping at all points in the cycle and starting in either direction, from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Equip valve actuators with a force-limiting device such as spring yield so that, when in a relaxed position, device shall maintain a pressure on valve disc equivalent to system pressure at valve. Provide a power return operation adjustable up to 4 minutes with sufficient reserve power to fully stroke the valve once and hold in the desired FAIL SAFE position. Provide reversible shaded pole, split capacitor, synchronous, or stepper type electric motors. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between.

3. Hand-Off-Automatic (HOA) Switches
   a. Hand-Off-Automatic (HOA) switch shall be rated for a minimum of 600 VAC, 5 A. Dual auxiliary contacts shall be provided for the automatic position to provide sensing at the controller. Auxiliary contacts shall be rated at least 120 VAC, 1 A.
4. Output Switches
   a. Control Relays
      i. Field installed and DDC panel relays shall be double pole, double throw (DPDT), UL listed, with contacts rated to the application, indicator light, and enclosed in a dustproof enclosure. The indicator light shall be lit when coil is energized and is off when coil is not energized. Relays shall be socket type, plug into a fixed base, and be replaceable without need of tools or removing wiring.
   b. Motor Starter Contactor
      i. IEC form factor Contactors shall be used to control power to motors. These devices shall be DIN rail mount, have multiple poles that depend upon the application such as single phase verses three phase contactor, shall be controlled via the DDC using 24 VAC Coils, shall be rated for the inductive loading such as ½ hp vs. 5 hp motors and shall have suitable terminations for the incoming power and outgoing power wire sizes

2.6 ELECTRICAL POWER AND DISTRIBUTION

A. Provide a source of 120 volts , 60 Hz, single phase, two wire with ground to step down to 24 VAC which shall be used to power any new DDC equipment that is not able to be powered from existing sources.

1. Devices shall be UL listed or FM approved. Power output to all new shall be 24 VAC and shall be provided from the nearest existing power sources to the maximum extent feasible.
2. Transformers
   a. Transformers shall conform to UL 506. Provide power to the primary side of the transformer from a dedicated circuit breaker. Add a new breaker if required at the nearest electrical panel with available spare capacity. Transformers for Digital Controllers shall be fed from the nearest distribution panel board or motor control center, using circuits provided for the purpose. Provide a fuse cutout on the secondary side of the transformer. Transformers shall be fused or current limiting and rated at 125% power consumption.
3. Surge Protection
   a. Provide each Building network Controller and Digital Controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.
   b. Power Line Surge Protection
      i. Surge suppressors shall be installed on all incoming AC power. Surge suppressor shall be rated by UL 1449, and have clamping voltage ratings below the following levels:
         1. Normal Mode (Line to Neutral): 350 Volts
         2. Common Mode (Line to Ground): 350 Volts
   c. Telephone and Communication Line Surge Protection
      i. Telephone and Communication Lines shall be protected from surges. Metal oxide varistor (MOV) protection, rated for the application, shall be installed at the equipment. Additional protection, gas tubes rated for the application, shall be installed within 3 feet of the building cable entrance or within 3 feet of the telephone company's network interface.
   d. Sensor and Control Wiring Surge Protection
      i. Controllers shall have sensor and control wiring surge protection with optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.
4. Wiring
   a. Provide complete electric wiring for DDC System, including wiring to transformer primaries. Control circuit conductors which run in the same conduit as power circuit conductors shall have the same insulation level as power circuit conductors. Circuits operating at more than 100 Volts shall be in accordance with SECTION 26 2726, "Wiring Devices." Circuits operating at 100 Volts or less shall be defined as low voltage and shall be run in rigid or flexible conduit, metallic tubing, metal raceways or wire trays, armored cable, or multi-conductor cable for outdoor usage.

b. For indoor use provide circuit and wiring protection as required by NFPA 70. Aluminum-sheathed cable or aluminum conduit may be used but shall not be buried in concrete. Protect exposed wiring from abuse and damage.

c. AC Control Wiring
   i. Control wiring for 24 V circuits shall be insulated copper 18 AWG minimum and shall be rated for 300 VAC service.
   ii. Wiring for 120 V shall be 14 AWG minimum and shall be rated for 600 V service.

d. Analog Signal Wiring
   i. Analog signal wiring for analog inputs and analog outputs shall be 20 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded, and have 20 AWG drain wire. Exception is direct connect RTD wiring which shall be a single 20 AWG minimum-twisted pair, 100 percent shielded, and with 20 AWG drain wire. Each wire shall have insulation rated to 300 V ac. Cables shall have an overall aluminum-polyester or tinned-copper (cable-shield tape), overall 20 AWG tinned copper cable drain wire, and overall cable insulation rated to 300 V ac. Install analog signal wiring in conduit separate from AC power circuits.

e. Digital Signal Wiring
   i. Digital signal wiring for digital inputs and digital outputs shall be 18 AWG single twisted pair. Each cable shall be 100 percent shielded with 20 AWG drain wire. Each wire shall have insulation rated to 300 V ac. Cables shall have an overall aluminum-polyester or tinned-copper (cable-shield tape), overall 20 AWG tinned copper cable drain wire, and overall cable insulation rated to 300 V ac. Install digital signal wiring in conduit separate from AC power circuits.

2.7 FIRE PROTECTION DEVICES

A. Provide smoke detectors in return and supply air ducts on downstream side of filters in accordance with NFPA 90A, except as otherwise indicated. Provide UL listed or FM approved detectors for duct installation.

1. Smoke Detectors
   a. Provide duct smoke detectors in HVAC ducts in accordance with NFPA 72 and NFPA 90A, except as indicated otherwise. Smoke detector interlocks shall be hardwired to the MCC or thru the unit's internal packaged control board for direct shutdown. Each smoke detector shall be monitored and an alarm shall be generated upon detection of smoke. Provide UL listed or FM approved detectors, designed specifically for duct installation. Provide smoke detectors as follows:
      i. Provide duct-mounted supply air smoke detectors for each air-handling system with supply air capacity equal to or greater than 2000 cfm. Locate the detector downstream of the supply air fan, before the first branch connection.

ii. Provide duct-mounted return air smoke detectors for each air-handling system serving more than one story, and where the total return air capacity is equal to or greater than 15,000 cfm. Provide a detector at each story's return duct main, before its connection to the common return air duct. Also provide a detector at the return air inlet connection to the air handler, before any fresh air or recirculation connection.

2.8 SMOKE DAMPERS AND COMBINATION SMOKE/FIRE DAMPER

A. Smoke damper and actuator assembly as required in accordance with NFPA 90A shall meet the Class II leakage requirements of UL 555S. Dampers shall be factory fabricated from galvanized steel or stainless steel with lubricated bearing, linkage, and seals to withstand temperatures from minus 20 to plus 250 degrees F. Provide seals that can be easily replaced. Combination smoke/fire dampers shall have UL 1.5 hour rating and shall be equipped with electric/thermal link which closes damper at 165 degrees F and then automatically resets after normal temperature is restored by cycling damper operator. Equip dampers with pneumatic or electric operators which close smoke dampers tightly when activated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Prior to commencement of installation, the Contractor shall schedule meeting with the Owner to finalize controls design submittal for approval and ensure that the System Names and Point Names to be used in the DDC system database are in accordance with the Owner overall requirements. Contractor shall: Perform installation under supervision of competent technicians regularly employed in the installation of DDC systems. Provide components for a complete and operational DDC system.

B. Building Network Controller

1. Communication interfaces shall be provided for the Building Network Controller,] to allow connectivity to the via the closest local Switch which is located in the telecom room. The Building Network Controller shall be located within 300 feet of the Ethernet switch. The Contractor shall provide, install, and establish communications between the Building Network Controller, and the Internet servers, including the provision of Ethernet Standard Category 5 cables between the Building Network Controller and the designated termination at the Ethernet Switch. Successful communication of the DDC system with the Internet based system shall be demonstrated.

C. Digital Controllers

1. Do not divide control of a single mechanical system such as an air handling unit, boiler, chiller, or terminal equipment between two or more controllers. A single controller shall manage control functions for a single mechanical system. It is permissible, however, to manage more than one mechanical system with a single controller.

2. No multiplexing of points is allowed.

3. Universal Programmable Controllers shall be specified for all boiler and chiller controllers regardless of the required point capacity.
4. Controllers shall have I/O function as spare capacity to the maximum extend feasible. The panel I/O functions shall be furnished complete, with no changes or additions necessary to support implementation of spare functions. Output relays associated with digital signals shall be considered part of the I/O function, whether physically mounted in the enclosure or separately mounted. Implementation of spare points shall necessitate only providing the additional field sensor or control, field wiring including connection to the system, and point definition assignment by the operator. The panel shall contain all necessary I/O functions to connect to field sensors and control panels. I/O function operation shall be fully supervised to detect I/O function failures.

D. Nameplates and Wire Tags
1. All HVAC equipment, controller cabinets (including Field Equipment Controller cabinets), sensors, control devices, relays, etc. are to be labeled with a minimum of 3" wide by 1" high WHITE laminated plastic nameplates with BLACK lettering and a minimum of ¼" high engraved, capitalized block lettering, backed with double-sided adhesive. Laminated plastic shall be 1/8" thick with black center core.
2. Each nameplate shall identify the system and object name as applicable. HVAC equipment, controller cabinets, and Field Equipment Controller cabinets, shall be labeled using the system name of the HVAC system it is associated with. All physical I/O equipment devices (sensors, control devices, relays etc.) shall be labeled using the object name of the I/O it is associated with All physical I/O equipment devices (sensors, control devices, relays, etc.) not located within 5 feet of the associated HVAC equipment (such as supply air static pressure sensors, differential pressure sensors, relays, etc) shall be labeled with both the system and object names. Nameplates shall be placed on or near the physical I/O equipment device, and shall be placed in a visible location to aid in locating the device. Plastic nameplates for controllers and devices above the ceiling shall be mounted in a visible location (T-bar, wall adjacent to ceiling, etc.), as such, controllers in enclosures located above drop ceilings will require two nameplates. Prior approval is required for alternative methods of nameplate mounting.
3. All Control wiring shall be labeled at both terminations utilizing printed labels with the object name of the physical I/O equipment device it is associated with, or the function it provides (24V AC, Network Comm., etc.). All controllers shall be properly labeled with the system name, and controller address, utilizing printed labels. The flip down cover on Universal programmable controllers shall be labeled with a printed list of the I/Os associated with the controller. All thermostats and space temperature sensors shall be labeled with both the system and object names, and if applicable, the system name of the primary system by which it is served (such as thermostats associated with VAV boxes where multiple air handlers serve the building). Handwritten labels are strictly prohibited.

E. Wiring Criteria
1. All control wiring shall be new including low voltage power. Do not run control wiring, Ethernet cable, or BACnet network wiring in the same conduit with low voltage or high voltage wiring (voltage above 30VAC).

2. The Contractor shall install control wiring as required to meet the project specifications, the National Electrical Code, the National Electrical Safety Code, and all state and local codes. Unless specifically noted otherwise on the plans, the Owner requires the least expensive wiring installation that meets these specifications and codes within the following guidelines:
   a. In mechanical rooms and un-finished interior rooms, the wiring shall be run in EMT in exposed areas, unless noted otherwise.
   b. Under slab, in dirt or direct buried underground, schedule 40 PVC shall be used.
   c. Where subject to foot traffic or when cabling is run along roof surface, rigid conduit with threaded fittings shall be used.
   d. Whenever low voltage control cable is utilized without conduit, the low voltage control cable shall be plenum rated. Plenum rated cable shall be hung with bridle rings as required to prevent drooping. Laying of plenum rated cable on ceiling tiles for support shall be prohibited. Squeeze type connectors shall be utilized where plenum rated cable enters equipment enclosures. Use of plenum rated cable in areas where induction is anticipated such as near lighting ballasts, is not acceptable. In areas where induction producing devices are located, control wiring shall be run in conduit.
   e. Whenever EMT conduit is attached to a vibrating surface indoors, a short run of flexible conduit shall be utilized.
   f. Whenever EMT or rigid conduit is attached to a vibrating surface outdoors, a short run of flexible seal tight conduit shall be utilized.
   g. Compression type fittings shall be utilized with EMT. The use of setscrews shall not be permitted.
   h. Weather proof compression type fittings shall be utilized with EMT subject to damp or wet locations. The use of setscrews shall not be permitted.
   i. Power wiring (120 Volt, 60 Hz or 480 Volt) inside of the buildings shall be run in EMT.
   j. Power wiring (120 Volt, 60 Hz or 480 Volt) exposed outdoors shall be run in rigid conduit.
   k. Rigid or flexible conduit shall be terminated at all sensors and output devices.
   l. Fill ratio of conduit shall not exceed 40%.
   m. Plenum rated cable shall be suspended and properly secured and shall not have contact with ceiling tiles.
   n. Not used.
   o. Grounding: Ground controllers and cabinets to earth ground. Ground controller to a ground in accordance with SECTION 26 0526, "Grounding and Bonding for Electrical Systems." Grounding of the green ac ground wire, at the breaker panel, alone is not adequate. Run metal conduit from controller panels to adequate building grounds. Ground sensor drain wire shields at controller end.
   p. Contractor is responsible for correcting all associated ground loop problems.

F. Temperature Sensors

1. Provide temperature sensors in locations to sense the appropriate condition. Provide sensor where they are easy to access and service without special tools. Calibrate sensors to accuracy specified. In no case will sensors designed for one application be installed for another application.

   a. Room Temperature Sensors

      i. Provide on interior walls to sense average room temperature conditions. Avoid locations that may cover the sensor by office furniture or where accurate room conditions may not be registered (near heat generating equipment). Room temperature sensors should not be mounted on exterior walls when other locations are available. Mount centerline of sensor at 5 feet above finished floor. Cut and patch or provide plate as required. Sensor shall be isolated from drafts due to wall penetrations.

   b. Duct Temperature Sensors

      i. Provide sensors in ductwork in general locations as indicated. Select specific sensor location within duct to accurately sense appropriate air temperatures. Do not locate sensors in dead air spaces or positions obstructed by ducts or equipment. Install gaskets between the sensor housing and duct wall. Seal duct and insulation penetrations.

      ii. Provide duct-averaging sensors to be used where stratification is likely to occur, typically for larger air ducts or in the mixing section of air handlers equipped with an economizer.

      iii. String duct-averaging sensors between two rigid supports in a serpentine position to sense average conditions. Thermally isolate temperature-sensing elements from supports. Provide duct access doors to averaging sensors.

      iv. Locate freeze protection sensors in appropriate locations to sense lowest temperatures, to avoid potential problems with air stratification.

   c. Immersion Temperature Sensors

      i. Provide thermo-wells for sensors measuring temperatures in liquid applications or pressure vessels. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to effect proper flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide thermo-wells with thermal transmission material within the well to speed the response of temperature measurement. Provide wells with sealing nuts to contain the thermal transmission material.

   d. Outside Air Temperature Sensors

      i. Provide outside air temperature sensor on north side of the building, away from exhaust hoods, air intakes and other areas that may affect temperature readings. Provide sunshields to protect outside air sensor from direct sunlight.

G. Damper Actuators
1. Actuators shall not be mounted in the air stream.

H. Thermometers
1. Not used.

I. Pressure Sensors
1. Differential Pressure
a. General: Install pressure-sensing tips in locations to sense appropriate pressure conditions.
b. Duct Static Pressure Sensing: Locate duct static pressure tip approximately two-thirds of distance from supply fan to end of duct with the greatest pressure drop.
c. Pumping Proof with Differential Pressure Switches: Install high-pressure side between pump discharge and check valve.
d. Filter differential Pressure Sensing: Install differential pressure sensors (analog) for tracking build-up and for the purposes of filter replacement.

3.2 ADJUSTMENTS

A. Calibrate all sensors, instrumentation, and controls and verify the specified accuracy using test equipment with accuracies in compliance with NIST standards. Adjust controls and equipment to maintain conditions indicated, to perform functions indicated, and to operate in the sequence specified.

3.3 FIELD QUALITY CONTROL

A. General
1. Demonstrate compliance of the heating, ventilating, and air conditioning control system with the contract documents. Furnish personnel, equipment, instrumentation, and supplies necessary to perform calibration and site testing. Ensure that tests are performed by competent employees of the DDC system installer or the DDC system manufacturer regularly employed in the testing and calibration of DDC systems.
a. Testing will include the Contractor Field Tests and the Performance Verification Tests. Contractor Field Tests shall demonstrate proper calibration of input and output devices, and the operation of specific equipment. Performance Verification Tests shall ensure proper execution of the sequence of operation and proper tuning of control loops.
b. Obtain approval of the plan for each phase of testing before beginning that phase of testing. Give the owner written notification of planned testing at least 45 days prior to test. Notification shall be accompanied by the proposed test procedures. In no case will the Contractor be allowed to start testing without written Owner approval of test procedures. The test procedures shall consist of detailed instructions for complete testing to prove performance of the heating, ventilating and air-conditioning system and digital control system. Test procedures shall include tests outlined in the following paragraphs.

c. Before scheduling the Performance Verification Test, furnish the Contractor Field Test documentation and written certification to the Owner that the installed system has been calibrated, tested, and is ready for the performance verification test. Contractor shall schedule meeting with the Owner to review all documentation and test procedures. Do not start the performance verification test prior to meeting and receiving written permission from the Owner.

d. Tests are subject to oversight and approval by the Owner. The testing shall not be run during scheduled seasonal off-periods of heating and cooling systems.

B. Test Reporting for Contractor Field Testing and Performance Verification Tests

1. Document all tests with detailed test results. Explain in detail the nature of each failure and corrective action taken.

a. During and after completion of the Contractor Field Tests, and again after the Performance Verification Tests, identify, determine causes, replace, repair or calibrate equipment that fails to meet the specification, and deliver a written report to the Owner.

b. Provide a written report containing test documentation after the Contractor Field Tests and again after the Performance Verification Tests. Convene a test review meeting at the job site to present the results to the Owner. As part of this test review meeting, demonstrate by performing all portions of the field tests or performance verification test that each failure has been corrected. Based on the report and test review meeting, the Owner will determine either the restart point or successful completion of testing. Do not commence retesting until after receipt of written notification by the Owner. At the conclusion of retesting, assessment will be repeated.

c. Any and all points selected by the Owner shall be proven to work end-to-end during PVT.

C. Contractor's Field Testing

1. Testing, Adjusting, and Commissioning: After the Contractor has received written approval of the shop drawings and as specified, the Contractor will be authorized to proceed with the installation of the system equipment, hardware, and software. Once the installation has been completed, the Contractor shall test, adjust and commission each control loop and system; and shall verify proper operation of each item in the sequences of operation, including hardware and software. The Contractor shall calibrate field equipment, including control devices, adjust control parameters and logic (virtual) points including control loop set points, gain constants, and constraints, and verify data communications before the system is placed on-line. The Contractor shall calibrate each instrumentation device connected to the DDC system by making a comparison between the reading at the device and the display at the Workstation, using a standard at least twice as accurate as the device to be calibrated. The Contractor shall check each control point within the DDC system by making a comparison between the control command at the Workstation and field-controlled device. I/O function calibration checks shall include before and after calibration readings (deviation of reading from actual value as measured by a known calibration standard). Contractor shall utilize analog test instruments with calibration traceable to the National Institute of Standards and Technology, and

shall provide calibration documentation as a part of the report. Analog test instrumentation shall be at least twice as accurate as the device being calibrated. For each analog and digital point being controlled by the DDC system, the Contractor shall command each point and verify its proper operation, and the proper operation of connected equipment such as fans, valves, and dampers. Where practicable, create the field conditions for change of state for digital inputs and verify proper reporting at the control system interface. The contractor shall deliver trend logs/graphs of all points showing to the Owner that stable control has been achieved. Points on common HVAC systems shall be trended simultaneously. One log shall be provided showing concurrent samples taken once a minute for a total of 4 hours. One log shall be provided showing concurrent samples taken once every 15 minutes, for a total of 48 hours. The Contractor shall verify operation of systems in the specified failure modes upon DDC system failure or loss of power, and verify that systems return to DDC system control automatically upon a resumption of DDC system operation or return of power. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibration including written certification to the Owner that the installed complete system has been calibrated, tested, and is ready to begin the PVT. The report shall include certification. The report shall also include a copy of the approved PVT Procedure.

2. System Inspection: Observe the HVAC system in its shutdown condition. Check dampers and valves for proper normal positions. Document each position for the test report.
3. Calibration Accuracy and Operation of Input Test: Verify correct calibration and operation of input instruments. For each sensor and transmitter, including those for temperature, pressure, relative humidity, and dew point inputs, record the reading at the sensor or transmitter location using calibrated test equipment. Record the output reading provided by that sensor or transmitter. Document each of these locations and output readings for the performance verification test report. The test equipment shall have been calibrated within one year of the date of use in the field. Test equipment calibration shall be traceable to the measurement standards of the National Institute of Standards and Technology.
4. Operation of Outputs Test: Check the operation of each output to verify correct operation. Command digital outputs on and off. Command analog outputs to minimum range, such as 4 mA, and maximum range, such as 20 mA, measure and record commanded and actual output values. Document each command and result for the test report.
5. Actuator Range Adjustment Test: With the digital controller, apply a control signal to each actuator and verify that the actuator operates properly from its normal position to full range of stroke position. Record actual spring ranges and normal positions for all modulating control valves and dampers. Include documentation in the test report.
6. Digital Controller Startup and Memory Test: Demonstrate that programming is not lost after a power failure, and Digital Controllers automatically resume proper control after a power failure.
7. Application Software Operation Test: Test compliance of the application software for:
    a. The ability to demonstrate seamless communications with the existing Internet based Server, location to be determined, as well as direct connect via the Building Network Controller in the facility where the work is being accomplished.

b. Editing Control programs: Demonstrate the ability to edit the control program off line.
c. Reporting of alarm conditions: Cause alarm conditions for each alarm, and ensure that workstations receive the alarms.
d. Reporting trend and status reports: Demonstrate ability of software to receive and save trend and status reports.

8. Contractor Field Test Report
   a. The contractor shall prepare a report including all pertinent data described above with the content and annotations as described below. Four (4) complete copies will be submitted for approval.
      i. Tab 1 - Engineering Review Checklists: Engineering Review Checklists shall be provided and shall list all Clarifications (including contract negotiated clarifications), Existing Conditions or deficiencies (ECRs), Requests for Information (RFIs) and Field Change Orders (FCOPs) pertaining to the individual building. Hardcopies of all RFIs with responses to be provided with the checklist sheet.
      ii. Tab 2 & 3 - Redline Drawings: Contractor's Redline Drawings shall be marked up copies of approved drawings. Redline A/E Design Drawings shall also be provided with updated panel locations, thermostat locations, and wire runs. Tabs shall separate A/E Design (Tab 2) and Contractor's (Tab 3) drawings. Both Contractor's and A/E Design Redline Drawings shall include all changes made during construction such as but not limited to panel and thermostat locations, occupancy time schedules, sequences of operation, or changes to controller/device type and will show these changes on all drawings that apply. References to directions given shall be noted (RFI) with all changes. Redline Drawings shall be legible and show description and date of revision and preparer's name.
      iii. Tab 4 - Graphic Templates: Include hardcopies of graphic templates for each primary system with sample copies of typical graphics for systems that are repeated. Include floor plan graphics templates and any summary or legend graphics templates that are required.
      iv. Tab 5 - Checkouts: Checkouts shall be provided for each system installed and/or networked. Checkouts shall be arranged by systems and shall include all hardware points of that system. States defined on I/O points shall be the engineering units for that point.
      v. Tab 6 - Calibration Certificates: Current Calibration Certificates shall be provided for all instruments used for calibration for the particular Building.
      vi. Tab 7 - Software: Provide softcopies of all database and programming data. They shall be in a separate electronic folder labeled "Software Files". Provide a Hardcopy of the expanded software tree showing all building systems. Provide printouts of the I/O summary for all primary systems with sample copies of typical systems that are repeated (e.g. VAV Boxes, Fan Coil Units, etc.).

vii. Trends: Softcopies of Trends shall be provided for each system installed and/or networked. Trends shall be provided in Microsoft Excel format and show data in tabular and graphical form. Trends for every system shall include all hardware points and any software points that relate to Sequence of Operations. Actual setpoints (in addition to RM-TSET) shall be provided. Trends shall be provided in two separate electronic files. One file will show data over at least a 48hour period in 15 minute intervals. The second file shall show data over at least four hours in one-minute intervals. Trends for each file for all systems shall be accumulated at concurrent time periods.

b. If more than a single worksheet is required to show all points of a system, control and monitoring points that correspond to each other shall be provided on the same worksheet

c. During the one minute trending, the technician will manipulate inputs and setpoints to show control actions that verify all items in the sequence of operation. The technician will describe in detail what inputs or setpoints were changed in a note on the far right side cell in the system's trend worksheet. The cell used for the description will correspond to the time the change was made.

d. All electronic data shall be provided on a single, inscribed/labeled CD in a pouch oriented so that the CD does not fall out of the CFT Book.

D. Test, Adjust, and Balance Support

1. The controls contractor shall coordinate with and provide on-site support to the test, adjust, and balance (TAB) personnel when applicable. This support shall include:

   a. On-site operation and manipulation of the control system during the testing and balancing.

   b. Control set point adjustments for balancing all relevant mechanical systems.

   c. Tuning control loops with set points and adjustments determined by the TAB personnel.

E. Performance Verification Test (PVT)

1. The Contractor shall demonstrate that the completed DDC system complies with the contract requirements. Using approved test procedures, all physical and functional requirements of the project including communication requirements shall be demonstrated and shown. Contractor shall verify that each control function operates as described in the sequence of operation. The PVT as specified shall not be started until after receipt by the Contractor of written permission by the Owner, based on the Contractor's written report including certification of successful completion of Contractor Field Testing as specified, and upon successful completion of training as specified. Upon successful completion of the PVT, the Contractor shall deliver test reports and other documentation as specified to the Owner.

2. The performance verification tests shall include verification that the control system maintains setpoints, that the system recovers properly following a power loss, that control loops are tuned, that sensors are calibrated, that the LON, RS-485/MODBUS, Ethernet communications are established and controllers are

programmed to execute the sequences of operations, as required by the contract. Conduct the performance verification test during one week of continuous HVAC and DDC systems operation and before final acceptance of work.

3. Demonstrate functionality of the new DDC system including graphics on the Contractor's portable workstation laptop computer and the Internet based computer (location to be determined) including functionality of temperature control, status points, and positions of dampers and valves. The Contractor shall provide the graphic templates on the Owner provided, Internet based, portable or fixed workstation during the test for this purpose.
4. Demonstrate the functionality of the sequence of operations for randomly selected systems utilizing the graphics, testing as individual systems, or included in the sampling of multiple typical systems. In some cases, because of the type of controllers, it may be necessary to use non graphic means of control to directly access the programs to manipulate the data to demonstrate control.
5. Panel Checkouts by the Owner shall be performed on all installed systems. The Contractor need only be present during Panel checkouts of systems included in the testing samples.
6. When dealing with typical systems such as air handling units, etc., the Owner will select a random sample for testing, in the quantities tested shown in the table below. In the CFT report, the Contractor shall apply the table below to the systems on the project, and provide a list of the quantities of typical systems and the quantities of samples to be tested during the PVT.

Quantity of Typical Units	Units to be sampled
1	1
2-5	2
6-10	3

7. As a part of the sample unit checkout verification testing by the Contractor, the Contractor shall demonstrate calibration compliance for calibrated points, and all outputs shall be verified. Recalibration of sensors and adjustments of outputs during the test will only be allowed at the discretion of the Owner Representative. If a large amount of sensors and / or outputs prove to be out of calibration during testing, the Owner Representative may require more samples on additional systems, or may choose to suspend the testing.

3.4 TRAINING

A. Provide a training course schedule, syllabus, and training materials 14 days prior to the start of training. Furnish a qualified instructor to conduct training courses for designated personnel in the maintenance and operation of the HVAC and DDC system. Orient training to the specific system being installed under this contract. Use operation and maintenance manual as the primary instructional aid in contractor provided activity personnel training. Base training on the Operations and Maintenance manuals and a DDC training manual. Manuals shall be delivered for each trainee with two additional sets delivered for archiving at the project site. Training manuals shall include an agenda, defined objectives and a detailed description of the subject matter for each

lesson. Furnish audio-visual equipment and all other training materials and supplies. A training day is defined as 8 hours of classroom or lab instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance, the Contractor should assume the attendees will have a high school education and are familiar with HVAC systems. Provide a minimum of one training day.

3.5 COMMISSIONING

A. The Contractor shall be responsible for commissioning the DDC system as specified in the commissioning SECTION 23 0800.

END OF SECTION 23 0923

SECTION 23 3500 - VEHICLE EXHAUST REMOVAL SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

A. Provide all labor, materials, and equipment necessary to put in working operation a complete turnkey system to remove both diesel and automotive exhaust gases and particulate of operating vehicles within the confines of specified fire station(s). All necessary controls, motors, fittings, ductwork, blower(s), labor and all other equipment and materials specified shall be part of the work.

B. Fire Station 14

1. Plymovent manufacturer or approved equal.
2. (1) 8661-A011: STR-501 Straight Rail System, Drive Through, Single Vehicle System, Automatic Crab Return
3. (1) 8456-A011: VSR-60 Vertical Stack Rail
4. (1) TEV-559: 5 HP Plymovent Blower
5. (1) OS-3: Control Panel With Pressure Sensors, Wireless Receiver And Two Transmitters
6. (1) Equipment: Air Compressor

a. Install SBT tracks, STR rail, and VTR track, mounting blower and control panel, including ducting to system blower and electrical connection to customer's electrical panel.

C. Fire Station 19

1. Plymovent manufacturer or approved equal.
2. (2) 8411-1011: SBTA-31B Sliding Balancer Track, Single Track, One Vehicle Back-In System, Standard Tailpipe Adapters
3. (1) TEV-3110: 3 HP Plymovent Blower
4. (1) OS-3: Control Panel With Pressure Sensors, Wireless Receiver And Two Transmitters
5. (1) Equipment: Air Compressor

a. Install SBT tracks, mounting blower and control panel, including ducting to system blower and electrical connection to customer's electrical panel.

D. Sliding Balancer Track Sections Include: Fire Stations 14 & 19

1. Sliding Track.
2. Support Legs.
3. Double Track Joiner Plate.
4. Track Splicing Assembly.
5. Riser Clamp Assembly.
6. Trolley/Balancer Assembly.
7. Regulator Assembly.
8. Uncoupling Valve Assembly.
9. Upper Flexible Hose.
10. Lower Hose Assembly.
11. Safety Disconnect Coupling.
12. Collection Nozzle Assembly.
13. Manual Fill Valve.
14. Compressed Air Features.
15. Hose Saddle.
16. Electrical Controllers.
17. Electrical System.
18. Air Moving Devices.
19. Ductwork System.

E. Straight Rail Sections Include: Fire Station 14

1. Rail Material.
2. Top Mounting Suspension.
3. Support Legs.
4. Hydraulic Brake System.
5. Rail Splicing Joint.
6. Middle Rail Duct Connection.
7. Trolley Assembly.
8. Regulator Assembly.
9. Uncoupling Valve Assembly.
10. Upper Flexible Hose.
11. Lower Hose Assembly.
12. Safety Disconnect Coupling.
13. Collection Nozzle Assembly.
14. Manual Fill Valve.
15. Hose Saddle.
16. Electrical Controllers.
17. Electrical System.
18. Air Moving Devices.
19. Ductwork System.

F. Vertical Stack Rail Sections Include: Fire Station 14

1. Rail Material.
2. Trapeze mounting Support.
3. Rail Splicing Joint.
4. Flexible Duct Connection.
5. Vertical Stack Adapter.
6. Electrical Controllers.
7. Electrical System.
8. Air Moving Devices.
9. Ductwork System.

G. All items of equipment and materials described in these specifications are to be furnished installed and placed into proper operating condition in accordance with good practice and manufacturer's written or published instructions.

1. The exhaust removal system shall provide virtually 100 percent complete evacuation of all diesel fumes at the source from start up to exit of the apparatus from the fire station. The diesel exhaust removal system shall be capable of delivering complete coverage for bays up to 110 feet in length. The system must be able to accommodate drive through and back-in bays to meet all the needs of the fire department.
2. The system shall not affect personnel boarding the apparatus. Hose loops shall not hang any lower then six feet from the bay floor. The hose assembly shall not come into contact with the vehicle other than one connection point to the vehicles tailpipe. The hose assembly shall not touch or drag on the bay floor.
3. The exhaust system shall not block doorways, exits, and aisles in the apparatus bay, which could endanger the welfare of fire personnel or visitors.
4. To protect the apparatus electrical system from possible damage, the system bid shall not incorporate any type of electromagnetic device that requires the apparatus to be utilized as an electrical ground for systems operation.
5. The system must be designed and capable of capturing virtually 100% of the exhaust gas and particulate even in the event of a complete power failure. The system shall not detach itself from the apparatus for any reason during a power failure other then normal exiting of the apparatus bay. System shall discharge exhaust outside the station even in the event of a power failure.
6. The system shall under no circumstance allow exhaust leakage or bypass the nozzle.

1.2 SUBMITTALS

A. Product Data: Indicate manufacturer's model number, technical data including description of components and static pressure/air flow chart, and installation instructions. Details of wiring for power differentiating between manufacturer-installed and field-installed wiring.

B. Support legs must have been previously calculated on another fire station project in state of California by a Civil or Seismic engineer licensed in the State of California to

meet zone 4 requirements. Provide calculations within submittal package and review by the City Engineer.

C. Closeout Submittals: Operation and Maintenance data manual including spare parts list.

1.3 QUALITY ASSURANCE

A. Engage a factory certified experienced installer to perform work of this Section who has completed installations similar in design and extent to that indicated for this Project, and who has a record of successful in-service performance.

B. All components shall be fabricated in strict accord with standards set forth in the current edition of ISO 9002. The manufacturer must be ISO 9001 Certified, UL and CUL Certified www.ul.com/database/ and certified by the Air Movement and Control Association (AMCA) www.amca.org/search.htm to ensure quality, consistency and reliability of products. Certification documents shall be provided and attached to the bid proposal. No exceptions.

C. Engage a firm experienced in manufacturing similar to that indicated for this Project and with a record of successful in-service performance.

D. Conduct conference at Project site. Review methods and procedures related to vehicle exhaust system installation.
   1. Review access requirements for equipment delivery.
   2. Review equipment storage and security requirements.
   3. Inspect condition of preparatory work performed by other trades.
   4. Review structural loading limitations.
   5. Review that all components specified in this Section and related components specified in other Sectionss are accounted for.

1.4 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading: Deliver hoses with protective packaging. Store in original protective crating and covering and in a dry location.

1.5 PROJECT/SITE CONDITIONS

A. Existing Conditions: Verify dimensions installation areas by field measurements.

1.6 COORDINATION

A. Coordinate layout and installation with other work, including light fixtures, fixed equipment and work stations, HVAC equipment, and fire-suppression system components.

B. Coordinate location and requirements of service-utility connections.

1.7 REFERENCES

A. Air Movement & Control Association California, Inc.

1. AMCA Standard 500-D-98, "Laboratory Methods of Testing Dampers for Rating".

B. ASTM California.
1. Stainless Steel:
   a. A240/A240M-04ae1 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
   b. Bright, Directional Polish: No. 4 finish.
2. Aluminum:
   a. B209/209M-04 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
   b. Powder-Coated Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.
3. Galvanized Steel:
   a. A653/A653M-04a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
4. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline.
   a. 2015: Edition

1.8 BIDDER QUALIFICATIONS

A. Bids will only be accepted from companies that have an established reputation in the business of system design, turnkey installation and long-term service of Automatic Emergency Response Vehicle Exhaust Removal Systems.

1.9 MANUFACTURER QUALIFICATIONS

A. The manufacturer must be ISO 9001 Certified, UL and CUL Certified www.ul.com/database/ and certified by the Air Movement and Control Association (AMCA) www.amca.org/search.htm to ensure quality, consistency and reliability of products. Certification documents shall be provided and attached to the bid proposal.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. PlymoVent Corporation/Plymovent Industrial Ventilation Systems
115 Melrich Rd., Suite 2, Cranbury, New Jersey 08512
Telephone: (732) 417 0808
Toll Free: (800) 644-0911
FAX: (732) 417-1818
WEB: info@plymoventusa.com

1. Manufacturer listed for purposes of description of the equipment required. This does not preclude other manufacturers who may meet this performance specification from bidding.

B. OR Approved Equal.

2.2 STRAIGHT RAIL: Fire Station 14

A. STR-501

1. RAIL MATETRIAL

a. Rail Material: One-piece continuous extruded aluminum rail in a minimum length of 19 feet (5791.2 mm) in an effort to reduce the points of leakage due to seams or connections. The construction profile shall be of a round profile type, diameter of 6.5 inches (165.1 mm) with a rail thickness of 0.175 inch (4.5 mm). The bottom portion of the rail shall have a continuous slot to accept a rubber seal. Rail Material: Aircraft aluminum alloy Type AA-6063 (ASTM B209/B209M). Aluminum Rail: Extruded as a one piece design unit to maximize the structural integrity of the rail and to minimize joints. Extruded into the rail profile shall be all necessary mounting guides, which will allow for support of the rail mounting hardware and airline support cable. Mounting Channels: Provided continuously along both sides of the rail extrusion in order the proper positioning of all required mounting supports in accordance with codes. The rail shall allow the trolley/hose assembly to glide to the door threshold in a safe and effective manner. The extruded rail channel shall allow the whole rail to remain rigid and shall provide an area to attach bolts for splicing additional rails together for systems over 19 feet (5791.2 mm) long. The overall extruded rail lengths shall be 19 foot (5791.2 mm) standard. Rail System: Equipped with a hydraulic braking system that limits travel of flex hose as the vehicle exits the building. Hydraulic Brake: Incorporated into the end cap of the suction rail.

2. TOP MOUNTING SUSPENSION

a. Top Mounting Suspension: Designed to attach with 2 mounting cleats to the mounting slots that were extruded into the rail profile. The top suspension mount support shall be zinc plated bright finish and provided with 2 mounting cleats with four 5/16 inch (7.9 mm) by ¾ inch (19 mm) hex head bolts to attach the mounting support to the rail.

3. SUPPORT LEGS
   a. Support Legs: Manufactured and provided by the supplier of primary exhaust removal system (Equipment Manufacturer). Support Leg Material: Aircraft aluminum alloy Type AA-6063 (ASTM B209/B209M). Supports: Standard in 19 feet lengths. A minimum of one support with appropriate bracing shall be provided for every 10 lineal feet(3 m) to 12 linear feet (3.7 m) of rail profile. The support legs shall consist of a square outer profile with dimensions no less than 2 inch (50.8 mm) OD by 0.1 inch (2.54 mm) by with 0.4 inch (10 mm) fastening hardware provided. The vertical adjustable mounting foot shall be capable of attaching the leg assembly to a ceiling with a 30 degree pitch, complete with 3/8 inch (9.5 mm) hardware necessary for mounting the leg assembly to the top suspension mount. The support leg shall be equipped with round tubular zinc-plated steel knee brace with pressed ends in standard lengths of 20 inch (508 mm), 30 inch (762 mm) and 72 inch (1828.8 mm). The angle shall be completely adjustable to the leg support and mounted perpendicular and parallel to direction of the rail. The typical support angle shall be 45 degrees from the centerline of the factory provided support leg. The standard leg shall be capable of meeting a Seismic Zone 4 requirement. Vertical support and bracing shall be provided to safely secure the rail profile in accordance with building code and seismic standards which may apply. A minimum of one support with appropriate bracing shall be provided for every 10 lineal feet (3 m) to 12 linear feet (3.7 m) of rail profile.
4. HYDRAULIC BRAKE SYSTEM – NOT APPLICABLE
5. RAIL SPLICING JOINT
   a. Rail Splicing Joint: The splice joint shall be formed aluminum extrusion equal to the internal diameter of the suction rail profile. The splice shall have a wall thickness of no less than .190 inches (4.8 m) in thickness and a length of no less than 8 inches (203.2 mm) from end to end. The rail splicing shall be safely secured by no less than 12- 3/8 inch 314.3 mm) by 1-½ inch (38.1 mm) bolts, nuts and lock washers. Each bolt shall pass through the exterior of the rail profile and splicing joint and be secured on the inside by a lock washer and nut. Self tapping bolts or screws are not acceptable.
6. MIDDLE RAIL DUCT CONNECTION
   a. Middle Rail Duct Connection: The rail duct connection shall be rectangular to an 8 inch diameter round transition fitting fabricated from 24 gauge galvanized steel (ASTM A653) with a double rubber U style lip seal. The rectangular slot shall be 19 inch (482.6 mm) long by 1-¾ inch (44.5 mm) high with a 3/8 inch (9.5 mm) external flange to slide into the rail profile.
7. TROLLEY ASSEMBLY
   a. Trolley Assembly: Gantry type trolley with sealed bearing loaded wheels designed to roll inside the internal rail profile flange. The trolley chassis shall be galvanized steel (ASTM A653) epoxy coated with a black finish. The chassis shall be fitted with a tapered cone. Rubber Sealing Lips: Vulcanized Teflon strip covering 1-½ inch (38.1 mm) of the bottom edge of the sealing lip which shall minimize resistance between the cone and the rubber sealing lips. The exhaust cone transition shall be a tapered slot design which shall fit inside the suction rail profile. The tapered slot

shall be equal or exceed in area the diameter of exhaust ventilation hose to which it is attached. Trolley Assembly: Equipped with rubber impact bumpers at both the front and rear of the trolley chassis to eliminate metal to metal contact which could damage the trolley assembly. There shall be a system balancer assembly provided to aid in the delivery of the hose to the exit door. Balancer Assembly: Self-adjusting weight spring tension balancer with a lifting capacity of no less than 31 pounds (31 KG). The balancer shall have a minimum diameter steel cable of .080 inch (2 mm) and have a safety link connection.

8. REGULATOR ASSEMBLY
   a. Regulator Assembly: Constructed of cast aluminum. The regulator shall safely operate with an input pressure of 0 psi (0 KG/m2) to 200 psi (140614 KG/m2); the output pressure shall be set at 12 psi (8437 KG/m2). Regulator: Attached to each trolley chassis to allow for independent adjustment of each pneumatic collection nozzle. Regulator: Provided with needle type adjustment gauge that is clearly marked with the proper operating range of system.
9. UNCOUPLING VALVE ASSEMBLY
   a. Uncoupling Valve Assembly: Activate the release of the pneumatic collection nozzle located on vehicle's exhaust pipe. It shall be a whisker type valve that shall provide a single direction action and affixed to a mounting bracket directly onto the trolley chassis. The valve shall be activated when the whisker switch comes in contact with a disconnect plate located on the side of the rail profile. Disconnect Plate: Provide activation of the uncoupling valve switch mounted on the suction trolley chassis. Disconnect Plate: Capable of being mounted anywhere along the outside of the rail in a manner that allows for easy adjustment. One disconnect plate shall be provided for each trolley that is provided to allow for independent adjustment of exit speeds.
10. UPPER FLEXIBLE HOSE
   a. Upper Hose: Flexible exhaust hose manufactured for the sole purpose of venting high temperature exhaust gases. Flexible Hose: Designed strictly for the harsh environment of rapid response and auto-release of a vehicle exhaust tailpipe. Hose: Range from 4 inch (101.6 mm) to 5 inch (127 mm) diameters with length of 25 feet (7.6 m) without joining or splicing connections. Hose Material: High temperature synthetic rubber impregnated into a high temperature laminated fabric with a minimum overlapping thickness of 2-7/16 inches (61.9 mm). This construction of hose must be capable of operating at continuous temperatures of 400 degrees F (204 degrees C) and intermittent temperatures of 500 degrees F (260 degrees C) such as are experienced when pump checks are performed inside the station. Wire Helix: Bound and protected in laminations of hose winding. This shall be accomplished in a fashion, which eliminates any possibility of personnel coming in contact with an exposed hot metal helix. The hose shall further protect the internal wire helix from heat buildup and in turn add increased visibility to personnel. Wear Strip: 9/16 inch (14.28 mm) wide and be provided as a safety yellow color. The bend radius of the high temperature hose shall be no less than 1.5 times the diameter of hose to ensure that hot gases are not restricted as they pass through the system.

11. LOWER HOSE ASSEMBLY
    a. Lower Hose: Rigid 4 inch (101.6 mm) to 5 inch (127 mm) diameter by 2 foot (609.6 mm) long section of yellow and black hose identical in appearance to the upper hose assembly. Lower Hose: Support the pneumatic connection nozzle and chrome reducing elbow in a rigid fashion to allow for the operator to place hose collection nozzle onto the tailpipe without bending over. Lower hose is the only section of hose which shall disconnect from the upper hose assembly and act as a safety disconnect in the unlikely event the nozzle gets entangled.
12. SAFETY DISCONNECT COUPLING
    a. Safety Disconnect Coupling: 4-part segmented coupling with removable wear strips to protect the vehicle and disconnect from wear shall be incorporated in the design of the system. Coupling: Consist of two spun aluminum collars connected by a reusable-segmented coupling band. The release tension of this device shall be preset at 130 pounds and adjustable from 20 pounds to 206 pounds of separating force to accommodate varying exit speeds of vehicles. Coupling: Reusable.
13. COLLECTION NOZZLE ASSEMBLY
    a. Collection Nozzle Assembly: Provide a substantially air tight seal around exhaust tail pipe when connected thus allowing for 100% source capture. The seal shall not allow for escape of life threatening exhaust gases, which may be present during the following conditions:
        i. In the event vehicle's engine is accelerated above normal idle resulting in an exhaust velocity greater than 5000 feet per minute (25.4 meters per second).
        ii. In the event that the output velocity or CFM of the exhaust exceeds the manufacturers normal capture velocity or CFM of exhaust system.
    b. Nozzle:
        i. Automatically adjust its internal orifice to accept any tailpipe ranging from one inch through six-inch (152.4 mm) diameter. Nozzle Pressure: Not exceed 15 psi (10546 KG/m^2). When connected to the vehicle's tailpipe. Nozzle Construction: High temperature synthetic rubber vulcanized to a high temperature synthetic fabric. A NOMEX inner liner shall be provided for the primary temperature source at the tailpipe to act as a friction barrier. The chrome-reducing elbow that connects to the connection nozzle shall be fabricated using continuous welded construction. Angle of Transition: No less than or greater than 67 degrees from the centerline of the reducer. Chrome Reducer: Incorporate a primary expanded metal debris screen, which is permanently affixed by welded seams to the inside opening of exhaust fitting.
14. MANUAL FILL VALVE
    a. Manual Connection Fill Valve: Located 6 inches (152.4 mm) above safety release coupling approximately 4 feet (1219.2 mm) from floor, sliding/push button type for manual or automatic release. In its design this valve shall incorporate in its design a handle which the operator may easily operate in a standing position. The attachment of the collection nozzle shall not position the operator's breathing zone closer than 36 inches (914.4 mm) from the exhaust tailpipe. The automatic release of the

connection valve shall be no greater than 3 psi (2109 KG/m^2) shift pressure to activate the automatic nozzle deflation. Primary Air Supply: Accomplished by means of a compression type fitting. The regulated air supply line to collection nozzle shall be designed to safely release from the upper hose at a pressure no greater than 80 lbs. (362.8 KG)

15. HOUSE SADDLE
    a. Hose Suspension Saddle: Fabricated of a rubber molded cushion specifically manufactured for the sole purpose of suspending high temperature exhaust ventilation hose in a rapid response and auto-release application. The design of the saddle shall smoothly transition the direction of the hose during its travel along the track. Securing clamps shall be provided including a link fastener, for the purpose of mounting it to the balancer safety link.
16. ELECTRICAL CONTROLLERS
    a. Controller:
        i. Built and supplied by a UL recognized and listed exhaust system manufacturer. Controller shall carry the UL - CUL listing label as an "Enclosed Industrial Control Panel." Individual components listed by UL - CUL shall not satisfy the above requirement. Manufacturer shall undergo monthly inspections by UL to verify all requirements and standards are met as outlined by UL. The controller shall be delivered as an Operating System Three series controller or an approved equal to the specifications to follow.
    b. Electrical Controllers:
        i. Bear a visible UL listing label as proof of subscribership and shall be validated by UL www.ul.com/database/ as an "Enclosed Industrial Control Panel". Certification documents shall accompany bid documents.
            1. Manufacturer Name: _____
            2. UL File No.: _____
            3. Electrical controller and manufacturer shall be recognized and listed by UL. Controller shall be manufactured in accordance with Underwriters Laboratories standard UL-508 for "Enclosed Industrial Control Panels". The electrical controller shall include a Class 1 limited energy control circuit. Enclosures shall be NEMA 12 rated and UL listed as Type 12. The electrical control components shall be provided and mounted in an electrical enclosure to restrict access to internal components of the controller by authorized personnel only.
    c. Controller Performance: Designed to sense the output pressure and temperature change inside the ductwork system, which is normally generated by any internal combustion engine designed to propel a motor vehicle. The operating logic shall be designed to complete this cycle. At any point in time when a collection device is connected to a motor vehicle's exhaust tailpipe, as the operator starts the vehicle, the controller shall automatically sense the engine's output pressure or temperature of the exhaust and in turn energize the electrical contactor which will supply power to the AMCA certified spark resistant fan motor. Through the use of an adjustable timer the controller shall keep the contactors energized for up to six minutes in accordance with the stations response requirement.

If the responding vehicle does not disconnect from the exhaust ventilation system in less than the designated setting, the temperature override switch shall override the time delay to ensure continuous system operation. This automated function will work for as long as the exhaust gas temperature is in excess of the setting on the heat sensor located in the ductwork system. This cycle shall not allow the electrical contactor, which energizes the exhaust fan, to short cycle or stop the fan while the system is connected to an operating vehicle.

d. Motor Control Contactor: Allen Bradley Industrial Electrical Contactor 100C series. The contactor shall be UL - CUL listed as an approved component.

e. Motor Control Overload Relay: Allen Bradley 193 ES series. Overload relay shall have an adjustable trip range to meet the proper full load amperage of the blower motor.

f. Soft Touch Controls: Incorporated on the face or the access door of the controller by the use of an adhesive backed Lexan membrane type label to prevent water infiltration, which would void the NEMA 12R rating. Label: Provided and secured permanently to the exterior of the electrical controller. Label: Include the name of the manufacturer, address, telephone number, user instructions and any warnings or cautions required by Underwriters Laboratories.

   i. Auto Start: This mode of operation shall be strictly for normal day to day use, as it would apply to receiving an emergency call and leaving the station. Any one or combination of the three devices listed below in Paragraph H shall activate the system. The system shall maintain itself in the Auto Start mode and always return there after the Stop sequence has been initiated. The controller shall not have a permanent off position due to the potential health hazards of diesel exhaust components.

   ii. Stop: This mode of operation shall be a system override to shut down the system manually. Upon activating this mode of operation the exhaust system blower shall shut down. After a period not to exceed three seconds the controller shall automatically return to the Auto Start ready mode. This shall be a safety feature to prevent a potential health hazard from carcinogenic diesel exhaust leakage from systems having an undesirable open nozzle.

   iii. This mode of operation shall be a system override to run the exhaust system blower continuously for the purpose of running the vehicles indoors for equipment checks during inclement weather. Upon activating this mode of operation the exhaust system blower shall start and run continuously until the Stop mode is activated at which point the system will automatically return to the Auto Start ready mode within a maximum three second time period.

g. System Indicator LED's: Show system status at all times.

   i. Auto Start Indicator: Indicate the system is in the fully automatic mode of operation and that power is on to the controller.

   ii. Fan On Indicator: Indicate that power is being applied to the system blower and the controller is operating normally.

   iii. Filter Status Indicator: Indicate, if flashing, excessive pressure loss across the filter bank media. Consequently the filter must be serviced to maintain optimum efficiency of the system.

iv. Stop Indicator: Indicate the fan has been manually de-energized and will return to the Auto Start ready sequence in less than three seconds to prevent the system blower from being left in the Off mode.

v. Manual Run Indicator: Indicate the fan is operating in a continuous run mode until interrupted by the stop mode activation.

h. Controller Transformer: UL listed industrial control circuit transformer sized to properly supply all components so that only one transformer shall be required. Transformer shall be provided with multi-tap primary for 115, 208, 240, 277, 400, 480, and 600VAC, and 24, 120, 230VAC secondary operating on 50 or 60 hertz with a capacity of 90 volt amperes.

i. Control Circuit Protection: By the use of primary and secondary fuses (NEC code ref. 430-72) to meet UL requirements. The primary shall be protected by a pair of FLQ style fuses rated at 1.6 amps for voltages under 400V and a pair of .75 amp fuses for voltages over 400V. The primary fuse holder shall have a standard indicator light feature to aid in troubleshooting blown fuses. A single glass fuse rated at 3 amps at 250V shall protect the secondary side of the control circuit.

j. Electronic Control Circuit Card: Solid state printed circuit board. The soft controls shall be an integral part of the control circuit card. The control circuit card shall utilize a potentiometer to adjust the length of the timing cycle from 7 to 360 seconds. It shall incorporate several different modes of operation and optional features.

k. Activation Devices:

i. Engine Start Switch: An engine pressure sensing type, capable of recognizing the output pressure of any type of motor vehicle exhaust. The electrical contact shall be dry type or not to exceed 24V ac. There shall be one sensor per vehicle.

ii. Thermal Start Switch: Temperature sensing switch of the snap disc type and adjustable from 90 degrees F (32 degrees C) to 130 degrees F (55 degrees C) to configure the system based on different exhaust temperatures. There shall be one sensor per vehicle.

iii. Remote Control Transmitter and Receiver: Shall be an optional feature with three independent channels of control. The receiver shall operate on 12V to 24 V AC or DC. The handheld transmitter shall be molded out of a highly visible orange composite with a visor clip on the back making it rugged and easy to locate. It shall be powered by a 9 volt battery for ease of replacement and cost savings. Utilizing three sets of normally open and normally closed contacts allows the device to be used to control three separate functions from up to one quarter of a mile away.

1. Channel A: Shall be capable of starting and stopping the exhaust system blower.
2. Channel B: Shall be capable of operating the apparatus bay door upon entering or leaving the fire station, if desired.
3. Channel C: Shall be capable of remotely controlling the traffic signal in front of the fire station, if so equipped.

l. Clean Filter Indicator Alarm: Used in conjunction with the optional Unifilter for filtering diesel exhaust particulate before release to the atmosphere. The clean filter indicator shall monitor the pressure loss across the filter bank media. Once the useful life of the filter has been depleted the pressure differential switch will signal a high-pressure loss and flash the "Fan On" indicator while the exhaust blower is running.

m. Electrical Wiring: Run in wire channel to allow for easier identification of the wiring circuits and for a neat appearance. All wiring circuitry shall meet California Electrical Code and UL standards for proper size, bending radiuses and terminations.

n. Electrical Terminal Block: 600 V, UL rated and recognized. It shall provide individual connection points for remote controls, clean filter indicator and power connections. The primary and secondary control wiring fuses shall be incorporated into the terminal block as one unit.

o. Product Manual: Shall be provided with each electrical control box supplied. The product manual shall include a description of components with part numbers inclusive to the controller. It shall include a wiring schematic showing all internal circuitry as well as all field installed wiring connections to the controller.

p. Electrical Interference: To protect the apparatus and communications, designs that allow any possibility of electrical back-feed or induced current which may interfere with a central services communication or onboard vehicle computer logic or navigational equipment will not be accepted.

17. ELECTRICAL SYSTEM

a. Station Electrical Supply Panel: The power circuit for the "Emergency Response Vehicle Exhaust Removal System" shall originate in a circuit breaker panel board of the appropriate size to handle the load. Fan circuit shall be supplied by a UL listed, HACR rated circuit breaker (HACR rating is specifically for motor type loads) of the same type as indicated by the manufacturer of the circuit breaker panel or a dual element time delay fuse for fuse style panels. The circuit shall be clearly marked on an engraved ledger plate or in ink on the panel schedule as "Emergency Response Vehicle Exhaust Removal System."

b. OS-3 Automatic Controller: Built and supplied by a UL recognized and listed exhaust system manufacturer. Controller shall carry the UL - CUL listing label as an "Enclosed Industrial Control Panel". Individual components listed by UL shall not satisfy the above requirement. Manufacturer must undergo monthly inspections by UL to verify all requirements and standards are met as outlined by UL. The controller shall be delivered as an Operating System Three series controller or an approved equal to the specifications in 2.17 Electrical Controllers. The controller shall be mounted 6 feet (1829 mm)to the top of the cabinet AFF (above finished floor). A safety disconnecting means must be within sight of the controller for servicing and for safety reasons. If the supply panel is not within sight, a separate disconnecting means is required beside the

controller (NEC code ref. 430-102 (a). Safety disconnect shall be capable of being locked in the off and on position to follow lockout, tag out procedures. See attached Table 1-1 for proper Square D part number of safety disconnect switch.

c. Power Wiring Conduit: Minimum of EMT utilizing compression type fittings for damp locations such as apparatus wash down areas (California Electrical Code). Conduit shall be supported with a conduit strap every 10 feet (3 m) and within 3 feet (914.4 mm) of each box or termination, (California Electrical Code and local modifiers).

d. Power Wiring from Supply Panel to OS-3: THHN stranded copper wire consisting of a flame retardant, heat-resistant thermoplastic insulation with a nylon jacket for abrasion, gas, and oil resistance and rated up to 600 volts.

e. Low Voltage Control Wiring: Minimum of a 14/2 multi-conductor shielded cable (Anixter part number #2AS-1401POS or equivalent) to meet UL standards for the controller's low voltage field wiring. Termination procedure shall be as follows; the shielded cable shall be stripped back inside the control cabinet, the mylar foil shield and silver drain wire are to be twisted together and secured under the screw in the grounding lug inside the control cabinet. Terminations at each sensor must leave foil shielding and drain wire intact and at no point shall it come into contact with ground. There shall be only one connection to ground.

f. Low Voltage Control: Encased in a minimum of ½ inch (12.7 mm) EMT from the OS-3 Controller to the attic or building steel where it shall terminate with an EMT connector with a threaded plastic bushing. Conduit: Supported with a conduit strap every 10 feet (3048 mm) and within 3 feet (914.4 mm) of each box or termination (California Electrical Code). The 14/2 multi-conductor shielded cable (Anixter part number #2AS-1401POS or equivalent) shall be supported by the building structure and ran in a manner that the cable will not be damaged by normal building use (California Electrical Code and local modifiers.), securely fastening it with nylon tie wraps every 24 inches (609.6 mm) to 36 inches (914.4 mm). Draping of the cable perpendicular to building steel or support members will be unacceptable.

g. Power Wiring from OS-3 to Fan Motor: Minimum of EMT utilizing compression type fittings for damp locations such as apparatus wash down areas (NEC code ref.348-10). Conduit shall be supported with a conduit strap every 10 feet (3048 mm) and within 3 feet 914.4 mm) of each box or termination (California Electrical Code and local modifiers.). Conduit shall extend through the outside wall through a hole of the proper size and terminate directly into the back of the safety disconnect with the appropriate connector and sealed with a silicon sealer or cement mortar. (Using fan model number select appropriate wire and conduit size from Table 1-1).

h. Fan Safety Disconnect: Square D, non-fusible, NEMA 3R rated for wet locations, mounted adjacent to the AMCA Certified blower. Safety disconnect shall be capable of being locked in the off and on position to follow lockout, tag out procedures. (Using fan model number select appropriate safety disconnect from attached Table 1-1).

i. Liquid Tight Flexible Metal Conduit: UL listed liquid tight flexible metallic conduit (Sealtite). Conduit will encase the load wires and ground wire from the safety disconnect switch to the blower motor. Conduit length not to exceed 4 feet (1219.2 mm) from disconnect to blower motor. The appropriate listed terminal fittings shall be used. (NEC code ref.351-7) (Using fan model select appropriate conduit size from attached Table 1-1).

j. Spark Resistant Blower: AMCA B certified, designed and installed as a direct drive spark resistant blower (IMC code ref. 503.2). The motor shall meet current EPACT standards for energy savings. Fans utilizing steel housings and impellers will not be accepted.

k. Temperature Switch: One for each apparatus connected to the system. The temperature switch shall be of the snap disc type and adjustable from 90 degrees F (32 degrees C) to 130 degrees F (54 degrees C). It shall be mounted on the ductwork 2 inches (50.8 mm) above the pressure switch by drilling a 1 inch (25.4 mm) hole, sealing the switch with silicon sealant and securing with 2 tek screws. Electrical connection shall be made with terminals provided or solder less type such as Thomas & Betts part no. 14RB-2577 or equivalent.

l. Pressure Switch: One for each apparatus connected to the system. The pressure switch shall operate at a maximum of 24VAC, pre-calibrated at .18 in. of water column. Mounting shall be accomplished by drilling a 3/8 inch (9.5 mm) hole 3 inches 76.2 mm) above the riser bracket and to the left of the regulator and threading the switch into the duct. The electrical connections shall be made with a 0.020 inch (.5 mm) by 0.187 inch (4.8 mm) female quick disconnect terminals, such as Thomas & Betts part no. 14RBD-18277 or equivalent.

18. INSTALLATION SIZING GUIDELINE

a. All local, city, state and the National Electric Code must be followed. The chart provided below is calculated for a maximum voltage drop of 3% and is to be used only as a guideline.

INSTALLATION EQUIPMENT SIZING CHART (Table 1-1)											
Single Phase											
Model Number	Rating Manuf.	HP	Voltage	FLA	OS-3 Model Number	Circuit Breaker Size	Wire Size THHN - AWG	Wire Length Feet (meter)		Conduit Size EMT - Inch (mm)	Non-fusible Disconnect Square-D Part No.
67003 (FS-19)	Leeson	3	230 V	16	706036	20 A	#12	0	135 (41 m)	1/2 (12.7)	DU221RB
							#10	135 (41 m)	215 (66 m)		
67006 (FS-14)	Leeson	5	208 V	13	706040	20 A	#10	0	187 (57 m)	1/2 (12.7)	DU321RB
							#8	187 (57 m)	298 (91 m)		
			230 V	12			#10	0	229 (70 m)		
			460 V	6		15 A	#14	0	362 (110 m)		HU321RB

19. AIR MOVING DEVICES

a. Centrifugal Fans: Direct drive centrifugal type, high pressure, single width, single inlet as required or indicated. Impeller Wheels: Backward incline design for high static pressure performance, spark resistance and made of Almag material to prevent static electricity build up. The impeller shall be dynamically and statically balanced and of the non-overloading type to provide maximum efficiency while achieving quiet, vibration-free operation. The fan housing shall be manufactured from steel with a powder coated epoxy finish. The outlet configuration shall be top horizontal, bottom horizontal, or up blast. The housing shall be capable of field reconfiguration in the event the mounting position needs to be changed for unforeseen reasons. The base shall have four (4) pre punched openings at bottom of fan base for field attachment to either an exterior wall or roof mounting structure.

b. Fan Motor and Bearing: All 1 horsepower (746 watts) to 15 horsepower (11190 watts) motors shall be totally enclosed fan cooled (TEFC) continuous duty rated. The motors shall be dual voltage where applicable. Motors built after October 27th, 1997 shall comply with the government mandated "Energy Policy and Conservation Act" (EPACT) as outlined by the Department of Energy. The bearings shall be self-aligned, ball bearing type permanently sealed and lubricated. The exhaust discharge outlet shall be in compliance with California Mechanical Code and ACGIH recommendations (min. of 36" above roofline). Air intakes, windows, cascade systems, prevailing currents, communication equipment and building aesthetics shall be considered in the final location of the fan.

i. Teflon Shaft Seal: The fan shaft shall be steel and rotate in a non-sparking TEFLON seal to prevent leakage and to prevent hot exhaust gases from coming into contact with the motor bearings.

ii. Variable Speed Drive: The motor shall be compatible with a variable speed drive unit.

c. Performance: The delivered volume shall take into account all the static regain of vehicle engine exhaust (based on an airtight connection at the tailpipe), lengths of ductwork, elbows, branches, shut off, wyes, etc. which accumulate the static pressure at the field inlet. The manufacturer's provided fan(s) shall be performance guaranteed.

i. Fan Capacity: The Fan Capacity shall be sized as such as to deliver the required CFM at each hose drop to which the vehicle is attached.

1. The 4 inch (101.6 mm) hose system shall be designed to deliver a minimum of 500 CFM (2.9 M/Second) at a velocity of 5800 FPM (33.6 M/Second) at the hose and nozzle connection.
2. The 5 inch (127 mm) hose system shall be designed to deliver a minimum of 750 CFM (4.4 M/Second) at a velocity of 5800 FPM (33.6 M/Second) at the hose and nozzle connection.
3. The 6 inch (152.4 mm) system shall be designed to deliver a minimum of 1100 CFM (6.4 M/Second) at a velocity of 5800 FPM (33.6 M/Second) at the hose and nozzle connection.

d. Location: The preferable fan location shall be on the outside of the fire station as far away from any living quarters as possible so that firefighters would not be disturbed by the system activation. No blower fans shall be mounted inside the fire station. Silencers shall be provided when fan sound pressure level exceeds 64 dB.

20. DUCTWORK SYSTEM

a. Ductwork Type and Materials: UMC Class 2 or SMACNA Class II product conveying duct, meet or exceed criteria for construction and performance as outlined in Round Industrial Duct Construction Standards, SMACNA. Materials of construction unless otherwise specified for all ductwork and fittings shall be a minimum G-90 galvanized sheet metal (ASTM A653/A653M). Only when specified, Type 304 stainless steel (ASTM A240/A240M) shall be provided.

b. Ductwork Sizing and Gauges: Round pipe construction, with the range of available sizes not to exceed 10 inches (254 mm) in diameter. Duct gauge shall depend on diameter and a minimum operating pressure of 8 inches water gauge (1990 Pa). Acceptable Gauge and Reinforcement Requirements: Inner duct diameter 4 inches (101.6 mm) through 11 inches (279.4 mm) diameter shall be 22 gauge standard pipe (California Mechanical Code).

c. Ductwork Fittings: Round and have a wall thickness 2 gauges (one even gauge number) heavier than the lightest allowable gauge of the downstream sectionof duct to which they are connected (California Mechanical Code). Air Duct Branch Entrances: Factory fabricated fittings or factory fabricated duct /tap assemblies. Fittings: Constructed so that air streams converge at angles no greater than 45 degree (California Mechanical Code). All Seams: Continuous stitch welded and if necessary internally sealed to ensure air tightness. Turning elbows shall be stitch-welded and used for all diameters and pressures. They shall be

fabricated of 24 gauge galvanized steel and constructed as two piece with continuous welded seam construction Tapered Body Fittings: Used wherever particular fallout is anticipated and where air flow is introduced to the transport duct manifold.

d. Ductwork Design Velocities: Minimum of 3500 FPM (20.3 M/Second) to 4000 FPM (23.2 M/Second) transport velocity. Capture Velocity: 5500 FPM (31.9 M/Second) to 6000 FPM (34.8 M/Second) to extract 100 percent of the exhaust gases.

e. External Ductwork: Sized for the exact inlet and outlet of the exhaust fan blower. An exhaust rain cap shall be supplied and manufactured in accordance with EPA standard for free draft rain cap requirements. Included as an integral part of this rain cap shall be a back draft damper to provide protection from rain and other inclement weather.

f. Exhaust Penetrations: The core drilling shall be properly sized to reduce the diameter of the opening to the smallest possible size.

2.3 SLIDING BALANCER TRACK: Fire Stations 14 & 19

A. SBTA-21B: Fire Station 14 and SBTA-31B: Fire Station 19

1. SLIDING TRACK

a. A one-piece continuous extruded aluminum track in a minimum length of 19 feet (5791.2 mm). Profile shall be of a Boxloc type profile, track height 3-1/8 inches (73.4 mm), track width 1-½ inches (38.1 mm), track thickness 1/8 inch (3.175 mm); aircraft aluminum alloy Type AA-6063 (ASTM B209/B209M). Track: Extruded design that shall incorporate three separate and functioning channels. Channels: Incluides the mounting channel, the trolley channel and the Boxloc channel. Mounting Compartment: Designed to accept the slider bars (which shall be provided with factory supplied vertical support legs and riser clamp duct connection) and to allow positioning along the full length of the slotted track-mounting channel. Mounting Channel: Also accommodate the compressed airlines for the purposes of safe storage and appearance. Trolley Channel: Allow the trolley/balancer/ hose assembly to glide to the door threshold in a safe and effective manner. Boxloc Channel: Allow the whole track to remain rigid as it hangs from factory supplied leg supports and also shall provide an area to attach bolts for splicing additional tracks together for systems over 19 feet (5791.2 mm) long. The overall extruded track lengths shall be 19 foot standard and shall weigh no more than 35 pounds (15.88 KG). The track system shall be equipped with end stops that limit travel of flex hose as the vehicle exits the building. The end stop shall be fabricated of zinc plated steel in a U shape form with a rubber end stop on the impact end. It shall be attached by using a ¼ inch (6.35 mm) molded locking bolt. The end stop shall be secured to the track with no less than (2) ¼ inch (6.35-mm) bolts and locking nuts located on the underside of the track. For security, a ¼ inch 6.35 mm) bolt shall be drilled through the ends of each track system to ensure that the trolley/balancer assembly(s) roll no further than the end of the track system.

2. SUPPORT LEGS
   a. Support Legs: Manufactured and provided by the supplier of primary exhaust removal system (Equipment Manufacturer). Support Leg Material: Aircraft aluminum alloy Type AA-6063 (ASTM B209/B209M). Supports: Standard in 19 feet lengths. A minimum of one support with appropriate bracing shall be provided for every 10 lineal feet(3 m) to 12 linear feet (3.7 m) of rail profile. The support legs shall consist of a square outer profile with dimensions no less than 2 inch (50.8 mm) OD by 0.1 inch (2.54 mm) by with 0.4 inch (10 mm) fastening hardware provided. The vertical adjustable mounting foot shall be capable of attaching the leg assembly to a ceiling with a 30 degree pitch, complete with 3/8 inch (9.5 mm) hardware necessary for mounting the leg assembly to the top suspension mount. The support leg shall be equipped with round tubular zinc-plated steel knee brace with pressed ends in standard lengths of 20 inch (508 mm), 30 inch (762 mm) and 72 inch (1828.8 mm). The angle shall be completely adjustable to the leg support and mounted perpendicular and parallel to direction of the rail. The typical support angle shall be 45 degrees from the centerline of the factory provided support leg. The standard leg shall be capable of meeting a Seismic Zone 4 requirement. Vertical support and bracing shall be provided to safely secure the rail profile in accordance with building code and seismic standards which may apply. A minimum of one support with appropriate bracing shall be provided for every 10 lineal feet (3 m) to 12 linear feet (3.7 m)of rail profile. Attach supports to temporary structure I beam with approved sprung instant structure rated hard ware.
3. DOUBLE TRACK JOINER PLATE
   a. Not Applicable
4. TRACK SPLICING ASSEMBLY
   a. Not Applicable
5. RISER CLAMP ASSEMBLY
   a. Riser Clamp: Fabricated as a one piece welded assembly, manufactured to create the transfer of the hard spiral pipe joined at the top and flexible duct connection at the bottom. The riser clamp shall be pre-drilled to mount an air regulator assembly for the pneumatic nozzle and to accept airlines that pass through airtight seals mounted to riser pipe. A slider bar and associated hardware shall be provided with riser clamp assembly. Sizes of the riser clamp will range from 4 inches (101.6 mm) to 5 inches (127 mm) in diameter to match the output velocity of the vehicles that will park in that station.
6. TROLLEY/BALANCER ASSEMBLY
   a. Galvanized steel assembly including bumper stops at each end. Fixed to the side of the trolley are solid steel pins, which shall be for load carrying bearings that are sealed and permanently lubricated. The load carrying bearings shall travel internally in track trolley channel. Two additional permanently lubricated trolley wheels shall be provided on bottom side of the track to reduce wobble of trolley as it conveys the hose assembly to the door threshold. Release Plate: Attached to the chassis of the trolley to smoothly energize the uncoupling release valve when the trolley-balancer assembly approaches the door threshold. System Balancer Assembly: Self-adjusting weight spring tension balancer with a lifting capacity of no less than 31 pounds (14 KG). The balancer shall have a

minimum diameter stainless steel cable of .080 inch (2 mm), safety link connection.

7. REGULATOR ASSEMBLY
   a. Regulator Assembly: Constructed of cast aluminum. The regulator shall safely operate with an input pressure of 0 psi (0 KG/m^2) to 200 psi (140614 KG/m^2); the output pressure shall be set at 12 psi (8437 KG/m^2). Regulator: Attached to each trolley chassis to allow for independent adjustment of each pneumatic collection nozzle. Regulator: Provided with needle type adjustment gauge that is clearly marked with the proper operating range of system and the gauge shall be visibly read from standing on the bay floor.
8. UNCOUPLING VALVE ASSEMBLY
   a. Uncoupling Valve Assembly: Activate the release of the pneumatic collection nozzle located on vehicle's exhaust pipe. It shall be a whisker type valve that shall provide a single direction action and affixed to a mounting bracket directly onto the trolley chassis. The valve shall be activated when the whisker switch comes in contact with a disconnect plate located on the side of the rail profile. Disconnect Plate: Provide activation of the uncoupling valve switch mounted on the suction trolley chassis. Disconnect Plate: Capable of being mounted anywhere along the outside of the rail in a manner that allows for easy adjustment. One disconnect plate shall be provided for each trolley that is provided to allow for independent adjustment of exit speeds.
9. UPPER FLEXIBLE HOSE
   a. Upper Hose: Flexible exhaust hose manufactured for the sole purpose of venting high temperature exhaust gases. Flexible Hose: Designed strictly for the harsh environment of rapid response and auto-release of a vehicle exhaust tailpipe. Hose: Range from 4 inch (101.6 mm) to 5 inch (127 mm) diameters with length of 25 feet (7.6 m) without joining or splicing connections. Hose Material: High temperature synthetic rubber impregnated into a high temperature laminated fabric with a minimum overlapping thickness of 2-7/16 inches (61.9 mm). This construction of hose must be capable of operating at continuous temperatures of 400 degrees F (204 degrees C) and intermittent temperatures of 500 degrees F (260 degrees C) such as are experienced when pump checks are performed inside the station. Wire Helix: Bound and protected in laminations of hose winding. This shall be accomplished in a fashion, which eliminates any possibility of personnel coming in contact with an exposed hot metal helix. The hose shall further protect the internal wire helix from heat buildup and in turn add increased visibility to personnel. Wear Strip: 9/16 inch (14.28 mm) wide and be provided as a safety yellow color. The bend radius of the high temperature hose shall be no less than 1.5 times the diameter of hose to ensure that hot gases are not restricted as they pass through the system.

10. LOWER HOSE ASSEMBLY
    a. Lower Hose: Rigid 4 inch (101.6 mm) to 5 inch (127 mm) diameter by 2 foot (609.6 mm) long section of yellow and black hose identical in appearance to the upper hose assembly. Lower Hose: Support the pneumatic connection nozzle and chrome reducing elbow in a rigid fashion to allow for the operator to place hose collection nozzle onto the tailpipe without bending over. Lower hose is the only section of hose which shall disconnect from the upper hose assembly and act as a safety disconnect in the unlikely event the nozzle gets entangled.
11. SAFETY DISCONNECT COUPLING
    a. Safety Disconnect Coupling: 4-part segmented coupling with removable wear strips to protect the vehicle and disconnect from wear shall be incorporated in the design of the system. Coupling: Consist of two spun aluminum collars connected by a reusable-segmented coupling band. The release tension of this device shall be preset at 130 pounds and adjustable from 20 pounds to 206 pounds of separating force to accommodate varying exit speeds of vehicles. Coupling: Reusable.
12. COLLECTION NOZZLE ASSEMBLY
    a. Collection Nozzle Assembly: Provide a substantially air tight seal around exhaust tail pipe when connected thus allowing for 100% source capture. The seal shall not allow for escape of life threatening exhaust gases, which may be present during the following conditions:
        i. In the event vehicle's engine is accelerated above normal idle resulting in an exhaust velocity greater than 5000 feet per minute (25.4 meters per second).
        ii. In the event that the output velocity or CFM of the exhaust exceeds the manufacturers normal capture velocity or CFM of exhaust system.
    b. Nozzle: Automatically adjust its internal orifice to accept any tailpipe ranging from one inch through six-inch (152.4 mm) diameter. Nozzle Pressure: Not exceed 15 psi (10546 KG/m^2). when connected to the vehicle's tailpipe. Nozzle Construction: High temperature synthetic rubber vulcanized to a high temperature synthetic fabric. A NOMEX inner liner shall be provided for the primary temperature source at the tailpipe to act as a friction barrier. The chrome-reducing elbow that connects to the connection nozzle shall be fabricated using continuous welded construction. Angle of Transition: No less than or greater than 67 degrees from the centerline of the reducer. Chrome Reducer: Incorporate a primary expanded metal debris screen, which is permanently affixed by welded seams to the inside opening of exhaust fitting.
13. MANUAL FILL VALVE
    a. Manual Connection Fill Valve: Located 6 inches (152.4 mm) above safety release coupling approximately 4 feet (1219.2 mm) from floor, sliding/push button type for manual or automatic release. In its design this valve shall incorporate in its design a handle which the operator may easily operate in a standing position. The attachment of the collection nozzle shall not position the operator's breathing zone closer than 36 inches (914.4 mm) from the exhaust tailpipe. The automatic release of the connection valve shall be no greater than 3 psi (2109 KG/m^2) shift pressure to activate the automatic nozzle deflation. Primary Air Supply: Accomplished by means of a compression type fitting. The regulated air

supply line to collection nozzle shall be designed to safely release from the upper hose at a pressure no greater than 80 lbs. (362.8 KG)

14. COMPRESSED AIR FEATURES
    a. Airlines: ¼ inch (6mm) OD tubing capable of exposure of high temperature air stream inside the ventilation hose and duct. Airlines: Fed through the exterior of the hose through Teflon and brass grommets. Airlines: Fed through the exterior of the duct through high temperature rubber grommets to protect against abrasion. Unless a fire station air compressor is to be utilized the bidder shall provide a quiet operating compressor to be located proximate to the vehicle bays. It shall also be located so that preventative maintenance can be performed quickly and effectively. The operation of the compressor running inside station shall not generate sound decibels in excess of 50 dB. The compressor shall be equipped with a filter/dryer to ensure the conveyance of clean dry air to the pneumatic controls incorporated in the auto-release ventilation system.
15. HOSE SADDLE
    a. Hose Suspension Saddle: Fabricated of a rubber molded cushion specifically manufactured for the sole purpose of suspending high temperature exhaust ventilation hose in a rapid response and auto-release application. The design of the saddle shall smoothly transition the direction of the hose during its travel along the track. Securing clamps shall be provided including a link fastener, for the purpose of mounting it to the balancer safety link.
16. ELECTRICAL CONTROLLERS
    a. REFER TO STRAIL RAIL, 2.2 A. 16
17. ELECTRICAL SYSTEM
    a. REFER TO STRAIL RAIL, 2.2 A. 17
18. AIR MOVING DEVICES
    a. REFER TO STRAIL RAIL, 2.2 A. 19
19. DUCTWORK SYSTEM
    a. REFER TO STRAIL RAIL, 2.2 A. 20

2.4 VERTICAL STACK RAIL: Fire Stations 14

A. VSR-60
1. RAIL MATERIAL
    a. Rail Material: One-piece continuous extruded aluminum rail in a minimum length of 19 feet (580 mm). Construction Profile: Rectangular profile, rail height of 10 inches (254 mm) including the rubber seals, rail thickness of 0.20 inch (5 mm), width of 8-½ inches (216 mm) id. Bottom Portion of Rail: Continuous slots to accept a rubber seal. Rubber Seals: Fitted into each side of the rail and shall join in the middle. Rail Material: Aircraft aluminum alloy Type AA-6063 (ASTM B209/B209M). Rail: Extruded as a one piece design unit to maximize the structural integrity of the rail and to minimize joints which may add to possible leakage of dangerous exhaust gases.
2. TRAPEZE MOUNTING SUPPORT
    a. Trapeze Mounting Support: Supplied by the manufacturer to ensure the integrity of the installation. A minimum of one trapeze support with appropriate bracing shall be provided for every 10 linear feet (3048 mm)

to 12 lineal feet (3658 mm) of rail profile. Trapeze Mounting Support: Free floating side to side track assembly and have a minimum travel of 18 inches (457 mm) from the natural rest position center line from the exhaust stack. The range of travel shall be set by 2 end stops with rubber bumpers. This shall be accomplished by the use of a Boxloc track provided with ball bearing trolleys secured to the rail by safety links. The Boxloc track shall be suspended from the ceiling by the use of a support leg assembly. Support Leg Material: Aircraft aluminum alloy Type AA-6063 (ASTM B209/B209M). Supports shall come standard in 19-foot (579-mm) lengths. The support legs shall consist of a square tubular profile with dimensions no less than 2 inch (50.8 mm) OD by 0.1 inch (2.54 mm) with 0.4 inch (10mm) fastening hardware provided. Vertical Adjustable Mounting Foot: Capable of attaching the leg assembly to a ceiling with a 30 degree pitch, complete with a slider bar and 3/8 inch (9.5 mm) hardware necessary for attaching the leg assembly to the mounting channel of the Boxloc track. Support Leg: Equipped with a round tubular zinc-plated steel knee brace with pressed ends in standard lengths of 20 inches (508 mm), 30 inches (762 mm) and 72 inches (1829 mm). Angle: Completely adjustable to the leg support and mounted perpendicular and parallel to the direction of the track. Typical Support Angle: 45 degrees from the centerline of the factory provided support leg. Rail: Provided with safety cables as a secondary safety device.

3. RAIL SPLICING JOINT
   a. Rail Splicing Joint: Formed steel fitting equal to the internal diameter of the suction rail profile. The splice shall have a wall thickness of no less than 0.190 inch (4.8 mm) in thickness and a length of no less than 8 inches (203.2 mm) from end to end. Rail Splicing: Safely secured by no less than 16-3/8 inches (416 mm) x 1-½ inch (38.1 mm) bolts, nuts and lock washers. Each bolt shall pass through the exterior of the rail profile and splicing joint and shall be secured on the inside by a lock washer and nut.
4. FLEXIBLE DUCT CONNECTION
   a. Flexible Duct Connection: With one end formed to fit a six-inch diameter flexible duct pipe located on the topside of the rail. Included with this fitting shall be a flexible hose manufactured of 600 degree Teflon construction with an overall length of five feet. The rail duct connection shall be a 6 inch (152.4 mm) diameter round transition fitting fabricated from 20 gauge galvanized steel (ASTM A653/A653M).
5. VERTICAL STACK ADAPTER
   a. Vertical Stack Adapter: Zinc plated steel specially designed to be accepted into the exhaust extraction rail. The outlet dimension of the vertical stack adapter must equal the outlet dimension of the stack exhaust system provided on the apparatus. Adapter: Secured to the exhaust stack by means of a female pipe connection with 2- 0.3 inch (8mm) hex head bolts utilized as "jack bolts".
6. ELECTRICAL CONTROLLERS
   a. REFER TO STRAIL RAIL, 2.2 A. 16
7. ELECTRICAL SYSTEM
   a. REFER TO STRAIL RAIL, 2.2 A. 17

8. AIR MOVING DEVICES
   a. REFER TO STRAIL RAIL, 2.2 A. 19
9. DUCTWORK SYSTEM
   a. REFER TO STRAIL RAIL, 2.2 A. 20

PART 3 EXECUTION: Fire Stations 14 & 19

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, service-utility connections, and other conditions affecting installation and performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide surface/substrate preparation as required by the manufacturer's printed installation instructions. Do not proceed with installation is in proper condition to receive vehicle exhaust installation.

3.3 INSTALLATION

A. Install vehicle exhaust system in accord with manufacturer's written instructions, original design and referenced standards.

3.4 ADJUSTING

A. Adjust vehicle exhaust system for proper operation. Replace any parts that prevent the system from operating properly.

3.5 CLEANING

A. Remove all debris caused by installation of the vehicle exhaust system. Clean all exposed surfaces to as fabricated condition and appearance.

3.6 PROTECTION

A. Provide protection of the completed installation until completion of the project. Repair any damage at no additional cost to Owner.

3.7 DEMONSTRATION

A. Provide the end user a minimum of one hour of hands-on demonstration and operation of the vehicle exhaust system and related equipment.

3.8 WARRANTY

A. Provide a written warrantee for a period of one year from date of shipment for all components.

3.9 TRAINING

A. Provide training to fire department personnel in the daily use and maintenance of the vehicle exhaust removal system that has been installed and specified herein. The fire department shall be notified at least 7 days prior to the date scheduled for the training course. Training shall be for all personnel involved with the operation of the exhaust removal system to include all shifts required to man the particular facility. The Training session shall be performed in person by a recognized representative of the manufacturer of the exhaust removal system, in addition a training video shall be provided to the fire department. Provide training to all shifts during their normal shift period.

END OF SECTION 23 0500

SECTION 23 7333 - HEATING, VENTILATING, AND COOLING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. Air Movement and Control Association International (AMCA)
   a. AMCA 210: (2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
   b. AMCA 500-D: (1998) Laboratory Methods of Testing Dampers for Rating
   c. AMCA 511: (1999; R 2004) Certified Ratings Program for Air Control Devices
2. Air-Conditioning, Heating and Refrigeration Institute (AHRI)
   a. AHRI 210/240: (2008) Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment
   b. AHRI 310/380: (2004) Standard for Packaged Terminal Air-Conditioners and Heat Pumps
   c. AHRI 340/360: (2004) Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
   d. AHRI 365: (2002) Commercial and Industrial Unitary Air-Conditioning Condensing Units
   e. AHRI 410: (2001; Addendum 2002) Standard for Forced-Circulation Air-Cooling and Air-Heating Coils
   f. AHRI 430: (1999) Standard for Central-Station Air-Handling Units
   g. AHRI 440: (2008) Standard for Room Fan-Coils and Unit Ventilators
   h. AHRI 550/590: (2003) Standard for Water-Chilling Packages Using the Vapor Compression Cycle
   i. AHRI 710: (2004) Standard for Performance Rating of Liquid-Line Driers
   j. AHRI 880 (2008) Standard for Air Terminals
   k. AHRI DCAACP (Online) Directory of Certified Applied Air-Conditioning Products
   l. AHRI DCUP: (Online) Directory of Certified Unitary Products
3. American Society Of Heating, Refrigerating And Air-Conditioning Engineers (ASHRAE)
   a. ASHRAE 15 & 34: (2007; Std 15 Errata 2007, 2009, & Addenda a-e; Std 34 Errata 2007, 2008, Addenda a-y, aa-ae) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants
   b. ASHRAE 90.1 – IP: (2007; Supplement 2008; Errata 2009; Errata 2009) Energy Standard for Buildings Except Low-Rise Residential Buildings, I-P Edition

4. American Society Of Sanitary Engineering (ASSE)
   a. ASSE 1003: (2001; Errata, 2003) Performance Requirements for Water Pressure Reducing Valves
5. ASME INTERNATIONAL (ASME)
   a. ASME B16.11: (2009) Forged Fittings, Socket-Welding and Threaded
   b. ASME B16.18: (2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings
   c. ASME B16.22: (2001; R 2005) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
   d. ASME B16.23: (2002; Errata 2003; R 2006) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
   e. ASME B16.26: (2006) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
   f. ASME B16.3: (2006) Malleable Iron Threaded Fittings, Classes 150 and 300
   g. ASME B16.34: (2009) Valves - Flanged, Threaded and Welding End
   h. ASME B16.39: (2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
   i. ASME B16.5: (2009) Standard for Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24
   j. ASME B16.9: (2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
   k. ASME B31.5: (2006) Refrigeration Piping and Heat Transfer Components
   l. ASME B31.9: (2008) Building Services Piping
   m. ASME BPVC: (2007) Boiler and Pressure Vessel Codes
6. Association Of Home Appliance Manufacturers (AHAM)
   a. AHAM RAC-1: (2005) Directory of Certified Room Air Conditioners
7. ASTM International (ASTM)
   a. ASTM A 106/A 106M: (2008) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
   b. ASTM A 167: (1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
   c. ASTM A 193/A 193M: (2009) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
   d. ASTM A 194/A 194M: (2009) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
   e. ASTM A 53/A 53M: (2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   f. ASTM A 653/A 653M: (2009) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   g. ASTM B 117: (2009) Standing Practice for Operating Salt Spray (Fog) Apparatus

h. ASTM B 280: (2008) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
i. ASTM B 306: (2009) Standard Specification for Copper Drainage Tube (DWV)
j. ASTM B 32: (2008) Standard Specification for Solder Metal
k. ASTM B 42: (2002e1) Standard Specification for Seamless Copper Pipe, Standard Sizes
l. ASTM B 88: (2003) Standard Specification for Seamless Copper Water Tube
m. ASTM B 88M: (2005) Standard Specification for Seamless Copper Water Tube (Metric)
n. ASTM C 1071: (2005e1) Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
o. ASTM F 441/F 441M: (2009) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

8. CSA America, Inc. (CSA/AM)
   a. CSA/AM Z21.22: (1999; Addenda A 2000, Addenda B 2001; R 2004) Relief Valves for Hot Water Supply Systems
9. ETL Testing Laboratories (ETL)
   a. ETL DLP: (updated continuously) Directory of ETL Listed Products
10. Foundation for Cross-Connection Control and Hydraulic Research (FCCCHR)
   a. FCCCHR List: (continuously updated) List of Approved Backflow Prevention Assemblies
11. Manufacturers Standardization Society Of The Valve and Fittings Industry (MSS)
   a. MSS SP-58: (2002) Standard for Pipe Hangers and Supports - Materials, Design and Manufacture
   b. MSS SP-67: (2002a; R 2004) Standard for Butterfly Valves
   c. MSS SP-69: (2003; R 2004) Standard for Pipe Hangers and Supports - Selection and Application
   d. MSS SP-70: (2006) Standard for Cast Iron Gate Valves, Flanged and Threaded Ends
   e. MSS SP-71: (2005) Standard for Gray Iron Swing Check Valves, Flanged and Threaded Ends
   f. MSS SP-80: (2008) Bronze Gate,Globe, Angle and Check Valve
   g. MSS SP-85: (2002) Standard for Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
12. National Electrical Manufacturers Association (NEMA)
   a. NEMA ICS 6: (1993; R 2006) Standard for Industrial Controls and Systems Enclosures
13. National Fire Protection Association (NFPA)
   a. NFPA 31: (2006; Errata 2006; Errata 2007) Installation of Oil Burning Equipment
   b. NFPA 70: (2008; AMD 1 2008) National Electrical Code - 2008 Edition

c. NFPA 90A: (2008; Errata 2009) Standard for the Installation of Air Conditioning and Ventilating Systems

d. NFPA 96: (2007) Ventilation Control and Fire Protection of Commercial Cooking Operations

14. National Roofing Contractors Association (NRCA)

a. NRCA RWM: (2003) Roofing and Waterproofing Manual

15. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

a. SMACNA 1143: (1985) HVAC Air Duct Leakage Test Manual

b. SMACNA 1780: (2002; 3rd Ed) HVAC Systems - Testing, Adjusting and Balancing

c. SMACNA 1966: (2005) HVAC Duct Construction Standards Metal and Flexible

16. U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

a. Energy Star: (1992; R 2006) Energy Star Energy Efficiency Labeling System

17. UNDERWRITERS LABORATORIES (UL)

a. UL 1316: (1994; Rev May 2006) Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures

b. UL 142: (2006; Rev thru Dec 2007) Steel Aboveground Tanks for Flammable and Combustible Liquids

c. UL 181: (2005; Rev thru Oct 2008) Standard for Factory-Made Air Ducts and Air Connectors

d. UL 296: (2003; Rev thru Aug 2009) Oil Burners

e. UL 507: (1999; Rev thru Apr 2007) Electric Fans

f. UL 555: (2006; Rev thru Feb 2009) Standard for Fire Dampers

g. UL 726: (1995; Rev thru Aug 2009) Oil-Fired Boiler Assemblies

h. UL Bld Mat Dir: (2009) Building Materials Directory

i. UL Elec Equip Dir: (2009) Electrical Appliance and Utilization Equipment Directory

18. The City of San Diego Facilities DIVISION Construction Standards and Specification Guideline.

a. 2015: Edition

1.2 SYSTEM DESCRIPTION

A. Provide new heating, ventilating, and cooling (HVAC) systems complete and ready for operation. HVAC systems include equipment, ducts, and piping which is located within, on, under, and adjacent to buildings.

1.3 SUBMITTALS

A. Product Data

1. Product data for integral or appurtenant space temperature controls (STC) supplied with the listed equipment shall include point-to-point electrical wiring diagrams for each STC.
   a. Packaged air-conditioners
   b. Split-system heat pumps
   c. Packaged air-handling units
   d. Air-cooled condensing units
   e. Room fan-coil air-conditioners
   f. Room air-conditioners
   g. Packaged terminal air-conditioners
   h. Packaged terminal heat pumps
   i. Exhaust fans
   j. Sound-Attenuator Ducts
   k. Diffusers, registers, and grilles
   l. Fire dampers
   m. Dielectric Connections

B. Test Reports

1. Packaged air-conditioners - field acceptance test plan;
2. Split-system air-conditioners - field acceptance test plan:
3. Split-system heat pumps - field acceptance test plan
4. Packaged air-handling units - field acceptance test plan;
5. Multi-zone air-handling units - field acceptance test plan;
6. Variable volume terminals (VVT) - field acceptance test plan;
7. Air-cooled condensing units - field acceptance test plan;
8. Packaged air-conditioners - field acceptance test report;
9. Split-system air-conditioners - field acceptance test report:
10. Split-system heat pumps - field acceptance test report;
11. Packaged air-handling units - field acceptance test report;
12. Multi-zone air-handling units - field acceptance test report;
13. Variable volume terminals (VVT) - field acceptance test report;
14. Air-cooled condensing units - field acceptance test report;

C. Certificates

1. Employer's record documents

D. Manufacturer's Instructions

1. Packaged air-conditioners - installation instructions
2. Split-system heat pumps - installation instructions
3. Packaged air-handling units - installation instructions
4. Air-cooled condensing units - installation instructions
5. Room fan-coil air-conditioners - installation instructions
6. Packaged terminal air-conditioners - installation instructions

7. Series motor powered air volume control (VVT) terminals - installation instructions; submit with respective air-handling unit.
8. Exhaust fans - installation instructions
9. Fire dampers - installation instructions

E. Operation and Maintenance Data
1. Packaged air-conditioners
2. Split-system air-conditioners
3. Split-system heat pumps
4. Packaged air-handling units
5. Air-cooled condensing units
6. Room fan-coil air-conditioners
7. Packaged terminal air-conditioners
8. Series motor powered variable air volume terminals (VVT) Submit with respective air-handling unit.
9. Fire dampers

PART 2 PRODUCTS

2.1 Provide HVAC system including equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.5, ASME B31.9,and NFPA 70, as modified and supplemented by the contract specifications and drawings.

A. EQUIPMENT
1. Equipment using refrigerants R-11, R-12, R-113, R-114, R-115, R-500, or refrigerants with ozone depletion factor (ODF) greater than 0.05 shall not be permitted.
a. Split-System High Wall Heat Pumps
i. Provide units factory assembled, designed, tested, and rated in accordance with AHRI 210/240 or AHRI 340/360 and be Energy Star rated and labeled. Minimum efficiencies SEER(cooling) and HSPF(heating) shall be as required in ASHRAE 90.1 - IP. Units shall be AHRI certified or rated in AHRI DCUP in lieu of listing in the AHRI Directory. Outside unit shall include compressor and condenser. Units shall include casing, centrifugal fan and motor, primary VAV damper or valve, solid state speed controller or discharge air damper, primary air inlet cone with high and low pressure flow sensors, recirculating air filter frames, filter, and electrical disconnect.
1. Filter section: Provide with factory supplied cleanable filters.
2. Safety controls: Provide low refrigerant pressure protection and pressure relief device. Provide compressor motor with thermal and overload protection, 5 minute anti-recycle

timer, and start capacitor kit. Provide compressor with electrical crankcase heater and internal high pressure protection. The above safety controls are not required when scroll compressors are provided.

3. Space temperature controls: Provide micro-processor based control system with wireless infrared remote controls.
4. Air Coils: Extended-surface fin and tube type with seamless copper or aluminum tubes with copper or aluminum fins securely bonded to the tubes. On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy7072 or 5052. Provide a coating on outdoor air coils as specified in the paragraph entitled, "Coatings for Finned Tube Coils. "Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins."
5. Compressors: Compressor shall be fully hermetic veriable speed rotary type. Compressor shall be installed on rubber vibration isolators.
6. Special corrosion protection: Comply with requirements specified in paragraph "Corrosion Protection For Coastal Installations"

b. Packaged Air-Handling Units

i. Provide units factory assembled, designed, tested, and rated in accordance with AHRI 430. Units shall be AHRI certified for cooling. Provide heating and cooling units including direct expansion refrigerant coils with expansion devices and solenoid valves. Unit shall include fan section coil section face and bypass damper section, filter section and access panels. Insulate interior of casing with manufacturer's standard insulation. Provide nylon bushings for dampers.

1. Fan section: Provide draw-through fan SECTION including motor, starter, and drives. Provide adjustable sheaves to permit fan capacity variation from 5 percent above to 5 percent below rated capacity.
2. Coil section: Provide AHRI 410 coils and slope for drainage. Provide insulated drain pans under cooling coils and valves.
3. Filter section: Provide UL listed, 1 inch thick 30 percent efficient throwaway fiberglass filters, standard dust-holding capacity.

4. Weatherproof casing: Provide removable gasketed panels designed to exclude driving rain for access to fans, coils, filters, compressors, motors, and controls. Provide weatherproof outside air intake louvers or weatherproof hoods.
5. Roof curbs: Provide factory-fabricated galvanized steel roof curbs, wood nailers, insulation, and seal strips in accordance with NRCA RWM curb details for rooftop air-handling units. Roof curbs shall be furnished by unit manufacturer.
6. Special corrosion protection: Comply with requirements specified in paragraph "Corrosion Protection For Coastal Installations".

c. Exhaust Fans

i. Centrifugal Exhaust Fans

1. AMCA 210 with AMCA seal. Provide centrifugal type exhaust fans with aluminum housing, fan wheel, and bird screen. Motors shall be completely shielded from the airstream. Provide exhaust opening and gravity closing type automatic backdraft dampers. Provide roof curb for roof mounted exhaust fans as recommended by fan manufacturer. Provide with disconnect and speed controller. Provide v-belt and direct drive exhaust fans as indicated on drawings.

ii. In-Line Centrifugal Fans

1. AMCA 210 with AMCA seal. Provide welded steel casings, centrifugal backward inclined blades, adjustable motor mounts direct drive. Inlet and outlet connections for fan casings to ductwork and equipment casings, may be of the slip fit or flanged type. Provide guards for discharges. Rate fans with guards in place. Air shall enter and leave the fan axially. Inlet shall be streamlined and conversion vanes shall eliminate turbulence and provide smooth discharge airflow. Enclose fan bearings and drive shafts, and isolate from the airstream. Fan bearings shall be mechanically sealed against dust and dirt and shall be self-aligning, pillow block ball or roller type. Motor and drive shall be provided by fan manufacturer. Provide with disconnect, speed controller, backdraft damper, and vibration isolated hanging rod and hardware.

iii. Utility Set(s)

1. AMCA 210 with AMCA seal. Provide single width, single inlet blower with backward inclined, non-overloading centrifugal wheel constructed of heavy gage steel. The housing shall be of heavy gage steel with airtight lock

seam construction. Provide a weatherhood to protect the motor and drive. Provide direct drive exhaust fans as indicated. Provide with disconnect, vibration isolators, and backdraft damper.

iv. Bathroom Exhaust Fans

1. UL 507 and UL listed for ceiling installation, HVI (Home Ventilating Institute) certified, with AMCA seal.

v. Range Hoods

1. UL 507 and UL listed, with AMCA seal, separately switched two-speed exhaust fan and lights. Fan capacity shall be 160 cfm with maximum sound level of 5.6 sones. Provide 30 inch stainless steel range hood with easily removable washable metal filter and zinc-coated steel ducts to exterior of building with weatherproof grille.

d. Corrosion Protection For Coastal Installations

i. Provide manufacturer anti-corrosion system. Corrosion system shall be a paint finish system that shall be capable of withstanding at least 3000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117 test procedure.

e. Electrical

i. Electrical Motors, Controllers, Contactors, and Disconnects

1. Furnish with respective pieces of equipment. Provide electrical connections. Provide controllers and contactors with maximum of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section

f. Metal Duct Systems

i. Provide shop-fabricated ductwork. Fabricate, construct, brace, reinforce, install, support, and seal ducts and accessories in accordance with SMACNA 1966. Provide rectangular ductwork for low pressure applications; round and flat oval ductwork for medium and high pressure applications as indicated. Cover duct transverse joints with single component synthetic rubber type compound suitable for use with passivated coating on zinc-coated steel. Lap joints in direction of flow. Provide ducts straight and smooth on inside with neatly finished airtight joints. Provide air supply and return openings in ducts with air diffusers, registers, or grilles.

g. Ducts of Pressure Classes 3 to 10 Inch WG

i. Construct ducts of zinc-coated steel conforming to ASTM A 653/A 653M coating designation G90.

ii. Duct construction, metal gages, and hangers and support reinforcements shall conform with the SMACNA 1966. Ducts shall not pulsate or vibrate when in operation. Pressure sensitive tape shall not be used as a primary sealant on ductwork. Duct air leakage shall be less than that allowed by SMACNA 1143 for the duct pressure class, duct seal class, and duct leakage class indicated. Curved elbows shall have a centerline radius not less than 1 1/2 times the width of ducts.

iii. Joints

1. Construct joints to meet the requirements of the leakage test specified herein. Duct components shall fit so that joints are not mismatched. Do not use duct sealant and tape to compensate for mismatched connections. Longitudinal locks or seams known as "button-punch snap-lock" will not be permitted. Apply fire-resistant sealing compound to exposed male part of fittings collars so that sealer will be on inside of joint and fully protected by the metal of the duct and fittings. Apply one brush coat of sealing compound over outside of joint to at least 2 inch band width covering screw heads and joint gap. When tape is used, apply a single wrap of a duct tape over the wet sealer. Tape provided shall be recommended by the sealer manufacturer to permit proper curing of the sealer. Dents in the male portion of the slip fitting collar will not be acceptable.

iv. Fittings

1. Square elbows, round elbows, fittings, branch take-offs, transitions, splitters, duct volume dampers, fire dampers, flexible connections, and access doors shall conform with the SMACNA 1966, SECTION 2.
2. Test holes: Provide factory fabricated, airtight, and noncorrosive test holes with screw cap and gasket. Provide extended neck fittings to clear insulation.
3. Round elbows: Provide 45 degree and 90 degree round elbows of two piece die stamped construction for ducts 8 inches or less in diameter. For ducts over 8 inches in diameter, provide 5 mitered piece for 90 degrees and 3 mitered piece for 45 degrees.

v. Round and Oval Ducts

1. SMACNA 1966, SECTION 3.

vi. Rectangular Ducts

1. Make joints between sections of duct and between ducts and fittings with either gasketed flanged connection, welded flange joints, or other joints recommended in SMACNA 1966, SECTION 1, and reinforce at the joints and between the joints as recommended.

vii. Sound Attenuators

1. Provide factory fabricated attenuators that will reduce the rated sound pressure level of the fan down to at least 65 decibels in the 250 Hz (third octave band) center frequency by using a reference sound source calibrated in decibels of sound power at 10 to 12 watts. Maximum permissible pressure drop shall not exceed 0.63 inch of water. Attenuators to be constructed airtight when operating under an internal pressure of 10 inches of water. The air-side surface shall be capable of withstanding air velocity of 10,000 feet per minute. When attenuators are submitted for approval, provide manufacturer's product data verifying the net sound reduction values. Sound absorbing material shall conform with ASTM C 1071, Type I or II. Provide suitable duct-transition sections for connections to ductwork.

2. Net sound reduction values: Conform with the following:

Minimum Net Sound Reduction Values
Sound Pressure Level dB
(Reference Sound Power at 10-12 Watts)

Octave	Pass Band		2	3	4	5	6	7
Center	Frequency	(Hz)	125	250	500	1000	2000	4000
Noises	Reduction	(db)	11	16	19	30	40	32

3. Factory-fabricated sound attenuators (traps): Provide sound attenuators constructed of galvanized sheet steel casing and sound absorbing material covered with an internal perforated zinc-coated metal liner. Sound absorbing materials shall be faced with glass fiber cloth and hold in compression to prevent settling. The internal perforated metal liner shall be not less than 24 gage, with perforations met larger than 5/32 inch in diameter providing a net open area not less than 22 percent of the surface. Attenuators shall be insulated to prevent sweating.

4. Factory-fabricated sound-attenuator ducts: Sound-attenuator ducts may be provided in lieu of sound attenuators (traps). Comply with requirements specified herein for sound attenuators. Construct each double-walled duct and fitting of an outer zinc-coated metal pressure shell with one inch thick acoustical blanket insulation and an internal perforated zinc-coated metal liner. Install sufficient length of run to obtain the noise reduction value specified. Provide product data from manufacturer verifying that the sound reduction value specified will be obtained within the length of duct run provided. Noise reduction data shall include effects of flanking paths and vibration transmission. The internal perforated zinc-coated metal liner shall be not less than 24 gage, unless ribbed, not less than 28 gage for the duct liner and not less than 26 gage for the fitting liner with perforations not larger than 3/32 inch diameter. Seal joints as specified in paragraph entitled "Round and Oval Ducts." Rigid molded fiber-glass inserts with the air side surface neoprene-coated, when complying with requirements specified herein, may be used in lieu of internal preformed zinc-coated metal liner.

h. Ducts of Pressure Classes Less than 3 Inch WG

i. Construction, metal gage, hangers and supports, and reinforcements shall conform with SMACNA 1966, except that ducts with pressure classifications below 2 inch water gage that are located outside of the conditioned space shall have a seal Class C. Ductwork shall be airtight and shall not vibrate or pulsate when system is in operation. Pressure sensitive tape shall not be used as a primary sealant on ductwork with pressure classifications above one inch water gage. Duct air leakage shall be less than that allowed by SMACNA 1143 for the duct pressure class, duct seal class, and duct leakage class indicated. Construct ductwork of zinc-coated steel conforming to ASTM A 653/A 653M coating designation G90. Exhaust ductwork exhausting non-residential kitchens shall be constructed of ASTM A 167 stainless steel with welded seams and joints except the flanged connection to the exhaust fan.

ii. Curved Elbows

1. Make a centerline radius not less than 1 1/2 times the width or diameter of the duct.

iii. Laps

1. Make laps at joints in the direction of airflow. Space button-punch or bolt-connection in standing seams at fixed centers not greater than 6 inches. Longitudinal locks or

seams, knows as "button-punch snap lock," may be in lieu of Pittsburgh Lock.

iv. Fittings

1. Elbows, vaned elbows, take-offs, branch connections, transitions, splitters, volume dampers, fire dampers, flexible connections, and access doors shall conform with SMACNA 1966, SECTION 2. Provide factory fabricated, airtight, and noncorrosive test holes with screw cap and gasket.

v. Acoustical Duct Lining

1. Provide where indicated. Provide ASTM C 1071 fiberglass duct lining, minimum of one inch thick, with black-pigmented fire-resistant coating on side exposed to airstream. Secure to duct interior with 100 percent coverage of adhesive and with mechanical fastening devices, spaced in accordance with SMACNA 1966. Provide metal nosing at duct lining beginnings and endings.

vi. Preformed Duct Liner

1. Provide preformed round duct liner minimum of one inch thick, with black-pigmented fire-resistant, anti-microbial agent designed for insertion in round ducts may be used in the sizes commercially available. Provide duct liner sections with slip-lap joints not less than 2 inches wide. Make joints in accordance with manufacturer's printed instructions. Furnish fire-resistant adhesive to field-coated joints when recommended by the manufacturer to prevent delamination or erosion at joints. Tabular sections of duct liner shall fit the metal duct snugly and without gaps between duct-liner section.

vii. Factory-Fabricated Sound-Attenuator Ducts

1. Provide double-walled duct and fitting of an outer zinc-coated metal pressure shell with one inch thick acoustical blanket insulation and an internal perforated zinc-coated metal liner. Install sufficient length of run to obtain the noise reduction value specified. Submit product data from manufacturer verifying that the net sound reduction values specified will be obtained within the length of duct run provided. The internal perforated zinc-coated metal-liner shall be not less than 24 gage, unless ribbed, then not less than 28 gage for the duct liner and not less than 26 gage for the fitting liner with perforations not larger than 3/32 inch diameter. Seal joints as specified in paragraph entitled "Round and Oval Ducts." Rigid molded fiberglass inserts with the air-side surface neoprene-coated, if complying

with requirements specified herein, may be used in lieu of internal perforated zinc-coated metal liner. Each sound attenuator duct system shall comply with the following requirements:

Minimum Net Sound Reduction Values
Sound Pressure Level dB
(Reference Sound Power at 10-12 Watts)

Octave	Pass Band	2	3	4	5	6	7
Center	Frequency	(Hz) 125	250	500	1000	2000	4000
Noises	Reduction	(db) 11	16	19	30	40	32

i. Flexible Duct Connectors
   i. Provide a minimum of design pressure rated plus 0.5 inch W.G. static pressure airtight flexible duct connectors at duct connections to each air-conditioning unit, air-handling unit, exhaust fan, and ventilating fan. Support connectors at each end with metal angle frame bands, securely bolt in place. Provide not less than 20 ounce glass fabric duct connectors coated on both sides with neoprene.

j. Turning Vanes
   i. Provide fabricated tees and square elbows with double walled turning vanes in accordance with SMACNA 1966 for vaned elbows.

k. Dampers
   i. Provide factory manufactured opposed blade adjustable manual dampers where indicated for duct heights of 12 inches and larger. Provide factory manufactured single leaf dampers for duct heights less than 12 inches. Provide damper shafts with 2 inch standoffs to clear 2 inches of duct insulation with bearings at both ends of the shafts. Provide adjustment quadrant with indicator and locking devices. Provide galvanized steel dampers one gage heavier than duct in which dampers are installed.

l. Diffusers, Registers, and Grilles
   i. Provide factory-fabricated metal units with edges rolled or rounded where exposed to view, and factory primed with white enamel finish. Do not provide dampers in or on diffusers, registers and grilles. Provide each unit with rubber or plastic installation gaskets. Diffusers in same room shall have same face design.
      1. Diffusers: Provide round, square, or rectangular diffusers as indicated. Ceiling diffusers shall be designed to deliver

air in a horizontal direction. Provide baffles or other devices as required for proper air distribution pattern.

2. Registers: Provide double deflection supply registers arranged to control air direction, throw, and drop. Exhaust and return air registers shall have single set of nondirectional face bars or vanes having the same appearance as supply registers. Provide face bars or vanes spaced not more than 0.75 inch on center and not less than 0.62 inch depth.

3. Grilles: Provide as specified for registers without air-volume-control dampers.

m. Access Doors

i. Provide for access to volume dampers, fire dampers, plenum chambers, and where indicated. Provide each door with double wall zinc-coated steel construction, gasketed airtight, with continuous hinges and cam latches. Insulate access doors with one inch thick rigid insulation. Provide 12 by 12 inch door, except where larger sizes are indicated, or provide 12 inches by height of duct when duct is less than 12 inches high. Provide keyed-alike 90 degree turn cam locks on each access door in sleeping rooms; furnish three keys.

n. Fire Dampers

i. UL 555 and NFPA 90A. Dampers shall be listed in UL Bld Mat Dir. Dampers when open shall not protrude into the ducts.

o. Flexible Round Ducts

i. UL 181 and NFPA 90A with factory-applied insulation, vapor barrier, and end connections. Fire hazard rating of duct assembly shall not exceed 25 for flame spread and 50 for smoke developed. Provide ducts designed for working pressures of 2 inches W.G. positive and 1.5 inches W.G. negative. Flexible round duct length shall not exceed 5 feet. Secure connections by applying adhesive for 2 inches over rigid duct, apply flexible duct 2 inches over rigid duct, apply metal clamp, and provide minimum of three No. 8 sheet metal screws through clamp and rigid duct.

1. Inner duct core: Flexible core shall be interlocking spiral or helically corrugated and constructed of zinc-coated steel, aluminum, or stainless steel; or shall be constructed of inner liner of continuous galvanized spring steel wire helix fused to continuous, fire-retardant, flexible vapor barrier film, inner duct core.

2. Insulation: Inner duct core shall be insulated with mineral fiber blanket type flexible insulation, minimum of 25 mm one inch thick. Insulation shall be covered on exterior with

manufacturer's standard fire retardant vapor barrier jacket for flexible round duct.

p. Field-Installed TAB Test Ports
   i. Test ports required for testing by the TAB engineer shall be located in the field by the TAB engineer during TAB field work. It shall be the responsibility of the ductwork contractor to provide and install test ports as required by the TAB engineer.

q. Kitchen Exhaust Ductwork
   i. Ducts conveying smoke and grease laden vapors shall conform to requirements of NFPA 96 as modified and supplemented by this specification. Seams, joints, penetrations, and duct-to-hood collar connections shall have a liquid tight continuous external weld. Duct material shall be minimum 18 gauge, Type 304L or 316L, stainless steel. Duct construction shall include external perimeter angle sized in accordance with SMACNA 1966; pitched to drain at low points; welded pipe coupling-plug drains at low points; welded fire protection and detergent cleaning penetration; steel framed, stud bolted, and flexible ceramic cloth gasketed cleaning access provisions where indicated. Angles, pipe couplings, frames, and bolts shall be same material as that specified for the duct.

r. Piping Systems
   i. Provide the following pipe and fittings. Provide dielectric fittings, unions or flanges between steel piping and copper tubing for all piping sizes; except that copper alloy valves and strainers may be used without dielectric fittings, unions or flanges. Water piping sizes 4 inches and smaller shall be copper tubing.
   ii. Refrigerant Tubing
      1. Provide ASTM B 280, cleaned, dehydrated, and sealed. Provide ASME B16.22 solder joint refrigerant fittings and adapters. Provide silver brazing alloy solder and silver brazing alloy flux. During brazing operations bleed a small amount of dry oil-free nitrogen continuously through the refrigerant tubing. Provide ASME B16.26 flared fittings.
   iii. Steel Piping Systems
      1. Provide steel piping for Gas piping systems.
   iv. Steel Pipe
      1. Provide ASTM A 53/A 53M Type E or Type S, or ASTM A 106/A 106M steel pipe; except ASTM A 53/A 53M. Provide Weight Class XS or Schedule No. 80 black steel pipe for steam condensate piping systems and for all piping with threaded end connections.
   v. Steel Pipe Fittings

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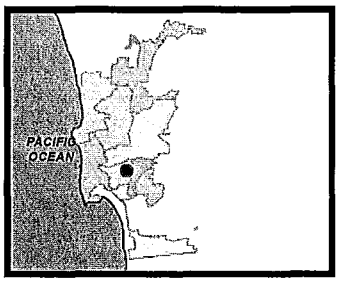

The City of SAN DIEGO Public Works

Fire Station 14 Roof & HVAC Replacement

SENIOR ENGINEER
George Freiha
(619) 533-7449

PROJECT MANAGER
Farhad Hossan
(619) 533-5492

FOR QUESTIONS ABOUT THIS PROJECT
Call: (619) 533-4207
Email: *engineering@sandiego.gov*

Legend

● Project Location

N W E S

COMMUNITY NAME: Greater North Park COUNCIL DISTRICT: 3 SAP ID: B13189

Fire Station 14 Roof & HVAC Replacement and Fire Station 19 Roof & HVAC Replacement

Date:October 7, 2016

SanGIS

Appendix E - Location Maps (Rev. Nov. 2016)

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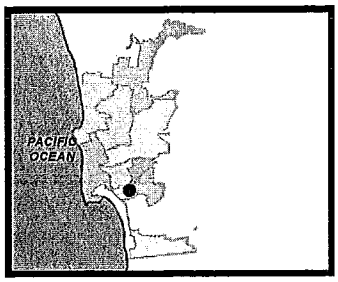


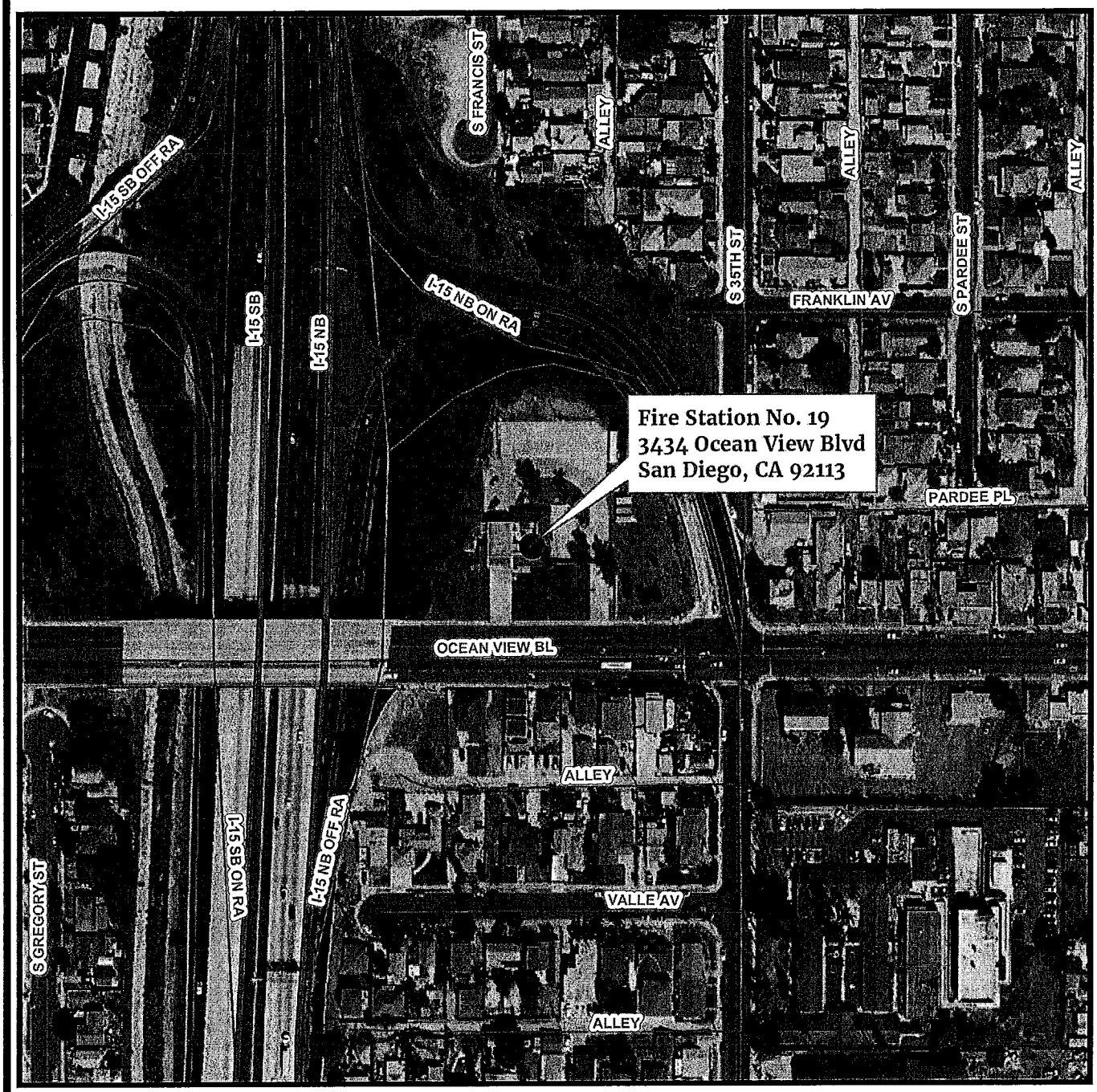
The City of SAN DIEGO Public Works

Fire Station 19 Roof & HVAC Replacement

SENIOR ENGINEER
George Freiha
(619) 533-7449

PROJECT MANAGER
Farhad Hossan
(619) 533-5492

FOR QUESTIONS ABOUT THIS PROJECT
Call: (619) 533-4207
Email: *engineering@sandiego.gov*



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● **Project Location**

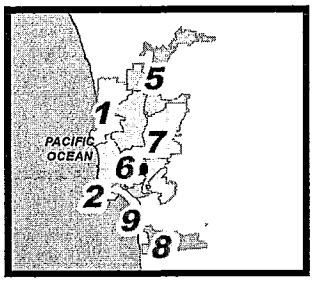
N W E S

COMMUNITY NAME: Southeastern San Diego COUNCIL DISTRICT: 9 SAP ID: B13190

APPENDIX F

ADJACENT PROJECTS

Appendix F - Adjacent Projects



The City of SAN DIEGO Public Works

Fire Station 14 Roof & HVAC Replacement

SENIOR ENGINEER
George Freiha
(619) 533-7449

PROJECT ENGINEER
Farhad Hossan
(619) 533-5492

FOR QUESTIONS ABOUT THIS PROJECT
Call: (619) 533-4207
Email: engineering@sandiego.gov

Legend

- UU306, Lincoln Avenue
- B13189|Fire Station 14 Roof & HVAC Replacement
- B00114|Sewer & Water Group 687B
- B00445|Sewer & Water Group Job 687B

N W E S

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COMMUNITY NAME: Greater North Park COUNCIL DISTRICT: 3 SAP ID: B13189

APPENDIX G

HAZARDOUS LABEL/FORMS

HAZARDOUS WASTE

STATE AND FEDERAL LAW PROHIBITS IMPROPER DISPOSAL
IF FOUND, CONTACT THE NEAREST POLICE, OR PUBLIC SAFETY AUTHORITY, OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY OR THE CALIFORNIA DEPARTMENT OF HEALTH SERVICES

GENERATOR NAME _____

ADDRESS _____ 24 HR. PHONE ( )

CITY _____ STATE _____ ZIP _____

EPA ID NO. _____ MANIFEST DOCUMENT NO. _____

EPA WASTE NO. _____ CA WASTE NO. _____ ACCUMULATION START DATE / /

CONTENTS, COMPOSITION _____

PROPER DOT SHIPPING NAME _____

TECHNICAL NAME (S) _____

UN/NA NO. WITH PREFIX _____

PHYSICAL STATE ☐ SOLID ☐ LIQUID | HAZARDOUS PROPERTIES ☐ CORROSIVE ☐ REACTIVE ☐ FLAMMABLE ☐ TOXIC ☐ OTHER _____

HANDLE WITH CARE!

CONTAINS HAZARDOUS OR TOXIC WASTES

INCIDENT/RELEASE ASSESSMENT FORM [1]

If you have an emergency, Call 911

Handlers of hazardous materials are required to report releases. The following is a tool to be used for assessing if a release is reportable. Additionally, a non-reportable release incident form is provided to document why a release is not reported (see back).

Questions for Incident Assessment:	YES	NO
1. Was anyone killed or injured, or did they require medical care or admitted to a hospital for observation?	☐	☐
2. Did anyone, other than employees in the immediate area of the release, evacuate?	☐	☐
3. Did the release cause off-site damage to public or private property?	☐	☐
4. Is the release greater than or equal to a reportable quantity (RQ)?	☐	☐
5. Was there an uncontrolled or unpermitted release to the air?	☐	☐
6. Did an uncontrolled or unpermitted release escape secondary containment, or extend into any sewers, storm water conveyance systems, utility vaults and conduits, wetlands, waterways, public roads, or off site?	☐	☐
7. Will control, containment, decontamination, and/or clean up require the assistance of federal, state, county, or municipal response elements?	☐	☐
8. Was the release or threatened release involving an unknown material or contains an unknown hazardous constituent?	☐	☐
9. Is the incident a threatened release (a condition creating a substantial probability of harm that requires immediate action to prevent, reduce, or mitigate damages to persons, property, or the environment)?	☐	☐
10. Is there an increased potential for secondary effects including fire, explosion, line rupture, equipment failure, or other outcomes that may endanger or cause exposure to employees, the general public, or the environment?	☐	☐

If the answer is YES to any of the above questions – report the release to the California Office of Emergency Services at 800-852-7550 and the local CUPA daytime: (619) 338-2284, after hours: (858) 565-5255. Note: other state and federal agencies may require notification depending on the circumstances.

Call 911 in an emergency

If all answers are NO, complete a Non Reportable Release Incident Form (page 2 of 2) and keep readily available. Documenting why a "no" response was made to each question will serve useful in the event questions are asked in the future, and to justify not reporting to an outside regulatory agency.

If in doubt, report the release.

[1] This document is a guide for accessing when hazardous materials release reporting is required by Chapter 6.95 of the California Health and Safety Code. It does not replace good judgment, Chapter 6.95, or other state or federal release reporting requirements.

NON REPORTABLE RELEASE INCIDENT FORM

1. RELEASE AND RESPONSE DESCRIPTION

Incident #

Date/Time Discovered	Date/Time Discharge	Discharge Stopped ☐ Yes ☐ No
Incident Date / Time:		
Incident Business / Site Name:		
Incident Address:		
Other Locators (Bldg, Room, Oil Field, Lease, Well #, GIS)		
Please describe the incident and indicate specific causes and area affected. Photos Attached?: ☐Yes ☐No		
Indicate actions to be taken to prevent similar releases from occurring in the future.		

2. ADMINISTRATIVE INFORMATION

Supervisor in charge at time of incident:	Phone:
Contact Person:	Phone:

3. CHEMICAL INFORMATION

Chemical	Quantity ☐ GAL ☐ LBS ☐ FT^3
Chemical	Quantity ☐ GAL ☐ LBS ☐ FT^3
Chemical	Quantity ☐ GAL ☐ LBS ☐ FT^3
Clean-Up Procedures & Timeline:	
Completed By:	Phone:
Print Name:	Title:

EMERGENCY RELEASE FOLLOW - UP NOTICE REPORTING FORM

A

BUSINESS NAME

FACILITY EMERGENCY CONTACT & PHONE NUMBER
( ) -

B

INCIDENT DATE MO DAY YR

TIME OES NOTIFIED (use 24 hr time)

OES CONTROL NO.

C

INCIDENT ADDRESS LOCATION

CITY / COMMUNITY

COUNTY ZIP

D

CHEMICAL OR TRADE NAME (print or type)

CAS Number

CHECK IF CHEMICAL IS LISTED IN 40 CFR 355, APPENDIX A ☐

CHECK IF RELEASE REQUIRES NOTIFI - CATION UNDER 42 U.S.C. Section 9603 (a) ☐

PHYSICAL STATE CONTAINED ☐ SOLID ☐ LIQUID ☐ GAS

PHYSICAL STATE RELEASED ☐ SOLID ☐ LIQUID ☐ GAS

QUANTITY RELEASED

ENVIRONMENTAL CONTAMINATION ☐ AIR ☐ WATER ☐ GROUND ☐ OTHER

TIME OF RELEASE

DURATION OF RELEASE
___DAYS ___HOURS___MINUTES

E

ACTIONS TAKEN

F

KNOWN OR ANTICIPATED HEALTH EFFECTS (Use the comments section for addition information)

☐ ACUTE OR IMMEDIATE (explain)_____

☐ CHRONIC OR DELAYED (explain)_____

☐ NOTKNOWN (explain)

G

ADVICE REGARDING MEDICAL ATTENTION NECESSARY FOR EXPOSED INDIVIDUALS

H

COMMENTS (INDICATE SECTION (A - G) AND ITEM WITH COMMENTS OR ADDITIONAL INFORMATION)

I

CERTIFICATION: I certify under penalty of law that I have personally examined and I am familiar with the information submitted and believe the submitted information is true, accurate, and complete.

REPORTING FACILITY REPRESENTATIVE (print or type) _____

SIGNATURE OF REPORTING FACILITY REPRESENTATIVE _____ DATE: _____

EMERGENCY RELEASE FOLLOW-UP NOTICE
REPORTING FORM INSTRUCTIONS

GENERAL INFORMATION:

Chapter 6.95 of Division 20 of the California Health and Safety Code requires that written emergency release follow-up notices prepared pursuant to 42 U.S.C. § 11004, be submitted using this reporting form. Non-permitted releases of reportable quantities of Extremely Hazardous Substances (listed in 40 CFR 355, appendix A) or of chemicals that require release reporting under section 103(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [42 U.S.C. § 9603(a)] must be reported on the form, as soon as practicable, but no later than 30 days, following a release. The written follow-up report is required in addition to the verbal notification.

BASIC INSTRUCTIONS:

- The form, when filled out, reports follow-up information required by 42 U.S.C § 11004. Ensure that all information requested by the form is provided as completely as possible.
- If the incident involves reportable releases of more than one chemical, prepare one report form for each chemical released.
- If the incident involves a series of separate releases of chemical(s) at different times, the releases should be reported on separate reporting forms.

SPECIFIC INSTRUCTIONS:

Block A: Enter the name of the business and the name and phone number of a contact person who can provide detailed facility information concerning the release.

Block B: Enter the date of the incident and the time that verbal notification was made to OES. The OES control number is provided to the caller by OES at the time verbal notification is made. Enter this control number in the space provided.

Block C: Provide information pertaining to the location where the release occurred. Include the street address, the city or community, the county and the zip code.

Block D: Provide information concerning the specific chemical that was released. Include the chemical or trade name and the Chemical Abstract Service (CAS) number. Check all categories that apply. Provide best available information on quantity, time and duration of the release.

Block E: Indicate all actions taken to respond to and contain the release as specified in 42 U.S.C. § 11004(c).

Block F: Check the categories that apply to the health effects that occurred or could result from the release. Provide an explanation or description of the effects in the space provided. Use Block H for additional comments/information if necessary to meet requirements specified in 42 U.S.C. § 11004(c).

Block G: Include information on the type of medical attention required for exposure to the chemical released. Indicate when and how this information was made available to individuals exposed and to medical personnel, if appropriate for the incident, as specified in 42 U.S.C. § 11004(c).

Block H: List any additional pertinent information.

Block I: Print or type the name of the facility representative submitting the report. Include the official signature and the date that the form was prepared.

MAIL THE COMPLETED REPORT TO:

State Emergency Response Commission (SERC)
Attn: Section 304 Reports
Hazardous Materials Unit
3650 Schriever Avenue
Mather, CA 95655

NOTE: Authority cited: Sections 25503, 25503.1 and 25507.1, Health and Safety Code. Reference: Sections 25503(b)(4), 25503.1, 25507.1, 25518 and 25520, Health and Safety Code.

APPENDIX H

SAMPLE OF PUBLIC NOTICES

FOR SAMPLE REFERENCE ONLY

The City of SAN DIEGO

CONSTRUCTION NOTICE

PROJECT TITLE

Work on your street will begin within one week to replace the existing water mains servicing your community.

The work will consist of:

- Saw-cutting and trench work on Ingulf Street from Morena Boulevard to Galveston Street to install new water mains, water laterals and fire hydrants.
- Streets where trenching takes place will be resurfaced and curb ramps will be upgraded to facilitate access for persons with disabilities where required.
- This work is anticipated to be complete in your community by December 2016.

How your neighborhood may be impacted:

- Water service to some properties during construction will be provided by a two-inch highline pipe that will run along the curb. To report a highline leak call 619-515-3525.
- Temporary water service disruptions are planned. If planned disruptions impact your property, you will receive advance notice.
- Parking restrictions will exist because of the presence of construction equipment and materials.
- "No Parking" signs will be displayed 72 hours in advance of the work.
- Cars parked in violation of signs will be TOWED.

Hours and Days of Operation:
Monday through Friday X:XX AM to X:XX PM.

City of San Diego Contractor:
Company Name, XXX-XXX-XXXX

To contact the City of San Diego: SD Public Works
619-533-4207 | engineering@sandiego.gov | sandiego.gov/CIP

This information is available in alternative formats upon request.

The City of SAN DIEGO

CONSTRUCTION NOTICE

PROJECT TITLE

Work on your street will begin within one week to replace the existing water mains servicing your community.

The work will consist of:

- Saw-cutting and trench work on Ingulf Street from Morena Boulevard to Galveston Street to install new water mains, water laterals and fire hydrants.
- Streets where trenching takes place will be resurfaced and curb ramps will be upgraded to facilitate access for persons with disabilities where required.
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- Cars parked in violation of signs will be TOWED.

Hours and Days of Operation:
Monday through Friday X:XX AM to X:XX PM.

City of San Diego Contractor:
Company Name, XXX-XXX-XXXX

To contact the City of San Diego: SD Public Works
619-533-4207 | engineering@sandiego.gov | sandiego.gov/CIP

This information is available in alternative formats upon request.

APPENDIX I

ADVANCED METERING INFRASTRUCTURE (AMI) DEVICE PROTECTION

Protecting AMI Devices in Meter Boxes and on Street Lights

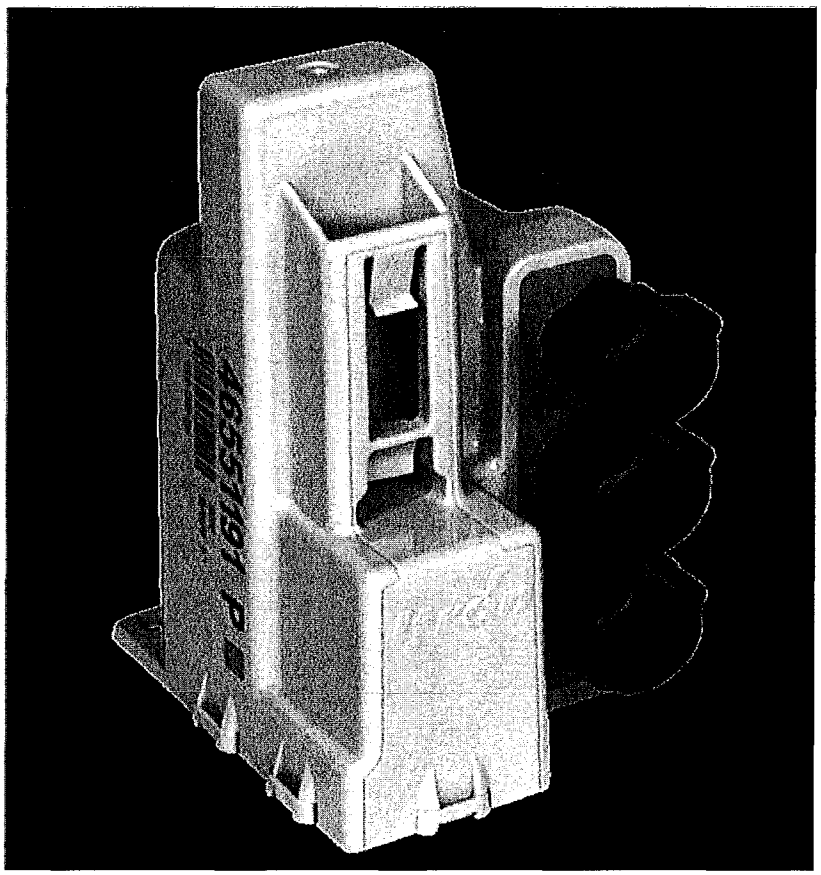
The Public Utilities Department (PUD) has begun the installation of the Advanced Metering Infrastructure (AMI) technology as a new tool to enhance water meter reading accuracy and efficiency, customer service and billing, and to be used by individual accounts to better manage the efficient use of water. **All AMI devices shall be protected per Section 5-2, "Protection", of the 2015 Whitebook.**

AMI technology allows water meters to be read electronically rather than through direct visual inspection by PUD field staff. This will assist PUD staff and customers in managing unusual consumption patterns which could indicate leaks or meter tampering on a customer's property.

Three of the main components of an AMI system are the:

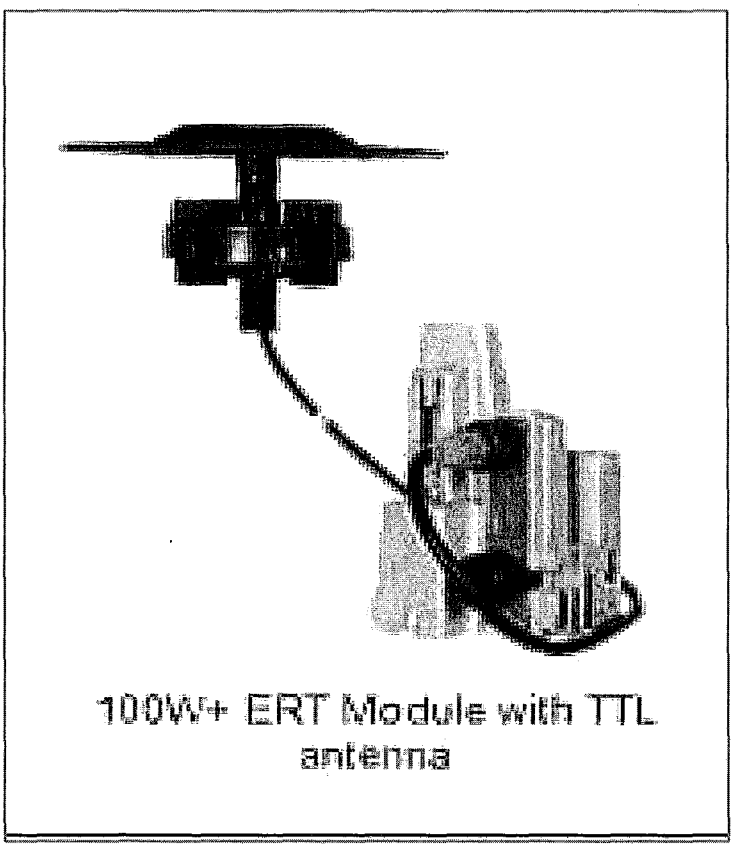
A. Endpoints, see Photo 1:

Photo 1



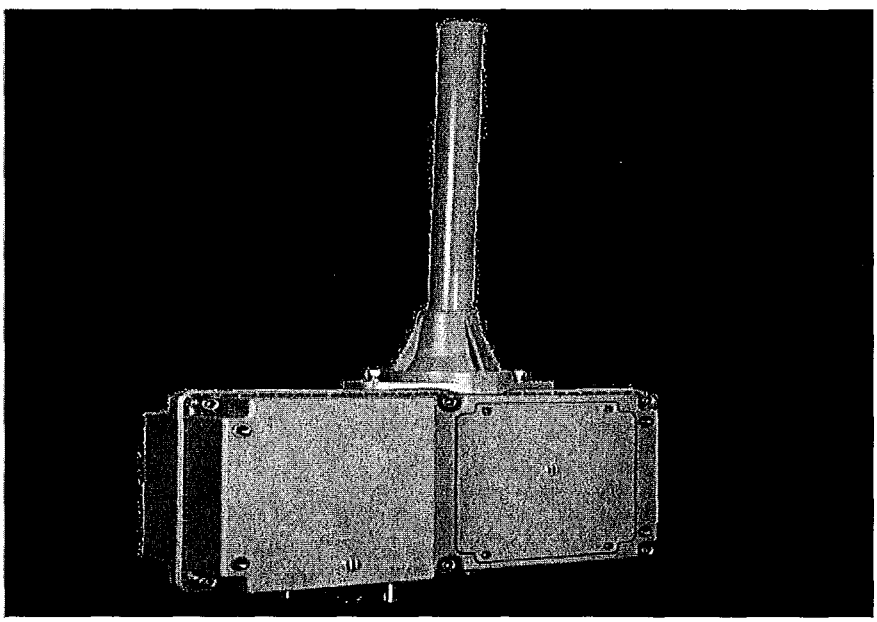
B. AMI Antenna attached to Endpoint (antenna not always required), see Photo 2:

Photo 2



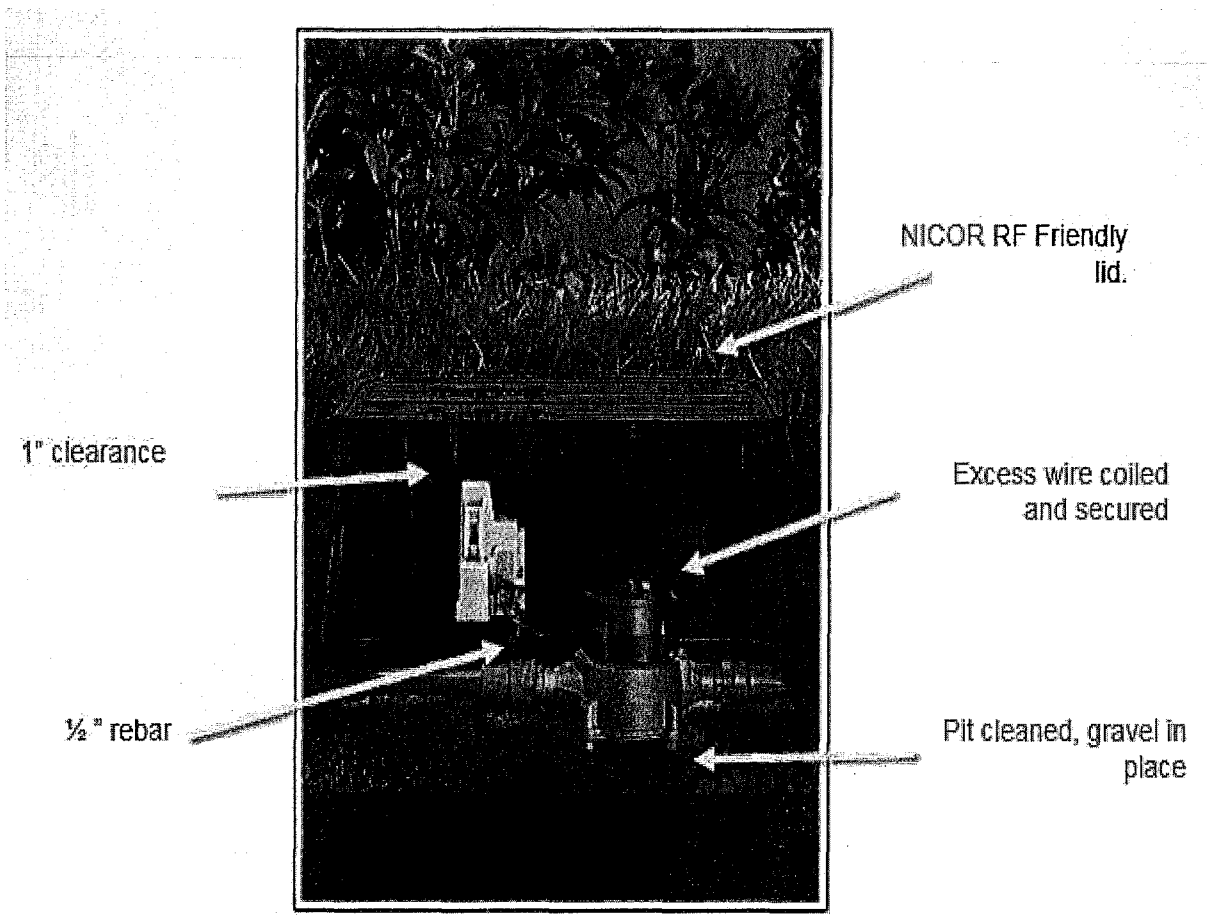
Network Devices, see Photo 3:

Photo 3



AMI endpoints transmit meter information to the AMI system and will soon be on the vast majority of meters in San Diego. These AMI devices provide interval consumption data to the PUD's Customer Support Division. If these devices are damaged or communication is interrupted, this Division will be alerted of the situation. The endpoints are installed in water meter boxes, coffins, and vaults adjacent to the meter. A separate flat round antenna may also be installed through the meter box lid. This antenna is connected to the endpoint via cable. The following proper installation shall be implemented when removing the lid to avoid damaging the antenna, cable, and/or endpoint. Photo 4 below demonstrates a diagram of the connection:

Photo 4



The AMI device ERT/Endpoint/Transmitter shall be positioned and installed as discussed in this Appendix. If the ERT/Endpoint/Transmitter is disturbed, it shall be re-installed and returned to its original installation with the end points pointed upwards as shown below in Photo 5.

The PUD's code compliance staff will issue citations and invoices to you for any damaged AMI devices that are not re-installed as discussed in the Contract Document

Photo 5 below shows a typical installation of an AMI endpoint on a water meter.

Photo 5

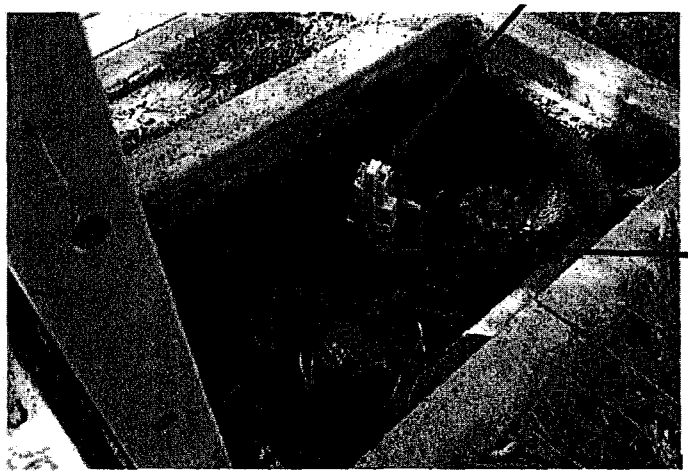
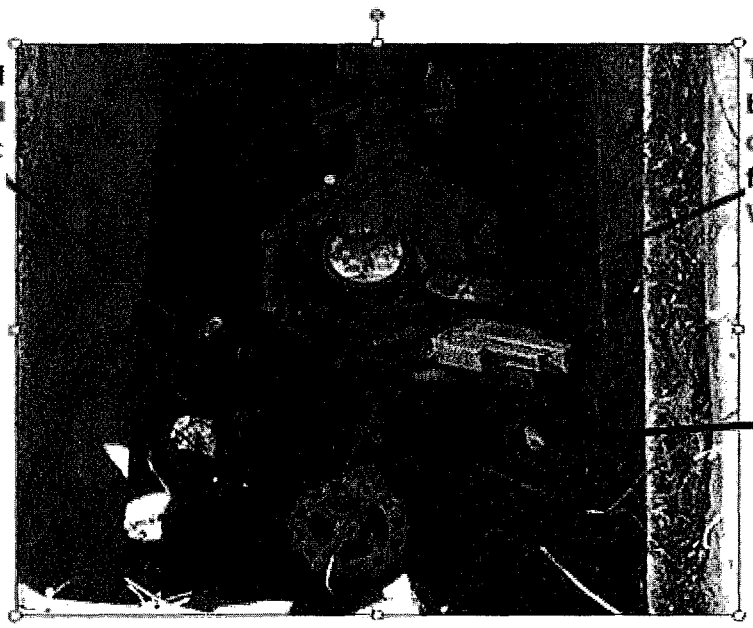


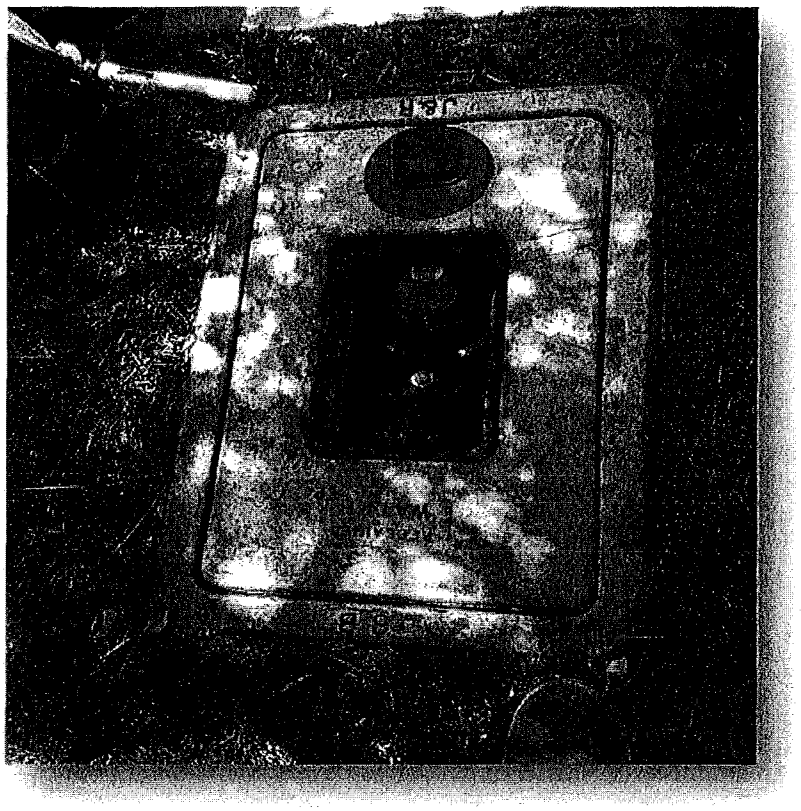
Photo 6 below is an example of disturbance that shall be avoided:

Photo 6



You are responsible when working in and around meter boxes. If you encounter these endpoints, use proper care and do not disconnect them from the registers on top of the water meter. If the lid has an antenna drilled through, do not change or tamper with the lid and inform the Resident Engineer immediately about the location of that lid. Refer to Photo 7 below:

Photo 7



Another component of the AMI system are the Network Devices. The Network Devices are strategically placed units (mainly on street light poles) that collect interval meter reading data from multiple meters for transmission to the Department Control Computer. **If you come across any of these devices on street lights that will be removed or replaced (refer to Photos 8 and 9 below), notify AMI Project Manager Arwa Sayed at (619) 362-0121 immediately.**

Photo 8 shows an installed network device on a street light. On the back of each Network Device is a sticker with contact information. See Photo 9. **Call PUD Water Emergency Repairs at 619-515-3525 if your work will impact these street lights.** These are assets that belong to the City of San Diego and you shall be responsible for any costs of disruption of this network.

Photo 8

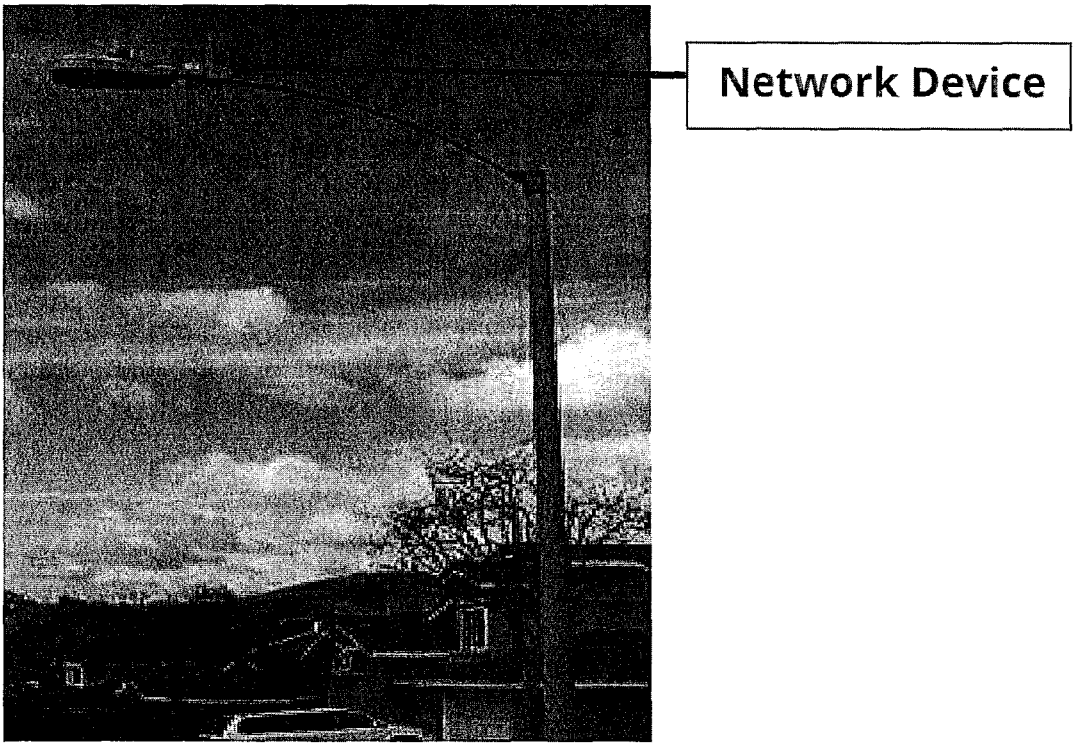


Photo 9

If you encounter any bad installations, disconnected/broken/buried endpoints, or inadvertently damage any AMI devices or cables, notify the Resident Engineer immediately. The Resident Engineer will then immediately contact the AMI Project Manager, Arwa Sayed, at (619) 362-0121.

APPENDIX J

ASBESTOS ABATEMENT SPECIFICATION

THE CITY OF SAN DIEGO

ENVIRONMENTAL SERVICES DEPARTMENT

ASBESTOS ABATEMENT SPECIFICATION

for

These Technicals are separate from your other Technicals for architect/electrical/ plumbing. Is this going to be used for the advertisement of your project?

Include this into the main Table of Contents on your other technicals if this is also being used and ensure that you have one, single, organized, and complete Table of Contents and not just ones for each disicpline.

ROJECT

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2016

Prep

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DIVISION 01 - GENERAL REQUIREMENTS

1.1 DESCRIPTION OF WORK

1.1.1 ABATEMENT CONTRACTOR shall supply all labor, transportation, material, apparatus, and equipment for the removal, and disposal of asbestos-containing roofing mastics to be impacted as a result of this project. A list of asbestos containing materials and quantities identified can be found in Appendix C of this section.

1.1.2 ABATEMENT CONTRACTOR shall be responsible for ensuring the interior of the building will not be contaminated with asbestos containing material during work and shall be responsible for any clean-up determined necessary by City of San Diego's PROJECT MONITOR.

1.1.3 Before submitting his/her bid, the ABATEMENT CONTRACTOR shall visit the project site and verify the location and quantity of the asbestos-containing materials that will be removed under the terms and conditions of the contract and this specification.

1.1.4 Abatement work shall be performed within agreed upon hours subm project start which will not include designated City holidays.

Avoid all usage of the term "should". This is not enforceable.

1.1.5 Before the beginning of the work related to asbestos abatement, AB CONTRACTOR shall hold a safety construction meeting with all asbestos related supervisors, workers, and other contractors on-site that provides an overview of the accepted asbestos work plan, decontamination procedures specific to this project (decontamination procedures shall be on paper with copies for all present), and disposal plan for this project. Meeting shall include the PROJECT MONITOR and any other designated City representative. Meeting time shall be provided for the PROJECT MONITOR to introduce them and identify their role in this project.

1.2 CONTRACTOR USE OF THE PREMISES

All site rules and regulations affecting the work should be complied with while engaged in project activities. The existing building should be maintained in a safe condition throughout the asbestos abatement activities. The Contractor will be responsible for adhering to all applicable building codes and fire safety requirements.

All public areas will be kept free of accumulated waste, materials, rubbish, and debris.

1.3 PROJECT COORDINATION

It will be the responsibility of the Contractor to coordinate all site activities with the City's Asbestos & Lead Management Program's (ALMP) PROJECT MONITOR including any meetings, surveys, special reports, and site usage limitations.

1.4 PROJECT SUBMITTALS

The contractor shall not commence any work until approval has been given from the City. The Contractor shall submit the following at least 60 days prior to commencement of any asbestos abatement activities:

1.4.1 Asbestos Abatement Work Plan: In addition to information required in this section, Work Plan shall contain all information required under 8 CCR 1529. Submit a detailed job-specific plan that includes:

a. The procedures proposed to comply with the requirements of this specification and all applicable regulations.

b. Detailed drawings that identify the location, size, layout and details of the Work Areas, any equipment, disposal storage, restrooms, and worker decontamination facilities.

c. The sequencing of abatement work and the interface of trades involved in the performance of work. Provide a time line that details each major phase of work activity and anticipated time it will occur.

d. The methods to be used to assure the safety occupants and visitors to the site.

e. Detailed description of the methods to be employed to ensure asbestos is not released above permissible exposure levels.

f. The method of removal to reduce asbestos dust generation in the Work Area,

1.4.2 Work site coordination submittals including:

a. Contingency and Spill Plan: Prepare a contingency plan for emergencies including fire, accident, power failure, or any other event that may require modification or abridgement of decontamination or Work Area isolation procedures. Include in plan specific procedures for decontamination or Work Area isolation. Plan should be specific for all types of hazardous materials or situations specific to this work site. Note that nothing in this specification should impede safe exiting or providing of adequate medical attention in the event of an emergency.

b. Telephone numbers and locations of emergency services including but not limited to fire, ambulance, doctor, hospital, police, power company, telephone company.

1.4.3 Notifications:

i. Notify emergency service agencies including fire, ambulance, police or other agency that may service the abatement work site in case of an emergency. Notification is to include methods of entering Work Area, emergency entry and exit locations, modifications to fire notification or fire-fighting equipment, and other information needed by agencies providing emergency services.

ii. Notifications of Emergency: Any individual at the job site may notify emergency service agencies if necessary without effect on this contract or the Contract Sum.

iii. Provide submittal identifying person responsible for responding to project site emergencies twenty-four hours a day, seven days a week.

1.4.4 ABATEMENT CONTRACTOR qualifications and personnel information submittals that include but are not limited to:

a. Provide all staff names, certifications, and experience. Identify their duties and responsibilities on this project. ABATEMENT CONTRACTOR shall have the following minimum levels of qualified supervision on the project site:

i. General Superintendent: Provide a full-time General Superintendent who is experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the ABATEMENT CONTRACTOR`s representative responsible for compliance with all applicable federal, state and local regulations and guidelines, particularly those relating to asbestos abatement and hazardous waste. Should, in the opinion of the OWNER, any language barrier exist between the on-site superintendent and the OWNER or PROJECT MONITOR, the ABATEMENT CONTRACTOR shall employ a qualified full-time interpreter or provide a new on-site superintendent at no additional cost to the OWNER. Shall be AHERA certified as asbestos supervisor.

ii. Foreman: Provide a full time Foreman to directly supervise and direct no more than 10 abatement workers. Each Foreman will act as the Competent Person as required by 8 CCR 1529 for the workers the foreman is directing. The Foreman has oversight authority over the workers and reports to the General Superintendent. If there are 10 or fewer abatement workers on the project the General Superintendent may fill the Foreman's position. Shall be AHERA certified as asbestos supervisor.

iii. Experience and Training: The General Superintendent and foreman shall meet all the requirements as a Competent Person as required by OSHA 8 CCR 1529. They shall have completed training in EPA Asbestos Supervisor Training. They shall have experience with projects of similar types and sizes.

iv. Workers: All asbestos abatement workers shall have current EPA and OSHA asbestos abatement training.

v. Certificate of Worker's Acknowledgment: Submit an original signed copy of the Certificate of Worker's Acknowledgment found in Appendix A of this section, for each worker and supervisor who is to be at the job site or enter the Work Area.

1.4.5 Submit a copy of the ABATEMENT CONTRACTOR's Asbestos DOSH Handling License.

1.4.6 If required by regulations, submit copies of notifications made to regulatory agencies along with a copy of certified mail receipt.

1.4.7 Submit respiratory protection information and air monitoring data as per the following:

a. Operating Instruction: Submit complete operating and maintenance instructions for all components and systems as a whole. Submittal is to be in bound manual form suitable for field use.

b. Respiratory Protection Program: Submit ABATEMENT CONTRACTOR's written respiratory protection program manual as required by 8 CCR 1529 and 5144.

c. Respiratory Protection Schedule: Submit level of respiratory protection intended for each operation required by the project.

1.4.8 Submit doctor's report from medical examination conducted within the last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the Work Area. Submit, at a minimum, the following for each worker:

a. Name and Social Security Number

b. Physicians Written Opinion from examining physician including at a minimum the following:

i. Whether worker has any detected medical conditions that would place the worker at an increased risk of material health impairment from exposure to asbestos. Any recommended limitations on the worker or on the use of personal protective equipment such as respirators.

ii. Statement that the worker has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos exposure.

1.4.9 Submit a notarized certification, signed by an officer of the ABATEMENT CONTRACTOR firm that exposure measurements, medical surveillance, and worker training records are being kept in conformance with 8 CCR 1529.

1.4.10 Identify disposal location and provide associated permits for all non-friable asbestos waste.

1.4.11 Identify state licensed transporter, disposal location, and associated permits for all friable asbestos waste.

1.4.12 Identify the laboratory that will be performing the analysis of the personnel samples and provide their accreditation. Also discuss how ABATEMENT CONTRACTOR will be providing the analytical results to the PROJECT MONITOR within 24 hours of sampling completion.

a. Submit the following during and at the completion of the work

1. Copies of all Waste Shipment Records

2. Copies of all air monitoring results within 24 hours

At the end of a project, the Contractor shall submit the following to the Project Monitor:

1. Personal Air Sample Results
2. Copies of Project Daily Logs
3. Containment Entry/Exit Logs
4. Waste Disposal Documentation
5. Certificate of Visual Inspection

1.5 SCHEDULES AND REPORTS

Prior to each phase of project, the Contractor shall provide the City with a tentative time line which outlines the project schedule. These documents will be reviewed and approved by the City prior to the commencement of work.

1.6 PRODUCT DATA

The Contractor shall submit product information that is to be used during the abatement activities prior to commencement of work (i.e., encapsulants). General information required on product date includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade association and testing agencies, and material safety data sheets (MSDSs).

1.6.1 POLYETHYLENE SHEET

a. A single polyethylene film in the largest sheet size possible to minimize seams, 4.0 or 6.0 mil thick as indicated, and clear, frosted, or black as indicated.

b. Provide flame resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 4.0 or 6.0 mil thick as indicated, and frosted or black as indicated.

c. Reinforced Polyethylene Sheet: Where plastic sheet is the only separation between the Work Area and building exterior, provide translucent, nylon reinforced, laminated, flame resistant, polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 4.0 or 6.0 mil thick as indicated, frosted or black as indicated.

1.6.2 TAPE

a. Provide duct tape in 2" or 3" widths as indicated, with an adhesive which is formulated to stick aggressively to sheet polyethylene.

1.6.3 SPRAY ADHESIVE

a. Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.

1.7 PROJECT CLOSE-OUT

Upon completion of work and prior to payment, the Project Monitor will proceed with an initial inspection of the abatement work area. A Certificate of Visual Inspection (Appendix B) will be signed by both the Contractor and Project Monitor. The Contractor will not be paid until the area meets the established project-specific clearance criteria and has submitted the required information.

DIVISION 02 - DEFINITIONS

2.1 DEFINITIONS

A. Accredited or Accreditation (when referring to a person or laboratory): A person or laboratory accredited in accordance with section 206 of Title II of the Toxic Substances Control Act (TSCA).

B. Air Monitoring: The process of measuring the fiber content of a specific volume of air.

C. Amended Water: Water to which a surfactant has been added to decrease the surface tension to 35 or less dynes.

D. Asbestos: The asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite grunerite, anthophyllite, and actinolite tremolite. For purposes of determining respiratory and worker protection both the asbestiform and non asbestiform varieties of the above minerals and any of these materials that have been chemically treated and/or altered shall be considered as asbestos.

E. Asbestos Containing Material (ACM): Any material containing more than 1% by weight of asbestos of any type or mixture of types.

F. Asbestos-Containing Building Material (ACBM): Surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a building.

G. Asbestos Containing Waste Material: Any material which is or is suspected of being or any material contaminated with an asbestos containing material which is to be removed from a work area for disposal.

H. Asbestos debris: Pieces of ACBM that can be identified by color, texture, or composition, or means dust, if the dust is determined by an accredited inspector to be ACM.

I. Authorized Visitor: The Owner, the Owner's Representative, testing lab personnel, the Architect/Engineer, emergency personnel or a representative of any federal, state and local regulatory or other agency having authority over the project.

J. Barrier: Any surface that seals off the work area to inhibit the movement of fibers.

K. Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches.

L. Ceiling Concentration: The concentration of an airborne substance that shall not be exceeded.

M. Curtained Doorway: Device to allow ingress and egress from one room to another while permitting minimal air movement between the rooms.

N. Demolition: The wrecking or taking out of any building component, system, finish or assembly of a facility together with any related handling operations.

O. Disposal Bag: A properly labeled 6 mil thick leak tight plastic bags used for transporting asbestos waste from work and to disposal site.

P. Encapsulant: a penetrating encapsulant specifically designed to minimize fiber release during removal of asbestos containing materials rather that for in situ encapsulation.

Q. Encapsulation: Treatment of asbestos containing materials, with an encapsulant.

R. Enclosure: The construction of an air tight, impermeable, permanent barrier around asbestos containing material to control the release of asbestos fibers into the air.

S. Filter: A media component used in respirators to remove solid or liquid particles from the inspired air.

T. Friable Asbestos Material: Material that contains more than 1.0% asbestos by weight and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry. A material can also be rendered friable via mechanical means.

U. HEPA Filter: A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97% of asbestos fibers greater than 0.3 microns in diameter.

V. HEPA Filter Vacuum Collection Equipment (or vacuum cleaner): High efficiency particulate air filtered vacuum collection equipment with a filter system capable of collecting and retaining asbestos fibers. Filters should be of 99.97% efficiency for retaining fibers of 0.3 microns or larger.

W. Negative Pressure Respirator: A respirator in which the air pressure inside the respiratory inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.

X. Personal Monitoring: Sampling of the asbestos fiber concentrations within the breathing zone of an employee.

Y. Protection Factor: The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer.

Z. Project Monitor: City of San Diego Asbestos & Lead Management Program staff or their designated consultant.

AA. Visible Emissions: Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.

BB. Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning utensils which have been dampened with amended water or diluted removal encapsulant and afterwards thoroughly decontaminated or disposed of as asbestos-contaminated waste.

CC. Work Area: The area where asbestos-related work or removal operations are performed which is defined and/or isolated to prevent the spread of asbestos dust, fibers or debris, and entry by unauthorized personnel. Work area is a Regulated Area as defined by 8 CCR 1529.

DIVISION 03 - SITE WORK

3.1 INTRODUCTION

This portion of the specification describes procedures and protocols for asbestos abatement activities. The protocols/procedures described hereafter are in accordance with federal/state/local requirements. In the absence of these requirements, the procedure/protocols are based on current industry standards.

3.2 BACKGROUND INFORMATION

Sampling has been performed by inspectors from the City's Asbestos and Lead Management Program (ALMP) and has been provided in Appendix C of this specification.

3.3 GENERAL INFORMATION

3.3.1 Potential Asbestos Hazard

The disturbance of asbestos containing materials may cause exposure to workers and building occupants. All workers, supervisory personnel, subcontractors, and consultants who will be at the job site, need to be apprised of the seriousness of the hazard and of proper work practices which must be followed to minimize exposure. The procedures and methods described herein must be followed and the Contractor must comply with all applicable federal/state/local requirements.

3.3.2 Stop Work

If the Project Monitor presents a verbal or written stop work order, the Contractor shall immediately and automatically stop all work. Recommencement of the work may not begin until authorized by the Project Monitor.

3.4 PROJECT ADMINISTRATION

3.4.1 CERTIFIED SUPERVISOR

The Contractor needs to provide a full-time asbestos abatement supervisor who is experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc. This supervisor must have completed an "Asbestos Abatement Supervision" course. This person

will act as the competent person on the job.

In addition, all employees working on the project must have taken a "Asbestos Abatement Worker" course.

3.4.2 SPECIAL REPORTS

a. Reporting Unusual Events

When an event of unusual and significant nature occurs at the site (e.g., a spill of asbestos debris, failure of special equipment used to contain asbestos), the Contractor shall prepare and submit a special report listing the chain of events, persons participating, response by Contractor's personnel, evaluation of results, and other pertinent information.

b. Reporting Accidents

The Contractor shall prepare and submit reports of significant accidents at the subject site. Pertinent data and actions need to be recorded. In addition, response actions should comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury or potential environmental contamination.

3.5 COMPLIANCE WITH CODES AND REGULATIONS

Except to the extent that more explicit, or more stringent requirements are written directly into this Asbestos Abatement Contract/Specification, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.

The Contractor will assume full responsibility and liability for the compliance with all applicable federal/state/local regulations pertaining to work practices, protection of workers, and visitors to the site, persons occupying areas adjacent to the site, hauling, and disposal of waste. The Contractor shall hold the City and its representative harmless for the Contractor's failure to comply with any applicable work, hauling, disposal, safety, health, or other regulation on the part of itself, its employees, or its subcontractors.
State requirements which govern asbestos abatement activities or hauling and disposal of hazardous waste include, but are not limited to, the following:

3.5.1 As required, ABATEMENT CONTRACTOR shall notify all Local, State, and Federal agencies regulating standards for the removal of asbestos-containing materials, including but not limited to: Cal-OSHA, San Diego Air Pollution Control District, and U.S. Environmental Protection Agency. ABATEMENT CONTRACTOR shall provide Owner a copy of each notification and a copy of a certified mail receipt proving proper notification to all required agencies.

3.5.2 ABATEMENT CONTRACTOR shall be registered as an asbestos contractor before performing any asbestos related work; a licensee must also be registered with the Department of Industrial Relations, Division of Occupational Safety and Health.

3.5.3 Transportation of hazardous materials shall be in accordance with the State of California Title 22 and the Department of Transportation regulations.

3.5.4 ABATEMENT CONTRACTOR shall comply with all provisions of California Title 8, Section 5208 and Section 1529.

3.5.5 ABATEMENT CONTRACTOR shall be in compliance with all provisions of Title 40 CFR Part 61.

3.5.6 ABATEMENT CONTRACTOR shall assume full responsibility and liability for compliance with all applicable Federal, State, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to site, and persons occupying areas adjacent to the site.

3.6 PERMITS AND LICENSES

The Contractor shall submit to the City in the bid submittal any permits or licenses necessary to carry out this work.

3.6.1 PERMITS

A valid Hazardous Waste Hauler registration is required for transporting any hazardous waste. Certain types of equipment require APCD permits (e.g., abrasive blasters).

3.6.2 LICENSES

The Contractor must be certified by the California Contractors State License Board. The Contractor, or its subcontractor, shall have current licenses, as required by all applicable state or local jurisdictions for the removal, transportation, disposal, or other regulated activity relative to the work described in this plan.

3.7 HEALTH AND SAFETY

This section describes the equipment and procedures required for protecting workers from asbestos contamination and other workplace hazards.

3.7.1 Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work.

3.7.2 Training

a. All workers are to be trained, certified and accredited as required by state or local code or regulation.

b. Train all workers, in accordance with Title 8 CCR section 5208 and section 1529, regarding the dangers inherent in handling asbestos and breathing asbestos dust, proper work procedures, and personal and area protective measures.

3.7.3 Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 fibers/cc or greater for an 8 hour Time Weighted Average. In the absence of specific airborne fiber data, provide medical examinations for all workers who will enter the Work Area for any reason. Examination shall as a minimum meet OSHA requirements as set forth in 8 CCR 1529. In addition, provide an evaluation of the individual's ability to work in environments capable of producing heat stress in the worker.

3.7.4 Protective clothing

a. Coveralls: Provide two (2) disposable "full body" coveralls and disposable head covers, and require that they be worn at all times by all workers in the Work Area. Provide a sufficient number for all required changes, for all workers in the Work Area.

b. Boots: Provide work boots with non skid soles, and where required by OSHA, foot protection for all workers. Provide boots at no cost to workers. Do not allow boots to be removed from the Work Area for any reason, after being contaminated with asbestos-containing material. Thoroughly clean, decontaminate and bag boots before removing them from Work Area at the end of the work.

c. Hard Hats: Provide head protection (hard hats) as required by OSHA for all workers, and provide 1 spare for use by Owner's Representative, Project Administrator, and Owner. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury. Provide hard hats of the type with plastic strap suspension. Require hats to remain in the Work Area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from Work Area at the end of the work.

d. Goggles: Provide eye protection (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury. Thoroughly clean, decontaminate and bag goggles before removing them from Work Area at the end of the work.

e. Gloves: Provide work gloves to all workers and require that they be worn at all times in the Work Area. Do not remove gloves from Work Area and dispose of as asbestos-contaminated waste at the end of the work.

3.7.5 Respirators

a. Air Purifying Respirators

1. Respirator Bodies: Provide half face or full face type respirators.

2. Filter Cartridges: Provide, at a minimum, HEPA type filters labeled with NIOSH and MSHA Certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.

3. Non permitted respirators: Do not use single use, disposable or quarter face respirators.

b. Require that respiratory protection be used at all times when there is any possibility of disturbance of asbestos containing materials whether intentional or accidental.

c. Require that a respirator be worn by anyone in a Work Area at all times, regardless of activity, during a period that starts with any operation which could cause airborne fibers until the area has been cleared for re occupancy.

3.7.6 Regardless of Airborne Fiber Levels: Require that the minimum level of respiratory protection used be half face air purifying respirators with high efficiency filters.

3.7.7 Fit testing

a. Initial Fitting: Provide initial fitting of respiratory protection during a respiratory protection course of training. Only allow an individual to use respirators for which training and fit testing has been provided.

b. Upon Each Wearing: Require that each time an air purifying respirator is put on it be checked for fit with a positive and negative pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2 (1980).

c. Respirators, disposable coveralls, head covers, and foot covers shall be provided by the ABATEMENT CONTRACTOR for the City of San Diego's Asbestos and Lead Management Program's PROJECT MONITOR, and other authorized representatives who may inspect the job site. Provide two (2) respirators and six (6) complete coveralls and, where applicable, six (6) respirator filter changes per day.

3.8 TEMPORARY FACILITIES

Temporary facilities for lead hazard control activities may comply with these specifications.

3.8.1 Materials and Equipment

Only material and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards, may be used.

3.8.2 Water Service

The Contractor will be able to obtain water services from on-site facilities. The City will designate the facilities from which water service may be obtained.

3.8.3 Electrical Services

The Contractor will be able to obtain electrical services from on-site facilities. The City will designate the facilities from which electrical services may be obtained. The contractor shall provide their own electrical hook-ups, i.e. spider boxes, ground fault circuit interrupter (GFCI) etc. and installed by a licensed electrician.

The electrical services need to comply with the applicable NEMA, NECA, and UL standards,

and governing regulations for materials and lay-out of temporary electrical services.

3.8.4 Sanitary Facilities

The Contractor will be able to use the sanitary facilities on-site. The City will designate the sanitary facilities that the Contractor may use.

3.8.5 Fire Extinguisher

Applicable recommendations of the National Fire Protection Association (NFPA) Standard 10, "Standard for Portable Fire Extinguishers," must be complied with by the Contractor. Fire extinguishers need to be located where they are most convenient and effective for their intended purpose, but not less than one (1) extinguisher in each work area, the equipment room, outside/work areas, and in the clean room.

3.8.6 First Aid

The Contractor will need to provide first aid supplies which should comply with the governing regulations and recognized recommendations within the construction industry.

3.9 WORK AREA PROCEDURES

3.9.1 Require that workers **NOT** eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the Work Area.

3.10 WORK AREA PREPARATION

3.10.1 ABATEMENT CONTRACTOR shall secure work area from access by public, staff or users of the area. Accomplish this where possible, by locking doors, gates, or other means of access to the area.

3.10.2 Barricade fencing is required for securing an outside area from unauthorized access. Work area delineation shall occur at no less then twelve feet (12') from the radius of the work and/or building. Yellow caution tape shall not be used.

3.10.3 All windows, vents, mechanical systems, etc., in close proximity to the abatement area shall be sealed with plastic and tape by the ABATEMENT CONTRACTOR prior to the work beginning.

3.10.4 Provide warning signs at entry to work area in accordance with California Title 8, Section 1529 reading as follows:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

3.11 REMOVAL OF ASBESTOS-CONTAINING MATERIALS

3.11.1 Asbestos-containing materials shall be adequately wetted with either amended water before and during removal process, to reduce fiber emission.

3.11.2 The ABATEMENT CONTRACTOR should exercise caution in using water, as he will be solely responsible for any water damage to the facility resulting from the work.

3.11.3 ABATEMENT CONTRACTOR is responsible for keeping all asbestos containing debris within the containment area at all times throughout removal. Any interior contamination, if created, is the responsibility of the ABATEMENT CONTRACTOR to clean with no additional cost to this contract.

3.11.4 ABATEMENT CONTRACTOR shall ensure there is no loose debris around the Work Area during the removal and if found, ABATEMENT CONTRACTOR shall clean the area immediately.

3.12 DISPOSAL

3.12.1 Non-friable asbestos materials may be disposed of at Miramar Landfill.

3.12.2 Friable ACM shall be containerized immediately, secured in a locked container, be transported by state licensed hauler with manifest, and disposed of at appropriate landfill location.

3.12.3 The PROJECT MONITOR or designated representative will inspect each load and sign all waste manifests before waste leaves the site.

3.12.4 Copies of Waste Shipment Records for each load of asbestos waste material shall be given to the City.

3.12.5 Cordon off the Work Area, a safe zone around the building, and the dumpster area with barrier fencing. **Yellow caution tape shall not be used.**

3.12.6 Provide warning signs at roof access in accordance with 8 CCR 1529 reading as follows:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

3.13 DECONTAMINATION PROCEDURE

3.13.1 Prior to leaving the Work Area, HEPA vacuum outer suit completely and remove, turning it inside out while doing so.

3.13.2 Hygiene facilities such as change rooms and showers are not required to be adjacent to the operations on top of a roof, but these facilities must be provided [California Title 8, Section 1529 (1)(3)]. Proceed to decontamination area where the second suit is to be removed while turning it inside out.

3.13.3 After wiping all areas and respirator, remove respirator and wipe facial area clean.

3.13.4 Place contaminated suits, towels, and respirator cartridges in a properly labeled disposal bag.

3.13.5 At the completion of the project, boots, hard hats, and goggles should be decontaminated and bagged prior to removal from the Work Area.

3.13.6 Equipment leaving the Work Area should be HEPA vacuumed and wet wiped.

3.14 AIR MONITORING/WORK AREA CLEARANCE

3.14.1 The City's PROJECT MONITOR will provide ambient area air monitoring during all phases of the removal of asbestos-containing roofing materials, including but not limited to interior of facility, dumpster area and downwind samples.

3.14.2 During the project, personnel air monitoring will be conducted by ABATEMENT CONTRACTOR to determine fiber levels. If fiber levels exceed 0.1 fibers/cc then work shall cease and not begin again until after PROJECT MONITOR approves the ABATEMENT CONTRACTOR's revised methodology which will lower fiber levels. Procedures shall be submitted in writing to the City prior to implementing these procedures. This includes Short Term Exposure Limit (STEL) air monitoring. The ABATEMENT CONTRACTOR shall install a personal pump on one of the employees working at the point where the asbestos-containing roofing materials are being cut. This air sample shall run for 30 minutes. At a minimum, ABATEMENT CONTRACTOR shall provide air monitoring for every four workers. Testing of air samples will be by Phase Contrast Microscopy following NIOSH 7400 rules.

3.14.3 If any of the ambient area samples taken by the PROJECT MONITOR either inside or outside exceed .01 fibers/cc then ABATEMENT CONTRACTOR is required to pay for the additional testing on those samples collected using transmission electron microscopy (TEM).

3.14.4 Release of the ABATEMENT CONTRACTOR from the asbestos-containing material removal phase of the contract will be accomplished by a visual inspection by the PROJECT MONITOR. Visual Clearance, performed the PROJECT MONITOR, shall include all exterior and interior areas of the facility.

3.15 PRE-TRANSPORTATION REQUIREMENTS

Any packaging used to ship hazardous waste off site such as a container, roll-off bin, tank or other device, must comply with 49 CFR Parts 173, 178, 179 and be labeled and prepared for transportation in accordance with 22 CCR Article 3. The hazardous waste label must be affixed and filled out when the first amount of hazardous waste is placed in the container. The label must include the initial accumulation date.

All additional pre-transportation labeling, marking or placarding must be conducted prior to transporting off site and in accordance with 22 CCR Chapter 12, Article 3.

All containers and tanks of hazardous waste must be managed in a way which minimizes the threat of fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste to the air, soil or surface water which could threaten human health or the environment.

Management techniques include containment areas capable of holding the contents of largest container within the containment area. Properly store and secure waste at all times. Do not leave hazardous waste in uncovered or unlocked trucks or dumpsters.

3.16 TRANSPORTATION AND DISPOSAL

A hazardous waste manifest will be completed in accordance with 22 CCR Chapter 12, Article 2 for each shipment of hazardous waste leaving the work site. All waste shall leave the project site by the end of the project. Only The Project Monitor employees shall sign as the generator on manifests.

APPENDIX A

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME: _____ DATE: _____
PROJECT ADDRESS: _____
CONTRACTOR'S NAME: _____

Working with lead can be dangerous. Inhaling and ingesting lead dust can cause an increase in blood lead levels which can lead to adverse health effects such as kidney damage, elevated blood pressure or infertility.

Your employer's contract with the City for the above project requires that: You be supplied with the proper respirator and be trained in its use. You be trained in safe work practices and in the use of the equipment found on the job. You receive a medical examination. These items are to have been done at no cost to you.

RESPIRATORY PROTECTION: You must have been trained in the proper use of respirators, and informed of the type respirator to be used on the above referenced project. You must be given a copy of the written respiratory protection manual issued by your employer. You must be equipped at no cost with the respirator to be used on the above project.

TRAINING COURSE: You must be an EPA certified Renovation, Repair, and Painting (RRP) Contractor or received training from an RRP contractor and be able to provide onsite documentation of training. You should have been trained in the dangers inherent in handling lead and breathing and ingesting lead dust and in proper work procedures and personal and area protective measures. The topics covered in the course must have included the following:

- Possible routes of exposure to lead
- Health hazards associated with lead
- Respiratory protection
- Use of protective equipment
- Work practices including hands on or on-the-job training
- Personal decontamination procedures
- Health and safety considerations

MEDICAL EXAMINATION: You must have had a medical examination within the past 12 months at no cost to you. This examination must have included: health history, physical examination, a blood pressure measurement, pulmonary function test and blood sample and analysis for lead.

By signing this document you are acknowledging only that the City has advised you of your rights to training and protection relative to your employer, the Contractor.

Signature: _____ Social Security No.: _____

Printed Name: _____

Witness (print): _____ Witness Signature: _____

APPENDIX B

CERTIFICATION OF VISUAL INSPECTION

Project #_____ Date:_____ Location: _____

Contractor: _____

The contractor hereby certifies that he/she has visually inspected the Work Area (all surfaces including pipes, counters, ledges, walls, ceiling and floor, behind critical barriers, sheet plastic, etc.) and has found no dust, debris or residue.

by: (Signature):_____ Date:_____

(Print Name): _____

(Company Name):_____

(Print Title): _____

CITY ALMP REPRESENTATIVE

The City ALMP Representative hereby certifies that he has accompanied the contractor on his/her visual inspection and verifies that this inspection has been thorough and to the best of his/her knowledge and belief, the contractor's certification above is a true and honest one.

by: (Signature):_____ Date:_____

(Print Name): _____

WORK AREA

Location: _____

Room: _____

Hazard Reduction Performed:

_____

_____

APPENDIX C

SUMMARY OF ASBESTOS RESULTS

Asbestos Sampling Results:

BROWN FIELD ASBESTOS CONTAINING MATERIALS			
SAMPLE #	**LOCATION**	**MATERIAL/QUANTITY**	**ASBESTOS %**
7011-002	Throughout roof at penetrations, seams and patches	Roofing Mastic/100sf	2% Chrysotile

APPENDIX K

TEMPORARY TRAILER LOCATION AT FS 19

1. Provide ASME B16.3 or ASME B16.11 threaded fittings, and ASME B16.39 threaded unions. Provide ASME B16.9 buttwelding fittings of the same material and weight as the piping in which fittings are installed; provide backing rings compatible with piping materials being butt welded. Provide ASME B16.11 socket welding fittings.

vi. Steel Pipe Unions

1. Provide ASME B16.39, Class 150, unions with threaded end connections on one side of threaded valve in steel piping systems.

vii. Steel Pipe Flanges

1. Provide ASME B16.5, Class 150 welding neck flanges. Extend bolts no less than two full threads beyond the nut with the bolts tightened to the required torque.
2. Gaskets: Provide one piece factory cut gaskets suitable for the intended service. Provide full-face gaskets for flat-face flanged joints, and ring gaskets for raised-face flanged joints.
3. Bolts: Provide ASTM A 193/A 193M, Grade B7 bolts.
4. Nuts: ASTM A 194/A 194M, Grade 7.
5. Washers: Provide steel flat circular washers under bolt heads and nuts.

viii. Dielectric Connections

1. Provide at connections between copper and ferrous metal piping materials. ASTM F 441/F 441M, Schedule 80, CPVC threaded pipe nipples, 4 inch minimum length, may be provided for dielectric connections in pipe sizes 2 inches and smaller.

ix. Valves

1. Valves shall have flanged end connections, except valves smaller than 2.5 inches may have threaded end connections with a union on one side of the valve. Solder end connections may be used for connections between copper alloy valves and copper tubing.

x. Gate Valves

1. MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-70, Class 125.

xi. Globe and Angle Valves

1. MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-85, Class 125.

xii. Check Valves

1. MSS SP-80, Class 125, swing check; except sizes 2.5 inches and larger shall conform to MSS SP-71, Class 125.

xiii. Ball Valves

1. Full port design, copper alloy body, except sizes 2.5 inches and larger shall be cast-iron body. Valves shall have two-position lever handles. Ball valves may be provided in lieu of gate valves.

xiv. Refrigerant Valves

1. ASME B31.5, and shall be copper alloy. Provide valves in each system for servicing and for isolating system components in compliance with ASHRAE 15 & 34.

s. Piping Accessories

i. Pipe Hangers and Supports

1. Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

ii. Pipe Sleeves

1. Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide one inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

iii. Sleeves in Masonry and Concrete

1. Provide steel pipe sleeves or Schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

iv. Sleeves not in Masonry and Concrete

1. Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

v. Flexible Pipe Connectors

1. Provide flexible bronze or stainless steel piping connectors with single braid where indicated. Connectors shall be suitable for the intended service.

vi. Sight Glass and Refrigerant Drier

1. AHRI 710. Provide in refrigerant liquid piping.

vii. Escutcheon Plates

1. Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

viii. ACCESS PANELS

1. Provide factory-prefabricated and primed flush face steel access panels with frames for all concealed valves, ducts, dampers, controls, and additionally for items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced.

PART 3 EXECUTION

3.1 INSTALLATION

A. HVAC Equipment

1. Installation of HVAC equipment including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with , ASME B31.5, ASME B31.9,NFPA 70, and in compliance with the manufacturer's written installation instructions, including the following:
   a. Split-system heat pumps - installation instructions
   b. Packaged air-handling units - installation instructions
   c. Exhaust fans - installation instructions
   d. Fire dampers - installation instructions

B. Connections to Existing Systems

1. Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems.

3.2 PIPING

A. Installation of HVAC piping systems, including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.5, and ASME B31.9. Test, inspect, and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing fittings; bushings will not be permitted. Install valves with stems horizontal or above. Provide flanges or unions at valves, traps, strainers, and connections to equipment; unions are not required in copper tubing piping systems.

1. Threaded connections: Provide Teflon pipe thread paste on male threads. Do not thread metal pipe into plastic piping.
2. Pipe hangers and supports: Provide additional pipe hangers and supports at in-line water pumps and flanged valves.
3. Support plastic piping every 4 feet. Support metal piping as follows:

Nominal Pipe: Maximum Spacing (Meters)

Size (inches)	25 & under	31.4	38.1	50.8	63.5	76.2	88.9	102	127	152
Copper Tubing	1.83	2.13	2.44	2.44	2.74	3.05	3.35	3.66	3.96	4.27
Steel Pipe	2.13	2.44	2.74	3.05	3.35	3.66	3.46	4.27	4.88	5.18

Nominal Pipe: Maximum Spacing (Feet)

Size (inches)	1 & under	1.25	1.5	2	2.5	3	3.5	4	5	6
Copper Tubing	6	7	8	8	9	10	11	12	13	14
Steel Pipe	7	8	9	10	11	12	13	14	16	17

4. Cleaning of piping: Keep interior and ends of new piping and existing piping affected by Contractor's operations, cleaned of water and foreign matter during installation by using plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.
5. Demolition: Remove materials so as not to damage materials which are to remain. Replace existing work damaged by Contractor's operations with new work of same construction.
6. Tee Joints: Extracted tee joints may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to ensure a free flow joint. Braze extracted joints using a

copper phosphorous classification brazing filler metal. Soldered joints shall not be permitted.

3.3 AIR DUCTS

A. Obtain approval before applying insulation.

3.4 ADJUSTMENTS

A. Adjust controls and equipment so as to give satisfactory operation. Adjust entire water temperature control system and place in operation so that water quantities circulated are as indicated. Air duct systems shall be adjusted and balanced so that air quantities at outlets are as indicated and so that distribution from supply outlets is free from drafts and has uniform velocity over the face of each outlet.

3.5 INSTRUCTING OPERATING PERSONNEL

A. Upon completion of work and at time designated by Contracting Officer, provide services of competent technician for period of not less than one 8-hour working day for instruction of City of San Diego operating personnel in proper operation and maintenance of equipment.

3.6 FIELD QUALITY CONTROL

A. Upon completion and before final acceptance of work, test each system in service to demonstrate compliance with the contract requirements. Adjust controls and balance systems prior to final acceptance of completed systems. Test controls through every cycle of operation. Test safety controls to demonstrate performance of required function. Correct defects in work provided by Contractor and repeat tests. Furnish steam, fuel, water, electricity, instruments, connecting devices, and personnel for tests. Flush and clean piping before placing in operation. Clean equipment, piping, strainers, ducts, and filters.

1. Piping Systems Except for Refrigerant Piping
   a. Before insulating, hydrostatically test each new piping system at not less than 188 psig; except pneumatically test fuel oil storage tank and fuel piping system at not less than 5 psig for tank and 50 psig for piping. Maintain pressure for 2 hours with no leakage or reduction in gage pressure. Obtain approval before applying insulation.
2. Refrigerant Piping
   a. Perform following when field piping connections are provided.
   i. Pressure test: Test refrigerant piping using dry, oil-free nitrogen, and prove tight at 300 psig on the high side and 150 psig on the low side. Maintain pressure for 2 hours with no leakage or reduction in gage pressure.
   ii. Evacuation: Using high vacuum pump and certified micron gage, reduce absolute pressure on both sides of system simultaneously to 300 microns. After reaching this point charge system with proper refrigerant until pressure of zero psig is obtained. Repeat evacuation-charging procedure for two more cycles, totaling to three evacuation-charging

cycles. On final evacuation, secure pump and maintain 300 microns for 2 hours before charging with required final refrigerant.

3. Equipment
   a. Field Acceptance Test Plans
      i. Manufacturer's Test Plans: Within 120 calendar days after contract award, submit the following plans:
         1. Split-system heat pumps - field acceptance test plan
         2. Packaged air-handling units - field acceptance test plan
      ii. Field acceptance test plans shall developed by the equipment manufacturer detailing recommended field test procedures for that particular type and size of equipment. Field acceptance test plans developed by the installing Contractor, or the equipment sales agency furnishing the equipment, will not be acceptable.
         1. The Contracting Officer will review and approve the field acceptance test plan for each of the listed equipment prior to commencement of field testing of the equipment. The approved field acceptance test plans shall be the plan and procedures followed for the field acceptance tests of the equipment and test reporting.
      iii. Coordinated testing: Indicate in each field acceptance test plan when work required by this section requires coordination with test work required by other specification sections. Furnish test procedures for the simultaneous or integrated testing of equipment controls which interlock and interface with controls factory prewired or external controls for the equipment.
      iv. Prerequisite testing: Equipment for which performance testing is dependent upon the completion of the work, SECTION 23 0593 TESTING, ADJUSTING, AND BALANCING FOR HVAC, must have that work completed as a prerequisite to testing work under this section. Indicate in each field acceptance test plan when such prerequisite work is required.
      v. Test procedure: Indicate in each field acceptance test plan each equipment manufacturers published installation, start-up, and field acceptance test procedures. Include in each test plan a detailed step-by-step procedure for testing automatic controls provided by the manufacturer.
         1. Each test plan shall include the required test reporting forms to be completed by the Contractor's testing representatives. Procedures shall be structured to test the controls through all modes of control to confirm that the controls are performing with the intended sequence of control.
         2. Controllers shall be verified to be properly calibrated and have the proper set point to provide stable control of their respective equipment.

vi. Performance variables: Each test plan shall list performance variables that are required to be measured or tested as part of the field test.

1. Include in the listed variables performance requirements indicated on the equipment schedules on the design drawings. Manufacturer shall furnish with each test procedure a description of acceptable results that have been verified.
2. Manufacturer shall identify the acceptable limits or tolerances within which each tested performance variable shall acceptably operate.

vii. Job specific: Each test plan shall be job specific and shall address the particular item of equipment and particular conditions which exist with this contract. Generic or general preprinted test procedures are not acceptable.

viii. Specialized components: Each test plan shall include procedures for field testing and field adjusting specialized components, such as hot gas bypass control valves, or pressure valves.

b. Field Acceptance Testing

i. Equipment Requiring Test Reports: Each piece of equipment listed shall be field acceptance tested in compliance with its approved field acceptance test plan and the resulting following field acceptance test report submitted for approval:

1. Split-system heat pumps - field acceptance test report; equipment greater than 17,600 W 60,000 Btuh.
2. Packaged air-handling units - field acceptance test report; equipment greater than 944 L/S 2,000 cfm.

ii. Manufacturer's recommended testing: Conduct the manufacturer's recommend field testing in compliance with the approved test plan. Furnish a factory trained field representative authorized by and to represent the equipment manufacturer at the complete execution of the field acceptance testing.

iii. Operational test: Conduct a continuous 24 hour operational test for each item of equipment. Equipment shutdown before the test period is completed shall result in the test period being started again and run for the required duration. For the duration of the test period, compile an operational log of each item of equipment. Log required entries every two hours. Use the test report forms for logging the operational variables.

iv. Notice of tests: Conduct the manufacturer's recommended tests and the operational tests; record the required data using the approved reporting forms. Notify the Contracting Officer in writing at least 15 calendar days prior to the testing. Within 30 calendar

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Circuit and System Grounding

B. Enclosure and Equipment Grounding System

1.2 SUBMITTALS

A. Submit the following:

1. Catalog Data: Submit catalog data for grounding conductors, grounding clamps, grounding bushings, grounding bars, exothermic weld materials, and compression grounding connector materials.

1.3 REGULATORY REQUIREMENTS

A. Comply with the National Electrical Code (NEC) for components and installation.

B. Provide products that are listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) for the application and environment in which installed.

1.4 RECEIVING, STORING AND PROTECTING

A. Receive, store, and protect, and handle products according to NECA 1 Standard Practices for Good Workmanship in Electrical Construction.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Alternate products may be accepted.

2.2 GROUND ELECTRODE CABLE

A. Provide bare stranded, soft temper copper cable that conforms to ASTM B8 Standard Specification for Concentric-Lay Stranded Copper Conductors.

2.3 EQUIPMENT GROUNDING CONDUCTORS

A. Provide NRTL-listed THHN/THWN insulated copper wire.

B. Use solid grounding conductors 10 AWG and smaller where not subject to vibration or repeated flexing.

C. Use stranded grounding conductors for 8 AWG and larger.

D. Use stranded grounding conductors where subject to vibration or repeated flexing. Use stranded grounding conductors in flexible conduit at motor connections.

E. Color code grounding conductors as follows:

1. Equipment ground:
   a. Conductors 6 AWG and smaller: Green colored insulation.
   b. Conductors 4 AWG and larger: Green colored insulation or black colored insulation with 3/4 inch wide band of water and oil-resistant green plastic adhesive tape.

2.4 PIPE GROUNDING CONNECTORS

A. Provide NRTL-listed copper-alloy connectors for making cable to pipe connections.

B. Manufacturer: O-Z/Gedney "ABG" or "CG".

2.5 CONDUIT GROUNDING BUSHINGS

A. Provide NRTL-listed, galvanized malleable iron, 150 C rated insulated throat grounding bushings with lay-in type ground cable lugs.

B. Manufacturers: O-Z/Gedney Type "BLG"

2.6 EXOTHERMIC WELD GROUNDING CONNECTIONS

A. Provide molds and welding material for making exothermic weld connections.

B. In interior locations and in vaults, use low smoke emission type welding material.

C. Match mold and weld material to material types, shapes and sizes to be joined.

D. Manufacturer: ERICO Cadweld

2.7 COMPRESSION GROUNDING CONNECTIONS

A. Provide wrought copper connectors, terminals, taps, and splices for making irreversible compression grounding connections.

B. Furnish NRTL-listed grounding connectors that are suitable for direct burial and have been tested successfully according to the requirements of IEEE Std. 837 IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

C. Provide connector manufacturer's hydraulic compression tools and dies that match the connectors.

D. Match connector and die size to material shapes and conductor sizes to be joined.

E. Use two-hole heavy-duty compression lugs for bolted connections to ground bars, ground plates, and equipment ground pads.

F. Manufacturer: Burndy "Hyground"

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work of other trades likely to damage grounding and bonding material has been completed.

B. Verify that field measurements are as shown on Drawings.

C. Electrode locations and grounding cable routing shown on Drawings are approximate unless dimensioned.

1. Install electrodes and route cable as required meeting project conditions.
2. Where electrode location or cable routing is not shown, and destination only is indicated, determine exact locations, routing, and lengths required to meet project conditions.

3.2 PREPARATION

A. Examine equipment and building finishes that are to receive grounding and bonding material for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 EXISTING WORK

A. Remove exposed abandoned grounding and bonding material, including that abandoned above accessible ceiling finishes. Patch surfaces where grounding and bonding materials are removed.

B. Disconnect abandoned grounding and bonding systems and remove.

C. Provide access to existing grounding and bonding connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing grounding and bonding systems using materials and methods specified.

3.4 GENERAL

A. Comply with the requirements of the NEC, this section and the drawings.

B. Install grounding and bonding material according to manufacturer's instructions. Have the manufacturer's installation instructions available at the construction site.

C. Use the following connection methods unless otherwise specified or indicated on the Drawings:

1. Use exothermic weld grounding connections for underground or concealed connections of dissimilar materials.
2. Use exothermic weld or compression grounding connections for underground or concealed connections of like materials.
3. Use exothermic weld, compression, or bolted grounding connections for accessible connections.

4. Make bolted connections using bolts, nuts, flat washers, and toothed lock washers suitable for the connector and the installation environment; acceptable materials include high strength silicon bronze and 18-8 alloy stainless steel.
5. Make irreversible bolted connections using 18-8 alloy stainless steel tamper-resistant bolts and tamper-resistant nuts along with flat washers, and toothed lock washers. Tamper-resistant nuts and bolts must resist loosening with common tools; acceptable tamper-resistant fasteners include penta-head, break-away, and oval designs.

D. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B. Use a calibrated torque wrench.

E. Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Follow connector manufacturer's installation instructions and use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed.

F. Install exothermic welds in accordance with manufacturer's instructions and recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

G. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.
2. Make connections with clean bare metal at points of contact.
3. Make aluminum to steel connections with stainless steel separators and mechanical clamps.
4. Make aluminum to galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections involving dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

H. Comply with requirements in SECTION 26 0529, Hangers and Supports for Electrical Systems.

3.5 CIRCUIT AND SYSTEM GROUNDING

A. Connect the service entrance equipment ground bus to the main electrode ground bar; use ground cable as indicated on the Drawings, or not smaller than the grounding electrode conductor required by the NEC and not smaller than 4 AWG.

B. In the service entrance equipment, connect the neutral bus to the ground bus using a bonding jumper not smaller than the grounding electrode conductor required by the NEC; do not use a bonding screw for this purpose. Make no other neutral-to-ground connections on the load side of the service entrance disconnect.

C. Separately Derived Systems:
   1. Connect ground bus of first disconnecting means for separately derived systems (e.g. dry type transformers, power distribution units, generators, and uninterruptible power supplies) in the vicinity of the main electrical equipment room to the main electrode ground bar; use grounding conductor sized as shown on the Drawings or as required by the NEC.
   2. Connect ground bus of first disconnecting means for separately derived systems that are remote from the main electrical room to the nearest effectively grounded building structural steel column and the nearest effectively grounded metal water pipe; use grounding conductor sized as shown on the Drawings or as required by the NEC. Make connections at accessible locations.
   3. Connect ground bus of first disconnecting means for separately derived systems that are remote from the main electrical room to an extension of the main electrode ground bar if there is neither a nearby effectively grounded building structural steel column nor an effectively grounded metal water pipe; use grounding conductor sized as shown on the Drawings or as required by the NEC.
   4. At the first system overcurrent device or disconnecting means, connect the neutral bus to the ground bus using a bonding jumper sized as required by the NEC; do not use a bonding screw for this purpose. Make no other neutral-to-ground connections on the load side of the separately derived system disconnect.

3.6 ENCLOSURE AND EQUIPMENT GROUNDING

A. Provide permanent and effective equipment, enclosure, and raceway grounding in accordance with NEC requirements and as further specified or shown on the Drawings.

B. Provide an equipment ground bar, separate from any neutral bar, in all switchboards, panelboards, transformers, starters, disconnect switches, cabinets, etc., for grounding the enclosure and for connecting other equipment and raceway ground conductors. Make connections to the ground bar using mechanical lugs or compression lugs.

C. Make connections and couplings on metallic conduit systems wrench tight.

D. Bonding Bushings:
   1. Install bonding bushings on metallic conduit containing circuits rated 100 amperes and higher.
   2. Install bonding bushings on metallic conduits entering enclosures through concentric, eccentric or oversize knockouts.
   3. Install bonding bushings on metallic conduits that terminate to a metallic enclosure without effective electrical connection such as locknuts or threaded bushings.
   4. Bond conduit bonding bushing lug to the equipment ground bar or ground lug in switchgear, panelboards, transformers, motor control centers, starters, disconnect switches, cabinets, etc. Size bonding jumpers in accordance with the NEC.

E. Provide an insulated equipment grounding conductor for each feeder and branch circuit.
   1. Install the grounding conductor within the common conduit or raceway with the related phase and neutral conductors and connect to the grounding terminal or grounding bus in each box or cabinet.

2. Size equipment ground conductor in accordance with the NEC or as shown on the Drawings.

F. In each 15 or 20 ampere branch circuit outlet box and junction box, install a green colored washer head grounding screw with a 12 AWG equipment grounding conductor pigtail.

G. Connect receptacle grounding terminals to the equipment ground system using minimum 12 AWG equipment grounding conductor. Do not use a "self-grounding" receptacle strap as the only equipment grounding path.

3.7 FIELD QUALITY CONTROL

A. General: Perform on-site verification, certification and acceptance testing of the grounding installation during construction. Verification and testing will be witnessed by owner.

B. Before work is concealed verify and certify that the following grounding installations have been made correctly:
   1. All underground grounding installations.

C. Acceptance Testing.
   1. Perform ground-impedance measurements using the "fall-of-potential" method in accordance with IEEE 81 Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System. Use instrumentation specifically designed for ground impedance testing. Provide sufficient spacing of test electrodes so that the plotted curves flatten in the 62% area of the distance between the item under test and the current electrode. When sufficient spacing of electrodes is impractical for the "fall-of-potential" method, perform ground-impedance measurements using either the "intersecting curves method" or the "slope method", referenced in IEEE Std. 81. Investigate and correct ground resistances that exceed the following values:
      a. Service rated 50 kVA or less: as required by the NEC
      b. Service rated more than 50 kVA but less than 2500 kVA: 5 Ohms
      c. Service rated 2500 kVA or greater: 1 Ohm
   2. Test equipment ground resistances for the following items. Measure resistance between the equipment item and the Main Ground Electrode Ground Bar. Use the "two-point method" of IEEE Std. 81. Investigate and correct equipment ground resistances that exceed 0.5 ohm.
      a. Transformers
      b. Switchboards
      c. Panelboards
      d. Motors larger than 1 HP

D. Prepare test reports, certified by the testing organization, of the ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe any measures taken to improve test results.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install, hangers, supports, anchors, concrete bases, and other positive fastenings for non-structural electrical components such that gravity loads are safely transferred to the structure.

1.2 QUALITY ASSURANCE

A. Furnish and install hangers and supports that conform to the requirements of the following codes and standards:

1. NFPA 70, *National Electric Code* (NEC)
2. CEC, *California Electrical Code*
3. NECA 1, *Standard Practices for Good Workmanship in Electrical Contracting*
4. Metal Framing Manufacturers Association
   a. MFMA-4, *Metal Framing Standards Publication*
   b. MFMA-102, *Guidelines for the Use of Metal Framing*

B. Where a Nationally Recognized Testing Laboratory (NRTL) has requirements for such products, provide products that are NRTL listed and labeled for the application, installation condition, and the environment in which installed.

1.3 SUBMITTALS

A. Submit the following:

1. Catalog Data: Submit catalog data for each type of product specified. Include information substantiating equivalent corrosion resistance to zinc coated steel of alternative treatment, finish, or inherent material characteristic.
2. Test reports: Submit ICC Evaluation Service, Inc evaluation report for each post-installed concrete or masonry anchor product showing that it complies with the current edition of the IBC and the intended conditions of use.

1.4 RECEIVING, STORING AND PROTECTING

A. Receive, store, and protect, and handle products according to NECA 1.

PART 2 PRODUCTS

2.1 SUBSTITUTIONS

A. Alternate products may be accepted.

2.2 COATINGS AND MATERIALS

A. Furnish products for use indoors protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic.

B. Furnish products for use outdoors or in damp or corrosive indoor locations with hot-dip galvanized coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or material such as stainless steel with inherent corrosion resistant characteristics.

2.3 RACEWAY SUPPORTING DEVICES

A. Furnish supports as described below for the installation of raceway systems.

B. Use pressed steel, single bolt hangers to support individual RGS, IMC or EMT conduits from threaded rods or beam clamps. Manufacturer: Steel City "6H Series".

C. For individual runs of EMT up to 1-inch trade size above accessible ceilings, use spring steel conduit clips with positive snap closure. Manufacturer: ERICO CADDY "M Series".

D. Use malleable iron conduit clamps to secure individual RGS, IMC or EMT conduit runs across, parallel, or perpendicular to beams, channels and angle supports. Manufacturer: Steel City "RC, EC, and PC Series".

E. Use two-piece carbon steel riser clamps for individual vertical conduits passing through floors. Manufacturer: Kindorf "C-210 Series".

F. Use snap-on type one-hole steel straps to secure individual conduits up to 2-inch trade size to flat, dry interior surfaces. Manufacturer: T&B "1210 Series" for RGS and IMC and "4100 Series" for EMT.

G. Use one-hole malleable iron straps to secure individual conduits up to 4-inch trade size to flat, dry interior surfaces. Manufacturer: T&B "1275 Series".

H. Use one-hole malleable iron straps and conduit spacers to secure individual conduits to flat exterior or damp flat interior surfaces. Manufacturer: T&B "1275 Series" straps with 1350 Series" spacers.

I. Support multiple parallel horizontal conduits with trapeze hangers fabricated from framing channel materials specified below.

2.4 OUTLET BOX SUPPORTING DEVICES

A. Furnish pre-fabricated sheet steel brackets to support outlet boxes from metal studs in dry-wall construction.

B. Single outlet boxes: Provide brackets that are inset to allow for dry-wall ring and have a far-side support leg. Manufacturer: ERICO CADDY "H Series" or "MEB1" attached with "SMS8" low-profile self-tapping screws.

C. Multiple outlet boxes: Provide brackets that are inset to allow for dry-wall rings and span from stud to stud. Manufacturer: ERICO CADDY "RBS Series" attached with "SMS8" low-profile self-tapping screws

2.5 HANGER RODS

A. Furnish mild steel rods that conform to ASTM A 307, *Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.*

B. Furnish rods that are threaded on both ends, threaded on one end, or continuous threaded with UNC (coarse) thread pitch.

2.6 FASTENERS

A. Pre-set Concrete Inserts

1. Furnish pre-set concrete inserts as shown on the Drawings.
2. Manufacturers:
   a. Continuous inserts for wood forms: B-Line "B22I-12" or longer.
   b. Spot inserts for wood forms or metal decks: B-Line "B2500" with "N2500" nut, "B2501"

B. Post-installed Concrete Anchors

1. Furnish post-installed concrete anchors as shown on the Drawings.
2. Each post-installed anchor shall have an ICC-ES evaluation report stating that the product is compliant with the current edition of the IBC and the intended conditions of use.
3. For applications in outdoor, damp, or corrosive locations furnish stainless steel post installed anchors.
4. Furnish post-installed expansion, adhesive, and undercut anchors specified in SECTION 03 1534 Post Installed Concrete Anchor Purchase – Normal Confidence.
5. Powder-actuated threaded studs: Use zinc-plated carbon steel or stainless steel suitable for the intended service:
   a. 1/4-20 threaded stud: Manufacturer: Hilti X-W6
   b. 3/8-16 threaded stud: Manufacturer: Hilti W10
6. Concrete and masonry screw anchors: Heat-treated carbon steel. Manufacturer: Simpson Strong-Tie "Titen HD".

C. Beam Clamps: NRTL-listed, or compliant with Federal Specification WW-H-171E, or compliant with Manufacturers' Standardization Society SP-69 and SP-58.

D. Hollow Wall Anchors: All steel-spring head type toggle bolts.

2.7 FRAMING CHANNEL SYSTEMS

A. Furnish U-channel framing systems that conform to MFMA-4 and are fabricated using minimum 12-gage steel, with 9/16-inch-diameter holes, from 1-1/2 to 1-7/8 inches on center, in the surface opposite the "U" opening.

B. Furnish fittings and accessories that mate and match with U-channel and are of the same manufacturer. Use two-piece, single bolt type conduit straps on U-channel supports.

C. Manufacturers: Unistrut, B-Line, Superstrut.

2.8 FABRICATED SUPPORTING DEVICES

A. Furnish shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Furnish steel brackets fabricated from angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

PART 3 EXECUTION

3.1 GENERAL

A. Install hangers and supports according to the NEC, IBC, NECA 1, the requirements in this section and specific supporting requirements in other sections.

B. Conform to manufacturer's instructions and recommendations for selection and installation of hangers and supports.

C. Do not use wire or perforated strap for permanent supports.

D. Install flexible sections in electrical conduits and raceways where they cross expansion joints and where they connect to equipment with seismic controls or vibration isolators. Refer to SECTION 26 0533 - Raceways and Boxes for Electrical Systems.

E. Do not support conduits, boxes, raceways, etc. from ceiling suspension wires.

3.2 EXAMINATION

A. Examine surfaces to receive hangers and supports for compliance with installation tolerances and other conditions affecting performance of the system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 FASTENERS

A. Pre-set inserts: Install pre-set inserts for anchoring to reinforced concrete slabs, sides of reinforced concrete beams, and reinforced concrete walls.

B. Post-installed concrete expansion anchors: Installation and Testing and the product's ICC-ES report conditions of use.

C. Masonry screw anchors: Use in accordance with NECA 1 and the product's ICC-ES report conditions of use.

D. Powder-actuated threaded studs:

1. Use only to fasten individual conduits 2-1/2 inches trade size and smaller.
2. Install in accordance with the product's ICC-ES report conditions of use and the manufacturer's instructions using recommended tools and loads.
3. Use only in uncracked concrete or concrete masonry units.
4. Install to provide embedment as indicated on the Drawings.

E. Hollow wall anchors: Use toggle bolts in accordance with NECA 1.

F. Use wood screws for fastening to wood construction.

G. Use beam clamps or machine bolts, nuts, and washers for fastening to metal.

H. The use of lead-cinch drop in anchors is not allowed.

I. Torque threaded fasteners as recommended by the manufacturer's instructions.

3.4 RACEWAY SUPPORTS.

A. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

B. Support three or more parallel runs of horizontal raceways together on trapeze hangers.

C. Support individual horizontal raceways by separate pipe hangers.

D. Do not support conduits from ceiling suspension wires.

3.5 BOXES AND CABINETS

A. Support sheet metal boxes directly from the building structure, or by approved brackets or bar hangers, as shown on the Drawings or as required. Where bar hangers are used, attach the bar to structure on opposite sides of the box.

B. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support.

C. Install surface-mounted cabinets and panelboards as shown on the Drawings or as required.

3.6 FRAMING CHANNEL SYSTEMS

A. Select and install framing channel systems in accordance with MFMA-103.

B. Use framing channel to support electrical equipment that is mounted free of walls.

C. Use framing channel to support equipment mounted on walls that do not have sufficient strength to resist pull-out or wallowing out of equipment mounting bolts.

3.7 CONCRETE BASES

A. Install a reinforced concrete base for each piece of floor-mounted electrical equipment.

1. Form concrete equipment bases using framing lumber with form release compounds.
2. Construct concrete bases as shown on the Drawings and not less than 3.5 inches high and not less than 4 inches larger in both directions than the supported equipment.
3. Place pre-set anchors, conduits, and sleeves using the equipment manufacturer's installation template or instructions. Install post-installed anchors in accordance with FASTENERS article above.

4. Place concrete and provide a steel trowel finish on top; chamfer top edges and corners.

B. Cure concrete not less than seven days before installing equipment.

3.8 PAINTING

A. Paint hangers and supports to match finish of adjacent surfaces.

END OF SECTION 26 0529

SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Conduits and fittings

B. Outlet boxes

C. Pull and junction boxes

D. Wireway

1.2 SUBMITTALS

A. Submit the following:

1. Catalog Data: Submit catalog data describing floor boxes. Include data substantiating that materials comply with specified requirements.
2. Catalog Data: Submit catalog data describing surface metal raceway. Include data substantiating that materials comply with specified requirements.
3. Catalog Data: Submit catalog data describing wireway. Include data substantiating that materials comply with specified requirements.

1.3 QUALITY ASSURANCE

A. Comply with the *National Electrical Code* (NEC) for components and installation.

B. Provide products that are listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) for the application, installation condition, and the environment in which installed.

1.4 RECEIVING, STORING, AND PROTECTING

A. Receive, store, and protect, and handle products according to NECA 1 – *Standard Practices for Good Workmanship in Electrical Construction*.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Alternate products may be accepted substitutions will be submitted in accordance with THE WHITEBOOK.

2.2 COATINGS

A. Provide products with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic that is suitable for the environment in which the product will be installed and used.

2.3 RIGID METAL CONDUIT AND FITTINGS (RMC)

A. Furnish rigid metal conduit (RMC) that meets the requirements of UL6 – *Rigid Metal Electrical Conduit*, NEMA C80.1 – *Electrical Rigid Steel Conduit (ERSC)*.

B. Furnish zinc-plated, threaded, malleable iron fittings and conduit bodies that meet the requirements of UL514B and ANSI/NEMA FB1.

2.4 PLASTIC-COATED STEEL CONDUIT AND FITTINGS

A. Furnish PVC exterior coated, urethane interior coated, RMC or IMC that meets the requirements of NEMA RN 1 – *PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit*.

B. Use factory-fabricated elbows.

C. Furnish 40 mils PVC exterior coated, urethane interior coated, zinc-plated, threaded, malleable iron fittings and conduit bodies meeting the requirements of UL514B – *Fittings for Conduit and Outlet Boxes* and NEMA RN 1 PVC.

2.5 RIGID NON-METALLIC CONDUIT AND FITTINGS (RNC)

A. Furnish rigid non-metallic conduit (RNC) that conforms to UL651 – *Schedule 40 and 80 Rigid PVC Conduit*, NEMA TC 2 – *Electrical Plastic Tubing and Conduit*.

B. Furnish non-metallic, solvent-welded socket fittings that meet the requirements of UL514C – *Non-Metallic Fittings for Conduit and Outlet Boxes*, and NEMA TC 3 – *PVC Fittings for Use with Rigid PVC Conduit and Tubing*.

2.6 ELECTRICAL METALLIC TUBING AND FITTINGS (EMT)

A. Furnish galvanized electrical metallic tubing (EMT) that conforms to UL797 – *Electrical Metallic Tubing*, NEMA C80.3 – *Steel Electrical Metallic Tubing (EMT)*.

B. Furnish compression or set-screw type fittings that meet the requirements of UL514B – *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 – *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies*. Furnish insulated throat connectors.

2.7 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Furnish galvanized steel flexible metal conduit that meets the requirements of UL1 – *Flexible Metal Electrical Conduit.*

B. Furnish zinc-plated malleable iron fittings that meet the requirements of UL514B – *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 – *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.* Furnish insulated throat connectors.

2.8 LIQUID-TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

A. Furnish liquid-tight flexible metal conduit that meets the requirements of UL360 – *Liquid-Tight Flexible Steel Conduit, Electrical.*

B. Furnish zinc-plated malleable iron or zinc-plated steel liquid-tight fittings that meet the requirements of UL514B – *Fittings for Conduit and Outlet Boxes*, and ANSI/NEMA FB1 – *Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.* Furnish insulated throat connectors.

2.9 INSULATING BUSHINGS

A. Provide NRTL listed insulating bushings with 105 °C rated insulation.

B. Manufacturer: O-Z/Gedney, Type IB.

2.10 GROUNDING BUSHINGS

A. Provide NRTL listed, galvanized malleable iron, 150 °C rated insulated throat grounding bushings with lay-in type ground cable lugs.

B. Manufacturer: O-Z/Gedney, Type BLG.

2.11 EXPANSION FITTINGS

A. Furnish NRTL listed expansion fittings with hot dipped galvanized malleable iron body, factory installed packing and a bonding jumper.

B. Manufacturer: O-Z/Gedney, Type AX, TX or EXE with Type BJ bonding jumper.

2.12 SEALING FITTINGS

A. Furnish zinc-plated, malleable iron sealing fittings that meet the requirements of UL886 *Outlet Boxes and Fittings for Use in Hazardous Locations.*

B. Select each sealing fitting so the cross-sectional area of conductors passing through the seal is not more than 25 percent of the cross-sectional area of a rigid metal conduit of the same trade size unless the fitting is specifically identified for a higher percentage of fill.

C. Provide sealing compound specifically listed for use with the sealing fitting.

D. Manufacturer: Crouse-Hinds Type EYS, EYSX, EYD.

2.13 CORROSION PROTECTION TAPE

A. Furnish pressure-sensitive, 10 mil thick. PVC based tape for corrosion protection of metal conduit and fittings.

B. Manufacturer: 3M, Type 50.

2.14 WIREWAY

A. Provide NRTL listed, raintight type wireway with covers, elbows, tees, hangers, and fittings required for a complete system.

B. Manufacturer: Square D "Square-Duct".

2.15 OUTLET BOXES

A. Provide outlet boxes selected for specific installations using the guidance in NEMA OS 3, *Selection and Installation Guidelines for Electrical Outlet Boxes*, and the requirements of this section.

B. For dry locations provide galvanized steel outlet boxes that comply with UL Standard 514-A – *Metallic Outlet Boxes* and ANSI/NEMA OS1 – *Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports*.

1. For luminaire outlets use 4 inch x 1-1/2 inch deep octagonal boxes with fixture stud attachment as required to support luminaires.
2. For flush outlets in stud walls or above-grade cast-in-place concrete walls use 4 inch square x 1-1/2 inch deep boxes; provide deeper boxes or multiple gang boxes as required to fit devices. Provide raised device covers that match the thickness of the wallboard and the number of devices. Provide supplemental box supports to prevent movement of the box.
3. For flush outlets in above-grade masonry walls use masonry boxes with conduit knockouts. Provide boxes with depth suitable for the masonry unit size. Provide multiple gang boxes as required by the number of devices.
4. For surface outlet boxes in EMT raceway systems, use 4 inch x 2-1/8 inch deep square boxes. Provide deeper boxes or multiple gang boxes as required to fit devices. Provide square surface covers that match the installed device and have not less than two holes for securing the device to the cover.

C. For damp or wet locations and for surface-mounted RMC or IMC raceway systems, provide outlet boxes that comply with UL Standard 498 and 514, ANSI/NEMA FB1.
   1. For lighting fixture outlets use 4 inch x 2-1/16 inch deep round cast malleable iron boxes with threaded hubs.
   2. For flush or surface wall-mounted outlets, use 4-11/16 square, 2-11/16 inch deep cast malleable iron boxes with threaded hubs. Provide multiple gang boxes as required to fit devices. Provide gasketed cast malleable iron or cast copper-free aluminum covers that match the installed device and have not less than two holes for securing the device to the cover.

2.16 PULL AND JUNCTION BOXES

A. For dry locations in clean, non-contamination environments use galvanized sheet steel pull and junction boxes that comply with UL Standard 50 Type 1 and the NEC as to size and construction. Use boxes not less than 4 inches square x 1-1/2 inches deep with screw-secured covers. Provide larger boxes as required by the number and size of conduits and conductors.

B. For dry locations in dusty or possible contamination (e.g. beryllium, explosives, or uranium) environments use galvanized steel pull and junction boxes that comply with UL Standard 50 Type 12 and the NEC as to size and construction. Use boxes not less than 6 inches square x 4 inches deep with gasketed covers. Provide larger boxes as required by the number and size of conduits and conductors.

C. For damp or wet, non-corrosive locations, in conduit runs up to 3/4 inch trade size, provide 4-11/16 inches square, 2-11/16 inches deep cast malleable iron pull and junction boxes with threaded hubs and gasketed cast malleable iron or cast copper-free aluminum covers.

D. For damp or wet, non-corrosive locations, in conduit runs 1 inch trade size and larger, provide galvanized sheet-steel pull and junction boxes and covers that comply with UL 50 Type 3R.

E. For damp or wet, non-corrosive locations that are subject to hose-directed water, provide pull and junction boxes and covers that comply with UL 50 Type 4.

F. For in-ground, non-metallic, open-bottom handholes provide products that are NRTL-listed to ANSI/SCTE 77 – *Specification for Underground Enclosure Integrity*.
   1. Material: Polymer concrete.
   2. Minimum ANSI/SCTE 77 load rating:
      a. Located in sidewalks: Tier 8.
      b. Located in driveways, parking lots, and off-roadway locations: Tier 15.
   3. Size: Up to 30" x 48"
   4. Cover: Non-skid cover with stainless steel cover bolts.
   5. Identification: Permanent mark or logo on cover prominently identifying the function of the enclosure in accordance with NEC requirements.
   6. Manufacturer: Quazite "Style PC, PG, or PT"

G. Provide connection points for equipment grounding conductors in each box.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Remove all exposed abandoned raceways, including abandoned raceways above accessible ceiling finishes, to the point that non-removable building construction (e.g. concrete or masonry) covers the raceway. Cut raceways flush with non-removable building construction.

B. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

C. Cap, plug, or seal remaining raceway openings to restore the original fire rating of floors, walls, and ceilings after electrical demolition. Patch surfaces to match existing.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations.

F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.2 EXAMINATION

A. Examine surfaces to receive raceways and boxes for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 GENERAL

A. Install complete systems of raceways and boxes for wiring systems.

B. Install raceways and boxes according to NECA 1 – *Standard Practices for Good Workmanship in Electrical Construction*, NECA 101 – *Standard for Installing Steel Conduits (Rigid, IMC, EMT)*, NECA 111 – *Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)*, the NEC, the manufacturer's instructions, and requirements in this section.

C. Raceway termination points and box locations shown on the Drawings are in approximate locations unless dimensioned. Verify locations before rough-in.

D. Raceway routing is shown on the Drawings in approximate locations unless dimensioned. Coordinate routing with structure and with work of other trades. Route as required for a complete wiring system.

E. Ground and bond raceways and boxes as required in SECTION 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

F. Support raceways and boxes in accordance with the requirements the National Electrical Code, SECTION 26 0529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS.

G. Identify raceways and boxes as required in SECTION 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS.

H. Arrange raceway and boxes to maintain headroom and present neat appearance.

I. Install knockout closures in unused openings in boxes or raceways.

3.4 CONDUIT INSTALLATION

A. For low-voltage wiring systems (less than 1000 volts) use conduit materials according to the NEC and the following:

1. Outdoors - underground:
   a. Direct buried: Use RNC, plastic-coated RMC, tape-wrapped RMC, or tape-wrapped IMC. Do not use RNC where subject to physical damage. Install with 24 inches minimum cover from top of conduit to finished grade or top of paving.
   b. Concrete encased: Use RNC, plastic-coated RMC, RMC, or IMC for concrete encased underground work. Install with 24 inches minimum cover from top of encasement to finished grade or paving.
2. Outdoors - exposed: Use RMC or IMC.
3. Outdoor corrosive locations (including cooling towers): Use plastic-coated RMC and fittings.
4. Outdoors - concealed: Use RMC or IMC for concealed outdoor work. Do not use bare RMC or IMC in direct contact with earth. EMT may be used for concealed outdoor work where not in contact with earth, not encased in concrete, and where not exposed to deteriorating agents.
5. Indoors – exposed outside of designated electrical rooms or telecommunications rooms:
   a. Exposed to severe physical damage during or after installation: Use RMC or IMC.
   b. Exposed to moisture: Use RMC or IMC.
   c. Exposed to corrosives: Use plastic-coated RMC and fittings.
   d. Not exposed to deteriorating agents, and not subject to severe physical damage during or after installation: Use RMC, IMC, or EMT.
6. Indoors – concealed:
   a. Within drywall partitions and above false ceilings: Use RMC or EMT.
   b. Within masonry or cast-in-place concrete walls or floors: Use RMC.
   c. Direct-buried under building floor slabs on grade: Use RNC, plastic-coated RMC, or tape-wrapped RMC. Locate top of conduits not less than 12 inches below the bottom of the concrete slab. Install warning tape approximately 6 inches above the conduits; install multiple warning tapes above parallel conduit runs wider than 18 inches.

d. Concrete encased under building floor slabs on grade: Use RNC, plastic-coated RMC, or RMC. Locate top of concrete encasement not less than 12 inches below the bottom of the concrete slab. Install warning tape approximately 6 inches above the concrete encasement; install multiple warning tapes above concrete encasements wider than 24 inches.

7. Install flexible conduit sections where raceways cross expansion joints or seismic joints, where they are attached to parts of the structure with a potential for differential seismic displacement, and where they connect to equipment with designed anchors (seismic controls) or vibration isolators. Refer to SECTION 26 0529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS.
   a. For raceway systems from 1/2 through 1-1/4 inches, install a minimum of 2 feet of flexible conduit, maximum length as determined by the NEC.
   b. For raceway systems from 1-1/2 through 2 inches, install a minimum of 3 feet of flexible conduit, maximum length as determined by the NEC.
   c. For raceway systems larger than 2 inches, install a minimum of 4 feet of flexible conduit, maximum length as determined by the NEC.
   d. Arrange the flexible conduit sections to accommodate 4 inches of movement in all directions,
   e. Use liquidtight flexible metal conduit outdoors, in wet, damp, or corrosive indoor locations, and in mechanical rooms. Use flexible metal conduit in dry indoor locations.
   f. Install pull boxes as required to comply with the limits on conduit bends and distance between pull points in the CONDUIT INSTALLATION article of this section; count each flexible conduit section described in this article as not less than a 90-degree bend.
8. Connection to vibrating equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment) - Use a minimum of 24 inches; maximum length as determined by the NEC:
   a. Outdoors: Use liquidtight flexible metal conduit.
   b. In mechanical rooms: Use liquidtight flexible metal conduit.
   c. Wet, damp, or corrosive indoor locations: Use liquidtight flexible metal conduit.
   d. Dry indoor locations: Use flexible metal conduit.
9. Connections to luminaires: Use 3/8 inch flexible metal conduit or metal-clad cable in 6 foot maximum lengths for tap conductors to luminaires above suspended ceilings.

B. Use 3/4-inch or larger conduit to enclose multiple conductors larger than 12 AWG.

C. Conceal conduits, unless otherwise indicated on the Drawings, with finished walls, floors and ceilings. Unless otherwise indicated on the Drawings, install concealed conduits with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions.

D. Position parallel underground conduits with not less than 7-1/2 inches center-to-center separation.

E. Install expansion fittings where embedded conduits cross building expansion joints.

F. Use conduit hubs to fasten conduit to boxes in damp and wet locations.

G. Use sealing locknuts, hubs, or similar water-resistant fittings on conduits entering the top of switchgear, switchboards, motor control centers, panelboards, cabinets, pull boxes, and similar enclosures that are exposed in structures with automatic fire sprinkler systems.

H. Install insulating bushings or connectors with an insulated throat to protect conductors or cables at conduit terminations.

I. Install conduits with the following limits of bends and distance between pull points:
   1. Less than 50 ft, follow the NEC.
   2. 50 ft to 100 ft, a maximum of 3 equivalent 90 degree bends.
   3. 100 ft to 150 ft, a maximum of 2 equivalent 90 degree bends.
   4. 150 ft to 200 ft, a maximum of with 1 equivalent 90 degree bend.
   5. Over 200 ft, a straight run with no bend.

J. Stub-Up Connections:
   1. 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 or equipment pad.
   2. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor.
   3. Where equipment connections are not made under this Subcontract, install threaded insert plugs set flush with the floor.

K. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduits dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

L. Install plastic-coated RMC and fittings according to the NEC and manufacturer's instructions. Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

M. Do not use RNC 90 degree elbows larger than 2 inch trade size; use plastic-coated RMC, tape-wrapped RMC, or tape-wrapped IMC for 2-1/2 inch trade size and larger 90 degree elbows.

N. Maintain the following minimum clearances between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C):

1. 6 inches at perpendicular crossings.

2. 12 inches between parallel runs.

O. Avoid moisture traps in conduit system; provide junction boxes with drain fitting at low points in conduit system.

P. Install corrosion protection tape on metal conduits and fittings in contact with soil using half-lapped wrappings.

Q. Install grounding bushings at the following locations:
   1. At every entry to enclosures on metallic conduits containing circuits rated 100 amperes and higher.
   2. On metallic conduits entering enclosures through concentric, eccentric or oversize knockouts.
   3. On metallic conduits that terminate to a metallic enclosure without effective electrical connection such as locknuts or threaded bushings.

R. Install conduit measuring tape in empty raceways. Leave not less than 12 inches of slack at each end of the tape. Secure each end of tape.

3.5 FIRESTOPPING

A. Install an NRTL approved firestop system at each electrical penetration in a fire-rated wall, floor, or partition.

B. At least 2 days prior to firestopping installation, notify the owner so that arrangements can be made for inspection during installation.

3.6 OUTLET BOX INSTALLATION

A. Install outlet boxes with centers at the following heights unless noted otherwise on the Drawings:
   1. Receptacle, telephone and data outlets:
      a. Common Areas: 18 inches above finished floor.

B. Where the Drawings show outlets as adjacent, align outlet boxes with each other and group them symmetrically.

C. Orient boxes to accommodate wiring devices oriented as specified in SECTION 26 2726 WIRING DEVICES.

D. Install a multi-gang box where more than one device is mounted together. Do not use sectional type boxes.

E. Install box with plaster ring for single or multiple device outlets.

F. Use flush mounted outlet boxes in finished areas.
   1. Install flush outlet boxes and fittings in walls and ceilings so that front edge is flush with the finished surface. Repair broken wall or ceiling surfaces so no gaps or open spaces exceed 1/8 inch at the edge of boxes or fittings.
   2. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
   3. Do not install flush mounting boxes back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
   4. Secure flush mounting boxes to interior wall and partition studs. Accurately position to allow for surface finish thickness.

5. Install stamped steel bridges to fasten multiple flush mounting outlet boxes between studs.
6. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

G. Install adjustable steel channel fasteners for hung ceiling outlet box.

H. Do not fasten boxes to ceiling support wires or other piping systems.

I. Support boxes independently of conduit.

J. Install partitions in boxes as follows:

1. Between 277 volt devices
2. Between 277 volt light switches devices and 120 volt devices.
3. Between either 120 volt or 277 volt devices and low voltage control switches.

K. Install a blank cover plate on each outlet box in which no device is installed.

3.7 PULL AND JUNCTION BOX INSTALLATION

A. Install pull and junction boxes as shown on the Drawings and as required for splices, taps, wire pulling, and compliance with regulatory requirements.

B. Install pull boxes as required to comply with limits on conduit bends and distance between pull points in the CONDUIT INSTALLATION article of this section.

C. Install indoor pull and junction boxes in accessible locations above accessible ceilings and in unfinished spaces. Position boxes so covers can be removed. Place boxes to maintain headroom.

3.8 WIREWAY INSTALLATION

A. Install wireways at locations indicated on the Drawings.

B. Mount plumb and level.

3.9 ADJUSTING

A. Adjust flush-mounted outlets to make front flush with finished floor, wall, or ceiling material.

B. Install knockout closures in unused openings in boxes.

3.10 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

C. Repair damage to paint finishes with matching touch-up coating recommended by the manufacturer.

3.11 FIELD QUALITY CONTROL

A. Provide final protection and maintain conditions to ensure that coatings and finishes are without damage or deterioration at final inspection.

END OF SECTION 26 0533

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Component identification tags.

B. Equipment nameplates.

C. Outlet labels.

D. Wire markers.

E. Voltage markers.

F. Warning signs.

G. Working space markers.

1.2 SUBMITTALS

A. Submit the following:

1. Catalog Data: Submit manufacturer's catalog literature for each product.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.
3. Manufacturer's Installation Instructions: Submit installation instructions, indicating special procedures and installation requirements.

1.3 REGULATORY REQUIREMENTS

A. Conform to requirements of the National Electrical Code (NEC), NFPA 70E, and OSHA.

B. Conform to applicable requirements of the following ANSI Standards:

1. Z535.1 Safety Color Code.
2. Z535.2 Environmental and Facility Safety Signs.
3. Z535.3 Criteria for Safety Symbols and Labels.
4. Z535.4 Product Safety Signs and Labels.
5. Z535.5 Safety Tags and Barricade Tapes (for Temporary Hazards).

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Subcontract Documents, Shop Drawings, and manufacturer's wiring diagrams, with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Alternate products may be accepted.

2.2 COMPONENT IDENTIFICATION TAGS

A. Furnish component identification tags as specified below and identified on the Drawings to identify electrical equipment using the system designation, and equipment identification.

B. Provide component identification tags with black letters on yellow background with 2 inches by 3 inches dimensions.

C. Provide minimum 48 point size lettering.

D. Provide tags made of one of the following materials:

1. Type 1 (Indoor Applications Only):
   a. Laminated plastic adhesive tape with machine printed letters.
   b. Manufacturer: Brother, Seton, Brady.
2. Type 2:
   a. Two-ply plastic nameplate with letters engraved through yellow surface showing black core.
   b. Provide UV stabilized material for outdoor applications.
   c. Manufacturer: Seton Nameplate Corp.

2.3 EQUIPMENT NAMEPLATES

A. Furnish equipment nameplates as specified below and identified on the Drawings to indicate the following information:

1. Category I nameplates:
   a. Served by nameplates: circuit directory information including circuit number, equipment identification, and location of equipment serving the item, plus the voltage, number of phases, and number of wires.
   b. Serves nameplates: circuit directory information including circuit number, equipment identification, and location of equipment served, plus the voltage, number of phases, and number of wires.

B. Provide nameplates made of one of the following materials:

1. Type 1 (Indoor Applications Only):
   a. Laminated plastic adhesive tape with machine printed letters.
   b. Manufacturer: Brother, Seton, Brady.
2. Type 2:
   a. Two-ply plates with letters engraved through surface color showing core color.
   b. Use UV stabilized material for outdoor applications.
   c. Manufacturer: Seton Nameplate Corp.

C. Provide 10 point minimum size lettering.

D. Provide colors as follows:

1. Category I nameplates: white or black letters on blue background.

E. Dimensions shall be as follows:

1. Category I nameplates: 1 inch by 2 1/2 inch minimum.

2.4 OUTLET LABELS

A. Furnish a typewritten or machine printed label for each switch and receptacle outlet indicating circuit number, panelboard, and voltage.

B. Provide labels of the following materials:

1. Laminated plastic adhesive tape with machine printed letters.

2. Manufacturer: Brother, Seton, Brady.

C. Provide black, 10 point minimum size lettering on a white background.

2.5 WIRE MARKERS

A. Provide wire markers for power, control, instrumentation, alarm, and communication circuit wires.

B. Furnish split sleeve, heat-shrinkable sleeve, or self-laminating adhesive wire markers.

C. Locate a wire marker on each conductor at switchgear, panelboards, pull boxes, outlet and junction boxes, and each load connection.

D. Provide typewritten lettering on wire markers as follows:

1. Power and lighting circuits: as-built branch circuit or feeder circuit number.
2. Control circuits: as-built control wire number indicated on schematic and interconnection diagrams or equipment manufacturer's wiring diagrams.

E. Manufacturer: LEM Products, Inc., Brady, Panduit.

2.6 VOLTAGE MARKERS

A. Furnish voltage markers for transformers, switchgear, panelboards, starters, motor control centers, safety switches, pull boxes, cabinets, and conduits.

Provide flexible pressure sensitive vinyl markers with minimum 1 inch X 4 inches orange background and black letters.

B. Provide voltage markers with lettering indicating the highest voltage present:

1. 208Y/120 volt system: 208 VOLTS
2. 120/240 and 240 volt system: 240 VOLTS
3. 480Y/277 and 480 volt system: 480 VOLTS

C. Manufacturer: Electromark, LEM Products, Inc.

2.7 WIRING SYSTEM COLOR CODE LABELS

A. In buildings with more than one voltage system, provide wiring system color code labels on each panelboard, switchboard, switchgear, and motor control center.

B. Provide labels with black, 10-point minimum size lettering on a white background.

C. Provide information on labels as follows:

THIS BUILDING HAS MULTIPLE WIRNG SYSTEMS: **480Y/277V: BROWN, ORANGE, YELLOW, GREY** **208Y/120V: BLACK, RED, BLUE, WHITE**

D. Provide labels of the following materials:

1. Outdoor labels shall be suitable for a high-UV environment.
2. Provide machine-produced custom labels printed using a thermal transfer process:
   a. Use polyester label stock that is NRTL-recognized to UL969, *Marking and Labeling Systems*, and has a high adhesion adhesive back.
   b. Use printing ribbon recommended by the label stock manufacturer.
3. Use a suitable label-printing machine to generate labels.
4. Manufacturer: Brother, Seton, Brady.

2.8 WORKING SPACE FLOOR MARKING

A. Provide black paint and white paint to mark the NEC-required working space on the floor at electrical equipment that is likely to require examination, adjustment, servicing, or maintenance while energized.

2.9 WORKING SPACE LABELS

A. Provide labels indicating required working clearance at electrical equipment that is likely to require examination, adjustment, servicing, or maintenance while energized and it is impractical mark the NEC-required working space on the floor

B. Material:

1. Use polyester label stock that is NRTL-recognized to UL969, *Marking and Labeling Systems*, and has a high adhesion adhesive back.
2. Use printing ribbon recommended by the label stock manufacturer.

3. Use a suitable thermal transfer process label-printing machine to generate labels and enter the application-specific information
4. Outdoor labels shall be suitable for a high-UV environment.

C. Minimum dimensions: 3-1/2 x 1-1/4 inches.

D. Use the following label design:

NOTICE
Keep area in front of this electrical equipment clear for #-#/# feet. OSHA-NEC regulations.

1. Signal word: "NOTICE" in 24 point minimum white italic letters on safety blue panel.
2. Word message: 16 point minimum black or safety blue letters on white background.
   a. Word message for 120/240-volt and 208Y/120-volt equipment: "Keep area in front of this electrical equipment clear for 3 feet. OSHA-NEC regulations."
   b. Word message for 480-volt and 480Y/277-volt equipment with exposed live parts on one side of the working space and no live parts on the other side of the working space: "Keep area in front of this electrical equipment clear for 3-1/2 feet. OSHA-NEC regulations."
   c. Word message for 480-volt and 480Y/277-volt equipment with exposed live parts on both sides of the working space: "Keep area in front of this electrical equipment clear for 4 feet. OSHA-NEC regulations."

E. Manufacturer: Brother, Seton, Brady

PART 3 EXECUTION

3.1 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.

B. Install identification on unmarked existing equipment

C. Replace lost nameplates.

3.2 EXAMINATION

A. Examine surfaces to receive identification products for compliance with installation tolerances and other conditions affecting performance of the identification products. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION - GENERAL

A. Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

1. Coordinate installation of identifying devices with location of access panels and doors.
2. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Install electrical identification products only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

D. Clean surface where electrical identification product is to be placed.

E. Use manufacturer's recommended adhesive for engraved tags and nameplates.

F. Place electrical identification products centered and parallel to equipment lines.

G. Position nameplates so they can be read from floor or ground.

3.4 OUTLET LABELS

A. Install outlet label on outside of device cover for each receptacle outlet and light switch.

3.5 WIRE MARKERS

A. Install wire markers on power, control and communication conductors at each appearance in locations such as pull boxes, outlet boxes, junction boxes, panelboards, switchgear, motor control centers, controllers, safety switches, enclosed circuit breakers, and load connections.

B. Position markers so they can be read from the front of the enclosure.

3.6 VOLTAGE MARKERS

A. Install voltage markers at the following locations and position markers so they can be read from floor or ground:

1. Front and rear of each free-standing low- voltage switchgear or switchboard section.
2. Front of each low-voltage transformer, panelboard, industrial control panel, motor control center, enclosed circuit breaker, safety switch, and motor controller enclosure, including those furnished with mechanical equipment.
3. Cover of each pull box containing low-voltage conductors.
4. Each 2 inch and larger conduit longer than 6 feet; space markers not more than 20 feet on center.

3.7 WORKING SPACE FLOOR MARKERS

A. Install floor marking paint on the floor at the locations listed below to indicate the working space required by the NEC.

1. Front and rear of each free-standing low-voltage switchboard section.
2. Front of each low-voltage transformer, switchboard, panelboard, industrial control panel, enclosed circuit breaker, safety switch, and motor controller enclosure including those furnished with mechanical equipment.
3. Any other equipment likely to require examination, adjustment, servicing, or maintenance while energized.

B. Dimensions of working space area shall be as follows:

1. Width: the greater of the width of the equipment or 30 inches.
2. Depth:
   a. 120/240-volt and 208Y/120-volt equipment: 3 feet
   b. 480-volt and 480Y/277-volt equipment with exposed live parts on one side of the working space and no live parts on the other side of the working space: 3-1/2 feet.
   c. 480-volt and 480Y/277-volt equipment with exposed live parts on both sides of the working space: 4 feet.

C. Thoroughly prepare floor surface to receive paint.

D. Paint the NEC-required working space area with alternating 3 to 6 inch wide black and white diagonal stripes.

3.8 WORKING SPACE LABELS

A. Install working space labels at the following locations only in cases where it is impractical to mark the NEC-required working space on the floor (e.g. carpeted areas).

1. Front of each low-voltage or switchboard section and rear of each freestanding low-voltage switchgear or switchboard section
2. Front of each meter enclosure, low-voltage transformer, panelboard, industrial control panel, motor control center, enclosed circuit breaker, safety switch, and motor controller enclosure, including those furnished with mechanical equipment.
3. Any other equipment likely to require examination, adjustment, servicing, or maintenance while energized.

B. Position labels so they can be read from floor or ground:

END OF SECTION 26 0553

SECTION 26 0813 - ELECTRICAL ACCEPTANCE TESTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide the services of a qualified Electrical Testing Agency (ETA) to perform the functions described below:

1. Acceptance tests, inspections, and system function tests of certain electrical systems, equipment, components, and material (SSCs) installed under the scope of this Project; refer to Part 3 of this section.
2. System function tests after completion of acceptance tests on certain electrical SSCs installed under the scope of this Project.
3. The following power system studies based on the installed electrical SSCs:
   a. Arc-flash hazard analysis

1.2 REGULATORY REQUIREMENTS

A. Make inspections and tests in accordance with the following codes and standards:

1. InterNational Electrical Testing Association - NETA ATS-2009, Acceptance Testing Specifications (ANSI). NETA ATS forms a part of this specification to the extent referenced.
2. National Fire Protection Association – NFPA
   a. NFPA 70: *National Electrical Code* (ANSI) (NEC)
   b. NFPA 70B: *Recommended Practice for Electrical Equipment Maintenance* (ANSI)
   c. NFPA 70E: *Standard for Electrical Safety in the Workplace* (ANSI).
3. Institute of Electrical and Electronics Engineers - IEEE
   a. IEEE Std 399: *IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis*
   b. IEEE Std 1584: *IEEE Guide for Performing Arc-Flash Hazard Calculations*

1.3 QUALITY ASSURANCE

A. The ETA shall be an independent testing organization which shall function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of the equipment or systems to be evaluated.

B. The ETA shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

C. The ETA shall have a documented quality assurance program, documented inspection and test and procedures, and a documented electrical safety program.

D. The ETA shall have successfully completed not less than three acceptance testing, inspection and calibration projects of similar scope to this project.

E. The ETA shall have a calibration program, and test instruments used shall be calibrated in accordance with NETA ATS.

F. Each ETA technician performing testing, inspection, calibration, and adjustments shall be a "qualified person" as defined by NFPA 70E and the NEC.

1. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated.
2. Technicians shall be capable of conducting the tests in a safe manner with complete knowledge of the hazards involved and the appropriate safety-related work practices.
3. Technicians shall be qualified to evaluate the test data and make a judgment on the serviceability of the specific equipment.

G. Final Walk Thru All manuals and training on all electrical system will be done at this time, which includes, but not limited to: testing of time clocks and exhaust fans. Provide one set of blue prints, spec book, and submittals:

1.4 SUBMITTALS

A. Submit the following:

1. Certifications: Submit name and qualifications of the ETA.
2. Certifications: Submit quality assurance program of the ETA.
3. Certifications: Submit instrument calibration program of the ETA.
4. Certifications: Submit electrical safety program of the ETA.
5. Certifications: Submit name and qualifications of the lead engineer or engineering technician performing the required testing services. Include a list of three comparable jobs performed by the individual with specific names and telephone numbers for reference.
6. Calculations: Submit certified copies of power system studies listed below. Calculations shall include certification of compliance with specified requirements, identify deficiencies, and recommend corrective action when appropriate. Type and neatly bind Calculations to form a part of the final record. Submit power system studies in paper format and also in electronic format transmitted on a CD-ROM.
   a. Arc-flash hazard analysis

1.5 COORDINATION

A. Schedule the project to allow adequate time for electrical acceptance testing BEFORE equipment or system is energized.

1. Notify the ETA when equipment becomes available for studies.

B. Notify the owner at least 14 days in advance scheduled acceptance tests, inspections, and system function tests.

1. Notify the owner again approximately 24 hours before start of testing.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.1 GENERAL

A. Perform the installation insulation-resistance, continuity, and rotation tests for electrical SSCs described in each section of these Specifications before, and in addition to, tests performed by the ETA that are specified in this section.

B. Supply suitable and stable electrical power, adequate lighting, and heating or ventilation as required at each test site for the ETA to perform the specified acceptance testing.

C. Supply one set of the following to ETA prior to the performance of any final testing:

1. Complete set of electrical Drawings, Specifications, and any pertinent Change Orders
2. Approved construction submittal documents for material and equipment
3. Site specific hazard notification and safety training.
4. Other information necessary for a safe and accurate test and inspection of the system.

3.2 POWER SYSTEM STUDIES

A. The ETA shall provide power system studies described below based on the installed electrical distribution system and equipment in accordance with procedures described in NETA-ATS and the referenced codes and standards.

1. Include in the study the effect of all portions of the electrical distribution system including alternate sources of power.
2. Address normal system operating configuration plus any plausible alternate configurations and operations that could result in maximum fault condition.

B. Arc-Flash Hazard Analysis. Perform arc-flash hazard analysis and shock hazard analyses based on the final short-circuit study and the final coordination study. Use procedures outlined in IEEE Std 1584 and NFPA 70E. Provide the following information in tabular form for the arc-flash warning labels described in SECTION 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS:

1. Flash hazard boundary (inches) calculated in accordance with IEEE Std 1584 or NFPA 70E.
2. Arc-flash incident energy (cal/cm^2) calculated in accordance with IEEE Std 1584 or NFPA 70E.
3. Working distance (inches) selected from IEEE Std 1584 or NFPA 70E (Annex D) based on equipment type.
4. Hazard/risk category number from NFPA 70E Table 130.7(C)(9) for operations with doors closed and covers on
5. System phase-to-phase voltage
6. Condition that exposes worker to electrical shock hazard
7. Limited Approach Boundary from NFPA 70E Table 130.2(C) based on nominal system phase-to-phase voltage.
8. Restricted Approach Boundary from NFPA 70E Table 130.2(C) based on nominal system phase-to-phase voltage.

9. Prohibited Approach Boundary from NFPA 70E Table 130.2(C) based on nominal system phase-to-phase voltage.
10. Class for insulating gloves based on system voltage (e.g. Class 00 for up to 500 volts).
11. Voltage rating for insulated or insulating tools based on system voltage (e.g. 1000 volts).
12. Equipment ID code based on Drawings and including TA number, building number, and system identifier.
13. Date that hazard analysis was performed.
14. "Served from" circuit directory information including the serving equipment ID code, location (e.g. room number), circuit number, and circuit voltage/phases/wires.
15. If applicable, "serves" circuit directory information including the served equipment ID code, location (e.g. room number), circuit number, and circuit voltage/phases/wires.

3.3 TEST REPORT

A. The ETA shall include the following information in the final test report:

1. Summary of project.
2. Description of equipment inspected and tested.
3. Description of inspections.
4. Data record resulting from each inspection.
5. Power system studies.
6. Analysis and identification of deficiencies, and recommendations for corrective action.

3.4 FIELD QUALITY CONTROL

A. Report to the owner, within three working days, any SSC or construction that is found defective based on inspections by the ETA.

B. Within 15 days of direction from the owner, rework, repair or replace any SSC or construction that is found defective based on acceptance tests or inspections.

C. The ETA shall retest any SSC or construction that did not pass acceptance tests or inspections.

END OF SECTION 26 0813

SECTION 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. Receptacles
2. Snap switches
3. Wall plates
4. Multi-outlet assemblies

1.2 SUBMITTALS

A. Submit the following:

1. Product Data

1.3 QUALITY ASSURANCE

A. Comply with the *National Electrical Code* (NEC).

B. Furnish products listed and labeled by a nationally recognized testing laboratory (NRTL) for the application, installation condition, and the environments in which installed.

C. Manufacturers of products addressed in this section shall maintain an ISO 9001 certification.

1.4 RECEIVING, STORING, AND PROTECTING

A. Receive, store, and protect, and handle products according to NECA 1, *Standard Practices for Good Workmanship in Electrical Construction*.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Alternate products may be accepted.

2.2 RECEPTACLES

A. Provide back and side wired, screw pressure terminal, straight-blade and locking type, receptacles as indicated on the drawings. Receptacles shall meet the performance and design requirements of Federal Specification WC596 and UL Standard 498, *Electrical Attachment Plugs and Receptacles*. Receptacle configurations shall be in accordance with NEMA WD 6.

B. For 120 volt convenience receptacles connected to general purpose branch circuits provide straight-blade NEMA 5-15R, 15 amperes, 125 volts, grounding

duplex receptacles. Receptacle mounting strap, ground terminal, and ground contacts shall be formed from one piece of brass alloy. Manufacturer: Hubbell "HBL5262".

C. For 120 volt receptacles connected to individual branch circuits provide straight-blade NEMA 5-20R, 20 amperes, 125 volts, grounding duplex receptacles. Receptacle mounting strap, ground terminal, and ground contacts shall be formed from one piece of brass alloy. Manufacturer: Hubbell "HBL5362".

D. For ground fault circuit interrupter (GFCI) receptacles provide straight-blade NEMA 5-15R, 15 amperes, 125 volts, grounding, "feed through" type, self-testing GFCI, duplex receptacle that meet the requirements of UL Standard 943, *Ground Fault Circuit Interrupters*. Provide units that can be installed in a 2-3/4-inch deep outlet box without an adapter. Manufacturer: Hubbell "GFR5252ST."

E. For ground fault circuit interrupter (GFCI) receptacles connected to individual branch circuits provide straight-blade NEMA 5-20R, 20 amperes, 125 volts, grounding, "feed through" type, self-testing GFCI, duplex receptacle that meet the requirements of UL Standard 943, *Ground Fault Circuit Interrupters*. Provide units that can be installed in a 2-3/4-inch deep outlet box without an adapter. Manufacturer: Hubbell "GFR5352ST."

2.3 SNAP SWITCHES

A. Provide single pole, double pole, three-way, four-way and illuminated handle snap switches as indicated on the Drawings.

B. Switches shall be rated 20 amperes, 120-277 volts AC, back and side wired, screw pressure terminal, quiet type AC switch with yoke grounding screw. Switches shall meet the performance and design requirements of UL Standard 20, *General Use Snap Switches*, and Federal Specification WS896.

C. Manufacturer: Hubbell "HBL1220" series

2.4 WALL PLATES

A. For flush mounted interior receptacles and wall switches, provide 0.032 inch thick (minimum) brushed 302/304 alloy stainless steel smooth wall plates that meet the requirements of Federal Specification WP-455A. Manufacturer: Hubbell "S" series.

B. For surface mounted interior receptacles and switches, furnish galvanized steel 4 inch square raised surface covers. Receptacles installed in raised covers shall be secured by more than one screw. Manufacturer: RACO "800" series.

C. For GFCI receptacles in damp locations provide weatherproof, cast aluminum, hinged, self-closing device covers. Manufacturer: Hubbell "WP26" or "WPFS26"

D. For GFCI receptacles in wet locations provide cast aluminum, hinged, self-closing device covers that are weatherproof whether or not the attachment plug cap is inserted. Manufacturer: Hubbell "WP26M" or "WP26MH"

E. Provide single, multi-gang, and combination type wall plates that mate and match with corresponding wiring devices.

F. Use metal plate-securing screws to match plate finish.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify outlet boxes are installed at proper locations and heights.

B. Verify wall openings are neatly cut and will be completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

D. Clean debris from outlet boxes before installing devices.

3.2 INSTALLATION

A. Install products following manufacturer's instructions. Have the manufacturer's installation instructions available at the construction site.

B. Install devices plumb, level, and secure.

C. Except as otherwise indicated on the Drawings, mount devices flush, with long dimension vertical, and grounding point of receptacles on top. Group adjacent switches and receptacles under single, multi-gang wall plates.

D. Do not use the duplex/split-wire break-off tabs in receptacles as circuit conductors for connecting downstream devices.

E. Cover devices and assemblies during painting.

F. Install wall plates on switch, receptacle, and blank outlets after painting is complete.

G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.3 GROUNDING

A. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

B. Connect isolated ground receptacle grounding terminal to the isolated grounding conductor.

3.4 IDENTIFICATION

A. Identify wiring devices with circuit number as required in SECTION 26 0553, IDENTIFICATION FOR ELECTRICAL SYSTEMS.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects before installing.

B. Operate each operable device at least six times with circuit energized; verify proper operation.

C. Test 15 and 20 ampere receptacles for proper polarity and ground continuity using an NRTL listed test device that impresses a momentary current of at least 15 amperes on the branch circuit conductors and equipment grounding path.

D. Test ground-fault circuit interrupter receptacle operation with both local and remote fault simulations according to manufacturer recommendations.

1. Verify that GFCI will trip at 5 ±1 mA current
2. Verify that GFCI does not trip at less than 1.8 mA current.

E. Replace damaged or defective wiring devices.

3.6 CLEANING AND ADJUSTING

A. Clean devices and wall plates. Replace stained or improperly painted wall plates or devices.

B. Adjust devices and wall plates to be flush and level.

END OF SECTION 26 0726

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Safety switches

B. Fuses

C. Enclosed circuit breakers

1.2 SUBMITTALS

A. Submit the following in accordance with project submittal procedures:

1. Product Data: Submit manufacturer's technical data for each type of safety switch and enclosed circuit breaker, including data proving that materials comply with specified requirements. Provide catalog sheets showing voltage and current ratings, short circuit ratings, dimensions, and enclosure details.

2. Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.3 QUALITY ASSURANCE

A. Comply with the *National Electrical Code* (NEC) for components and installation.

B. Provide safety switches and circuit breakers that are listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) for the application, installation condition, and the environment in which installed.

C. Comply with the following standards as applicable:

1. NEMA AB 3 – *Molded Case Circuit Breakers and Their Application*
2. NEMA FU 1 *Low Voltage Cartridge Fuses*
3. NEMA KS 1 - *Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)*
4. UL 50 - *Enclosures for Electrical Equipment.*
5. UL 489 – *Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures*

1.4 RECEIVING, STORING AND PROTECTING

A. Receive, inspect, handle, and store safety switches and enclosed circuit breakers according to the manufacturer's written instructions and NECA 1 *Standard Practices for Good Workmanship in Electrical Construction* (ANSI).

1.5 SERVICE CONDITIONS

A. Provide safety switches and enclosed circuit breakers that will perform satisfactorily in the following service conditions:

1. Maximum ambient temperature of 104 °F.
2. 24-hour average temperature not exceeding 86 °F.
3. Maximum solar heat gain: 110 W/sq/ft.
4. International Building Code / ASCE 7 seismic criteria:
   a. Seismic Design Category = D
   b. S_{DS} = spectral acceleration, short period = 0.75g
   c. S_{D1} = spectral acceleration, 1-second period = 0.64g
   d. a_p = component amplification factor = 2.5
   e. R_p = component response modification factor = 6.0

1.6 EXTRA MATERIALS

A. Provide one spray can of touch-up paint that matches finish of switches and enclosed circuit breakers finish.

B. Provide a spare set of three fuses of each type and size installed in fused safety switches.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Alternate products may be accepted.

2.2 SAFETY SWITCHES

A. Provide NRTL-listed, NEMA KS 1 Type HD safety switches with ratings and number of poles as indicated on the Drawings or as required by the NEC.

B. Safety switches used as service equipment shall be NRTL labeled for the application.

C. Enclosure type shall be in accordance with NEMA KS 1 and as required by the conditions of installation and use.

D. Fusible safety switches shall have rejection clips for NEMA FU 1, Class R fuses. Provide fuse pullers in 30, 60, and 100 ampere fusible safety switches.

E. Each safety switch shall have an equipment ground bar.

F. Furnish a neutral bar for each safety switch used on a circuit that includes a grounded "neutral" conductor.

G. Each safety switch shall have a factory-installed cover-mounted viewing window positioned over the blades to allow visual verification of ON-OFF status.

H. Provide auxiliary electrical interlock switches with safety switches as indicated on the Drawings or as required by the application.

I. Each safety switch shall have provisions for padlocking in the OFF position.

J. Manufacturer: Square D "Class 3110".

2.3 FUSES

A. Provide NRTL-listed, NEMA FU 1 Class R fuses for fusible safety switches as indicated on the Drawings, required by the NEC, or required by the manufacturer of served equipment.

B. Size fuses in accordance with NEC requirements based upon load supplied.

C. Provide a cabinet for spare fuses.

D. Manufacturer: Bussman "LPN-RK_SP" (250 V), "LPS-RK_SP" (600 V), and "SFC-FUSE-CAB"

2.4 ENCLOSED CIRCUIT BREAKERS

A. Provide, enclosed molded-case circuit breakers with ratings as indicated on the Drawings or as required by the NEC.

B. Enclosed molded-case circuit breakers shall be NRTL-listed to UL 489.

C. Multi-pole circuit breakers used on 480-volt or 480Y/277-volt systems shall be 600 V rated.

D. Enclosed circuit breakers used as service equipment shall be NRTL labeled for the application.

E. Enclosure type shall be in accordance with UL-50 and as required by the conditions of installation and use.

F. Each enclosed circuit breaker shall have an equipment ground bar.

G. Furnish a neutral bar for each enclosed circuit breaker used on a circuit that includes a grounded "neutral" conductor.

H. Enclosed circuit breakers rated 100 amperes and larger shall be suitable for use with crimp-on compression lugs.

I. Each enclosed circuit breaker shall have a permanently-installed provision for padlocking in the OFF position.

   1. Furnish handle lock-off device that will accept a 1/4-inch padlock shackle.
   2. Securely attach the device to the circuit breaker case; the attachment shall not depend on a friction fit or the presence of the enclosure front for the handle lock-off device to remain in place and be functional.

J. Manufacturer: Square D "Class 610" enclosure with F, K, L, or M frame circuit breaker.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove each abandoned safety switch and enclosed circuit breaker.

B. Maintain access to each existing safety switch and enclosed circuit breaker that is to remain active.

C. Clean, repair, and test existing safety switches and enclosed circuit breakers to remain or be reinstalled for the project per the Field Quality Control paragraphs of this section.

3.2 EXAMINATION

A. Examine surfaces to receive safety switches and enclosed circuit breakers for compliance with installation tolerances and other conditions affecting performance of the product. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install safety switches and enclosed circuit breakers where indicated on the Drawings and according to manufacturer's instructions, NECA 1, and the *NEC*. Have the manufacturer's installation instructions available at the construction site.

B. Install each safety switch and enclosed circuit breaker so the interlock bypass will be accessible.

C. Provide supports and seismic anchorage in accordance with the manufacturer's installation instructions and SECTION 26 0529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS.

D. Ground and bond safety switches and enclosed circuit breakers as required in SECTION 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

E. Install conduits as required in SECTION 26 0533 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.

F. Install conductors as required in SECTION 26 0519 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

   1. Use compression type lugs to connect all service, feeder, and branch circuit cables to enclosed circuit breakers rated greater than 100 amperes.
   2. Tighten electrical connectors and terminals to the manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

G. Install fuses in fusible safety switches as indicated on the Drawings or as required to match installed motor or load characteristics. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.4 IDENTIFICATION

A. Identify safety switches and enclosed circuit breakers and install warning signs and arc-flash warning labels as required in SECTION 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS.

B. Provide permanent indication of trip rating of each enclosed circuit breaker or fuses installed in each enclosed switch that will be visible without opening cover and exposing energized conductors.

C. Mark floor in front of safety switches and enclosed circuit breakers to show NEC required working space according to SECTION 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS.

3.5 FIELD QUALITY CONTROL

A. Clean interior and exterior of safety switches and enclosed circuit breakers.

B. Verify that ratings for safety switches and enclosed circuit breakers match values indicated on the Drawings.

C. Verify proper torque of accessible bus connections and mechanical fasteners after installing safety switches and enclosed circuit breakers.

D. After completing installation, cleaning, and testing, touch up scratches and mars on finish to match original finish.

END OF SECTION 26 2816

SUPPLEMENTARY SPECIAL PROVISIONS

APPENDICES

APPENDIX A

NOTICE OF EXEMPTIONS

NOTICE OF EXEMPTION

(Check one or both)

TO: __X__ RECORDER/COUNTY CLERK
P.O. BOX 1750, MS A-33
1600 PACIFIC HWY, ROOM 260
SAN DIEGO, CA 92101-2422

_____ OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET, ROOM 121
SACRAMENTO, CA 95814

FROM: CITY OF SAN DIEGO
DEVELOPMENT SERVICES DEPARTMENT
1222 FIRST AVENUE, MS 501
SAN DIEGO, CA 92101

PROJECT NO.: WBS # B-13189

PROJECT TITLE: Fire Station 14 Roof & HVAC Replacement

PROJECT LOCATION-SPECIFIC: The project is located at 4011 32nd Street in Greater North Park.

PROJECT LOCATION-CITY/COUNTY: San Diego/San Diego

DESCRIPTION OF NATURE AND PURPOSE OF THE PROJECT: The project proposes to replace the flat portion of the existing roof (less than 20% of total roof area), make spot repairs to sloped area of existing roof, and provide a new HVAC system at an existing fire station, which was built in 1992. Scope of work also includes mechanical, plumbing, and electrical upgrades associated with HVAC, all of which will be located within the existing structure. No expansion or changes to the building footprint or site are proposed.

NAME OF PUBLIC AGENCY APPROVING PROJECT: City of San Diego

NAME OF PERSON OR AGENCY CARRYING OUT PROJECT: City of San Diego, E&CP Dept/Joe Diab
525 B Street, Suite 750 (MS 908A)
San Diego, CA 92101
(619) 533-4615

EXEMPT STATUS: (CHECK ONE)

( ) MINISTERIAL (SEC. 21080(b)(1); 15268);
( ) DECLARED EMERGENCY (SEC. 21080(b)(3); 15269(a));
( ) EMERGENCY PROJECT (SEC. 21080(b)(4); 15269 (b)(c)
(X) CATEGORICAL EXEMPTION: 15301(A) (EXISTING FACILITIES)

REASONS WHY PROJECT IS EXEMPT: The City of San Diego conducted an environmental review which determined the repair and improvements for this project qualifies for State CEQA Guideline § 15301(a), "Existing Facilities," which allows for minor alteration of existing public structures, facilities, or mechanical equipment, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination. This project does not trigger any of the exceptions to categorical exemptions found in State CEQA Guideline § 15300.2.

LEAD AGENCY CONTACT PERSON: JEFF SZYMANSKI

TELEPHONE: (619) 446-3402

IF FILED BY APPLICANT:

1. ATTACH CERTIFIED DOCUMENT OF EXEMPTION FINDING.
2. HAS A NOTICE OF EXEMPTION BEEN FILED BY THE PUBLIC AGENCY APPROVING THE PROJECT?
   ( ) YES ( ) NO

IT IS HEREBY CERTIFIED THAT THE CITY OF SAN DIEGO HAS DETERMINED THE ABOVE ACTIVITY TO BE EXEMPT FROM CEQA

SENIOR PLANNER

SIGNATURE/TITLE

6/10/14

DATE

CHECK ONE:

(X) SIGNED BY LEAD AGENCY

DATE RECEIVED FOR FILING WITH COUNTY CLERK OR OPR:

NOTICE OF EXEMPTION

(Check one or both)

TO: __X__ RECORDER/COUNTY CLERK
P.O. BOX 1750, MS A-33
1600 PACIFIC HWY, ROOM 260
SAN DIEGO, CA 92101-2422

_____ OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET, ROOM 121
SACRAMENTO, CA 95814

FROM: CITY OF SAN DIEGO
DEVELOPMENT SERVICES DEPARTMENT
1222 FIRST AVENUE, MS 501
SAN DIEGO, CA 92101

PROJECT NO.: WBS # B-13190

PROJECT TITLE: Fire Station 19 Roof & HVAC Replacement

PROJECT LOCATION-SPECIFIC: The project is located at 3434 Ocean View Boulevard in Southeastern San Diego.

PROJECT LOCATION-CITY/COUNTY: San Diego/San Diego

DESCRIPTION OF NATURE AND PURPOSE OF THE PROJECT: The project proposes to replace the flat portion of the existing roof and provide a new HVAC system at an existing fire station, which was built in 1986. The flat portion being replaced composes approximately half of the total roof area, and is located to the interior of the sloped areas. Scope of work also includes mechanical, plumbing, and electrical upgrades associated with HVAC, all of which will be located within the existing structure. No changes to the building footprint or site are proposed.

NAME OF PUBLIC AGENCY APPROVING PROJECT: City of San Diego

NAME OF PERSON OR AGENCY CARRYING OUT PROJECT: City of San Diego, E&CP Dept/Joe Diab
525 B Street, Suite 750 (MS 908A)
San Diego, CA 92101
(619) 533-4615

EXEMPT STATUS: (CHECK ONE)

( ) MINISTERIAL (SEC. 21080(b)(1); 15268);
( ) DECLARED EMERGENCY (SEC. 21080(b)(3); 15269(a));
( ) EMERGENCY PROJECT (SEC. 21080(b)(4); 15269 (b)(c)
(X) CATEGORICAL EXEMPTION: 15301(A) (EXISTING FACILITIES)

REASONS WHY PROJECT IS EXEMPT: The City of San Diego conducted an environmental review which determined that the improvements for this project qualifies for State CEQA Guideline § 15301(a), "Existing Facilities," which allows for minor alteration of existing public structures, facilities, or mechanical equipment, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination. This project does not trigger any of the exceptions to categorical exemptions found in State CEQA Guideline § 15300.2.

LEAD AGENCY CONTACT PERSON: Jeff Szymanski

TELEPHONE: (619) 446-4324

IF FILED BY APPLICANT:

1. ATTACH CERTIFIED DOCUMENT OF EXEMPTION FINDING.
2. HAS A NOTICE OF EXEMPTION BEEN FILED BY THE PUBLIC AGENCY APPROVING THE PROJECT?
   ( ) YES ( ) NO

IT IS HEREBY CERTIFIED THAT THE CITY OF SAN DIEGO HAS DETERMINED THE ABOVE ACTIVITY TO BE EXEMPT FROM CEQA

Jeff Sz / SENIOR PLANNER

SIGNATURE/TITLE

6/10/14

DATE

CHECK ONE:
(X) SIGNED BY LEAD AGENCY

DATE RECEIVED FOR FILING WITH COUNTY CLERK OR OPR:

APPENDIX B

FIRE HYDRANT METER PROGRAM

CITY OF SAN DIEGO CALIFORNIA DEPARTMENT INSTRUCTIONS	NUMBER DI 55.27	DEPARTMENT Water Department
SUBJECT FIRE HYDRANT METER PROGRAM (FORMERLY: CONSTRUCTION METER PROGRAM)	PAGE 1OF 10	EFFECTIVE DATE October 15, 2002
	SUPERSEDES DI 55.27	DATED April 21, 2000

1. **PURPOSE**

1.1 To establish a Departmental policy and procedure for issuance, proper usage and charges for fire hydrant meters.

2. **AUTHORITY**

2.1 All authorities and references shall be current versions and revisions.

2.2 San Diego Municipal Code (NC) Chapter VI, Article 7, Sections 67.14 and 67.15

2.3 Code of Federal Regulations, Safe Drinking Water Act of 1986

2.4 California Code of Regulations, Titles 17 and 22

2.5 California State Penal Code, Section 498B.0

2.6 State of California Water Code, Section 110, 500-6, and 520-23

2.7 Water Department Director

Reference

2.8 State of California Guidance Manual for Cross Connection Programs

2.9 American Water Works Association Manual M-14, Recommended Practice for Backflow Prevention

2.10 American Water Works Association Standards for Water Meters

2.11 U.S.C. Foundation for Cross Connection Control and Hydraulic Research Manual

3. **DEFINITIONS**

3.1 **Fire Hydrant Meter:** A portable water meter which is connected to a fire hydrant for the purpose of temporary use. (These meters are sometimes referred to as Construction Meters.)

3.2 **Temporary Water Use:** Water provided to the customer for no longer than twelve (12) months.

3.3 **Backflow Preventor:** A Reduced Pressure Principal Assembly connected to the outlet side of a Fire Hydrant Meter.

4. **POLICY**

4.1 The Water Department shall collect a deposit from every customer requiring a fire hydrant meter and appurtenances prior to providing the meter and appurtenances (see Section 7.1 regarding the Fees and Deposit Schedule). The deposit is refundable upon the termination of use and return of equipment and appurtenances in good working condition.

4.2 Fire hydrant meters will have a 2 ½" swivel connection between the meter and fire hydrant. The meter shall not be connected to the 4" port on the hydrant. All Fire Hydrant Meters issued shall have a Reduced Pressure Principle Assembly (RP) as part of the installation. Spanner wrenches are the only tool allowed to turn on water at the fire hydrant.

4.3 The use of private hydrant meters on City hydrants is prohibited, with exceptions as noted below. All private fire hydrant meters are to be phased out of the City of San Diego. All customers who wish to continue to use their own fire hydrant meters must adhere to the following conditions:

a. Meters shall meet all City specifications and American Water Works Association (AWWA) standards.

b. Customers currently using private fire hydrant meters in the City of San Diego water system will be allowed to continue using the meter under the following conditions:

1. The customer must submit a current certificate of accuracy and calibration results for private meters and private backflows annually to the City of San Diego, Water Department, Meter Shop.

2. The meter must be properly identifiable with a clearly labeled serial number on the body of the fire hydrant meter. The serial number shall be plainly stamped on the register lid and the main casing. Serial numbers shall be visible from the top of the meter casing and the numbers shall be stamped on the top of the inlet casing flange.

3. All meters shall be locked to the fire hydrant by the Water Department, Meter Section (see Section 4.7).

4. All meters shall be read by the Water Department, Meter Section (see Section 4.7).

5. All meters shall be relocated by the Water Department, Meter Section (see Section 4.7).

6. These meters shall be tested on the anniversary of the original test date and proof of testing will be submitted to the Water Department, Meter Shop, on a yearly basis. If not tested, the meter will not be allowed for use in the City of San Diego.

7. All private fire hydrant meters shall have backflow devices attached when installed.

8. The customer must maintain and repair their own private meters and private backflows.

9. The customer must provide current test and calibration results to the Water Department, Meter Shop after any repairs.

10. When private meters are damaged beyond repair, these private meters will be replaced by City owned fire hydrant meters.

11. When a private meter malfunctions, the customer will be notified and the meter will be removed by the City and returned to the customer for repairs. Testing and calibration results shall be given to the City prior to any re-installation.

12. The register shall be hermetically sealed straight reading and shall be readable from the inlet side. Registration shall be in hundred cubic feet.

13. The outlet shall have a 2 ½ "National Standards Tested (NST) fire hydrant male coupling.

14. Private fire hydrant meters shall not be transferable from one contracting company to another (i.e. if a company goes out of business or is bought out by another company).

4.4 All fire hydrant meters and appurtenances shall be installed, relocated and removed by the City of San Diego, Water Department. All City owned fire hydrant meters and appurtenances shall be maintained by the City of San Diego, Water Department, Meter Services.

4.5 If any fire hydrant meter is used in violation of this Department Instruction, the violation will be reported to the Code Compliance Section for investigation and appropriate action. Any customer using a fire hydrant meter in violation of the requirements set forth above is subject to fines or penalties pursuant to the Municipal Code, Section 67.15 and Section 67.37.

4.6 **Conditions and Processes for Issuance of a Fire Hydrant Meter**

Process for Issuance

a. Fire hydrant meters shall only be used for the following purposes:

1. Temporary irrigation purposes not to exceed one year.

2. Construction and maintenance related activities (see Tab 2).

b. No customer inside or outside the boundaries of the City of San Diego Water Department shall resell any portion of the water delivered through a fire hydrant by the City of San Diego Water Department.

c. The City of San Diego allows for the issuance of a temporary fire hydrant meter for a period not to exceed 12 months (365 days). An extension can only be granted in writing from the Water Department Director for up to 90 additional days. A written request for an extension by the consumer must be submitted at least 30 days prior to the 12 month period ending. No extension shall be granted to any customer with a delinquent account with the Water Department. No further extensions shall be granted.

d. Any customer requesting the issuance of a fire hydrant meter shall file an application with the Meter Section. The customer must complete a "Fire Hydrant Meter Application" (Tab 1) which includes the name of the company, the party responsible for payment, Social Security number and/or California ID, requested location of the meter (a detailed map signifying an exact location), local contact person, local phone number, a contractor's license (or a business license), description of specific water use, duration of use at the site and full name and address of the person responsible for payment.

e. At the time of the application the customer will pay their fees according to the schedule set forth in the Rate Book of Fees and Charges, located in the City Clerk's Office. All fees must be paid by check, money order or cashiers check, made payable to the City Treasurer. Cash will not be accepted.

f. No fire hydrant meters shall be furnished or relocated for any customer with a delinquent account with the Water Department.

g. After the fees have been paid and an account has been created, the

meter shall be installed within 48 hours (by the second business day). For an additional fee, at overtime rates, meters can be installed within 24 hours (within one business day).

4.7 **Relocation of Existing Fire Hydrant Meters**

a. The customer shall call the Fire Hydrant Meter Hotline (herein referred to as "Hotline"), a minimum of 24 hours in advance, to request the relocation of a meter. A fee will be charged to the existing account, which must be current before a work order is generated for the meter's relocation.

b. The customer will supply in writing the address where the meter is to be relocated (map page, cross street, etc). The customer must update the original Fire Hydrant Meter Application with any changes as it applies to the new location.

c. Fire hydrant meters shall be read on a monthly basis. While fire hydrant meters and backflow devices are in service, commodity, base fee and damage charges, if applicable, will be billed to the customer on a monthly basis. If the account becomes delinquent, the meter will be removed.

4.8 **Disconnection of Fire Hydrant Meter**

a. After ten (10) months a "Notice of Discontinuation of Service" (Tab 3) will be issued to the site and the address of record to notify the customer of the date of discontinuance of service. An extension can only be granted in writing from the Water Department Director for up to 90 additional days (as stated in Section 4.6C) and a copy of the extension shall be forwarded to the Meter Shop Supervisor. If an extension has not been approved, the meter will be removed after twelve (12) months of use.

b. Upon completion of the project the customer will notify the Meter Services office via the Hotline to request the removal of the fire hydrant meter and appurtenances. A work order will be generated

for removal of the meter.

c. Meter Section staff will remove the meter and backflow prevention assembly and return it to the Meter Shop. Once returned to the Meter Shop the meter and backflow will be tested for accuracy and functionality.

d. Meter Section Staff will contact and notify Customer Services of the final read and any charges resulting from damages to the meter and backflow or its appurtenance. These charges will be added on the customer's final bill and will be sent to the address of record. Any customer who has an outstanding balance will not receive additional meters.

e. Outstanding balances due may be deducted from deposits and any balances refunded to the customer. Any outstanding balances will be turned over to the City Treasurer for collection. Outstanding balances may also be transferred to any other existing accounts.

5. EXCEPTIONS

5.1 Any request for exceptions to this policy shall be presented, in writing, to the Customer Support Deputy Director, or his/her designee for consideration.

6. MOBILE METER

6.1 Mobile meters will be allowed on a case by case basis. All mobile meters will be protected by an approved backflow assembly and the minimum requirement will be a Reduced Pressure Principal Assembly. The two types of Mobile Meters are vehicle mounted and floating meters. Each style of meters has separate guidelines that shall be followed for the customer to retain service and are described below:

a) **Vehicle Mounted Meters**: Customer applies for and receives a City owned Fire Hydrant Meter from the Meter Shop. The customer mounts the meter on the vehicle and brings it to the Meter Shop for

inspection. After installation is approved by the Meter Shop the vehicle and meter shall be brought to the Meter Shop on a monthly basis for meter reading and on a quarterly basis for testing of the backflow assembly. Meters mounted at the owner's expense shall have the one year contract expiration waived and shall have meter or backflow changed if either fails.

b) **Floating Meters**: Floating Meters are meters that are not mounted to a vehicle. **(Note: All floating meters shall have an approved backflow assembly attached.)** The customer shall submit an application and a letter explaining the need for a floating meter to the Meter Shop. The Fire Hydrant Meter Administrator, after a thorough review of the needs of the customer, (i.e. number of jobsites per day, City contract work, lack of mounting area on work vehicle, etc.), may issue a floating meter. At the time of issue, it will be necessary for the customer to complete and sign the "Floating Fire Hydrant Meter Agreement" which states the following:

1) The meter will be brought to the Meter Shop at 2797 Caminito Chollas, San Diego on the third week of each month for the monthly read by Meter Shop personnel.

2) Every other month the meter will be read and the backflow will be tested. This date will be determined by the start date of the agreement.

If any of the conditions stated above are not met the Meter Shop has the right to cancel the contract for floating meter use and close the account associated with the meter. The Meter Shop will also exercise the right to refuse the issuance of another floating meter to the company in question.

Any Fire Hydrant Meter using reclaimed water shall not be allowed use again with any potable water supply. The customer shall incur the cost of replacing the meter and backflow device in this instance.

7. **FEE AND DEPOSIT SCHEDULES**

7.1 **Fees and Deposit Schedules:** The fees and deposits, as listed in the Rate Book of Fees and Charges, on file with the Office of the City Clerk, are based on actual reimbursement of costs of services performed, equipment and materials. Theses deposits and fees will be amended, as needed, based on actual costs. Deposits, will be refunded at the end of the use of the fire hydrant meter, upon return of equipment in good working condition and all outstanding balances on account are paid. Deposits can also be used to cover outstanding balances.

All fees for equipment, installation, testing, relocation and other costs related to this program are subject to change without prior notification. The Mayor and Council will be notified of any future changes.

8. **UNAUTHORIZED USE OF WATER FROM A HYDRANT**

8.1 Use of water from any fire hydrant without a properly issued and installed fire hydrant meter is theft of City property. Customers who use water for unauthorized purposes or without a City of San Diego issued meter will be prosecuted.

8.2 If any unauthorized connection, disconnection or relocation of a fire hydrant meter, or other connection device is made by anyone other than authorized Water Department personnel, the person making the connection will be prosecuted for a violation of San Diego Municipal Code, Section 67.15. In the case of a second offense, the customer's fire hydrant meter shall be confiscated and/or the deposit will be forfeited.

8.3 Unauthorized water use shall be billed to the responsible party. Water use charges shall be based on meter readings, or estimates when meter readings are not available.

8.4 In case of unauthorized water use, the customer shall be billed for all applicable charges as if proper authorization for the water use had been obtained, including but not limited to bi-monthly service charges, installation charges and removal charges.

8.5 If damage occurs to Water Department property (i.e. fire hydrant meter, backflow, various appurtenances), the cost of repairs or replacements will be charged to the customer of record (applicant).

Larry Gardner
Water Department Director

Tabs:
1. Fire Hydrant Meter Application
2. Construction & Maintenance Related Activities With No Return To Sewer
3. Notice of Discontinuation of Service

APPENDIX

Administering Division: Customer Support Division

Subject Index:
Construction Meters
Fire Hydrant
Fire Hydrant Meter Program
Meters, Floating or Vehicle Mounted
Mobile Meter
Program, Fire Hydrant Meter

Distribution: DI Manual Holders

Application for Fire Hydrant Meter (EXHIBIT A)

City of San Diego PUBLIC UTILITIES Water & Wastewater

(For Office Use Only)

NS REQ	FAC#
DATE	BY

METER SHOP (619) 527-7449

Application Date	Requested Install Date:

Meter Information

Fire Hydrant Location: (Attach Detailed Map//Thomas Bros. Map Location or Construction drawing.) Zip:	T.B.	G.B. (CITY USE)
Specific Use of Water:		
Any Return to Sewer or Storm Drain, If so, explain:		
Estimated Duration of Meter Use:		Check Box if Reclaimed Water

Company Information

Company Name:			
Mailing Address:			
City:	State:	Zip:	Phone: ( )
*Business license#	*Contractor license#		
A Copy of the Contractor's license OR Business License is required at the time of meter issuance.			
Name and Title of Billing Agent: (PERSON IN ACCOUNTS PAYABLE)			Phone: ( )
Site Contact Name and Title:			Phone: ( )
Responsible Party Name:			Title:
Cal ID#			Phone: ( )
Signature:		Date:	

Guarantees Payment of all Charges Resulting from the use of this Meter. Insures that employees of this Organization understand the proper use of Fire Hydrant Meter

Fire Hydrant Meter Removal Request		Requested Removal Date:
Provide Current Meter Location If Different from Above:		
Signature:	Title:	Date:
Phone: ( )	Pager: ( )	

City Meter	Private Meter	
Contract Acct #:	Deposit Amount: $ 936.00	Fees Amount: $ 62.00
Meter Serial #	Meter Size: 05	Meter Make and Style: 6-7
Backflow #	Backflow Size:	Backflow Make and Style:
Name:	Signature:	Date:

WATER USES WITHOUT ANTICIPATED CHARGES FOR RETURN TO SEWER

Auto Detailing
Backfilling
Combination Cleaners (Vactors)
Compaction
Concrete Cutters
Construction Trailers
Cross Connection Testing
Dust Control
Flushing Water Mains
Hydro Blasting
Hydro Seeing
Irrigation (for establishing irrigation only; not continuing irrigation)
Mixing Concrete
Mobile Car Washing
Special Events
Street Sweeping
Water Tanks
Water Trucks
Window Washing

Note:

1. If there is any return to sewer or storm drain, then sewer and/or storm drain fees will be charges.

Date

Name of Responsible Party
Company Name and Address
Account Number:_____

Subject: Discontinuation of Fire Hydrant Meter Service

Dear Water Department Customer:

The authorization for use of Fire Hydrant Meter #_____, located at *(Meter Location Address)* ends in 60 days and will be removed on or after *(Date Authorization Expires)*. Extension requests for an additional 90 days must be submitted in writing for consideration 30 days prior to the discontinuation date. If you require an extension, please contact the Water Department, or mail your request for an extension to:

City of San Diego
Water Department
Attention: Meter Services
2797 Caminito Chollas
San Diego, CA 92105-5097

Should you have any questions regarding this matter, please call the Fire Hydrant Hotline at (619)_____-_____.

Sincerely,

Water Department

APPENDIX C

MATERIALS TYPICALLY ACCEPTED BY CERTIFICATE OF COMPLIANCE

Materials Typically Accepted by Certificate of Compliance

1. Soil amendment
2. Fiber mulch
3. PVC or PE pipe up to 16 inch diameter
4. Stabilizing emulsion
5. Lime
6. Preformed elastomeric joint seal
7. Plain and fabric reinforced elastomeric bearing pads
8. Steel reinforced elastomeric bearing pads
9. Waterstops (Special Condition)
10. Epoxy coated bar reinforcement
11. Plain and reinforcing steel
12. Structural steel
13. Structural timber and lumber
14. Treated timber and lumber
15. Lumber and timber
16. Aluminum pipe and aluminum pipe arch
17. Corrugated steel pipe and corrugated steel pipe arch
18. Structural metal plate pipe arches and pipe arches
19. Perforated steel pipe
20. Aluminum underdrain pipe
21. Aluminum or steel entrance tapers, pipe downdrains, reducers, coupling bands and slip joints
22. Metal target plates
23. Paint (traffic striping)
24. Conductors
25. Painting of electrical equipment
26. Electrical components
27. Engineering fabric
28. Portland Cement
29. PCC admixtures
30. Minor concrete, asphalt
31. Asphalt (oil)
32. Liquid asphalt emulsion
33. Epoxy

APPENDIX D

SAMPLE CITY INVOICE

City of San Diego, Field Engineering Div., 9485 Aero Drive, SD CA 92123		**Contractor's Name:**	
Project Name:		Contractor's Address:	
Work Order No or Job Order No.			
City Purchase Order No.		Contractor's Phone #:	**Invoice No.**
Resident Engineer (RE):		Contractor's fax #:	**Invoice Date:**
RE Phone#:	Fax#:	Contact Name:	Billing Period: (to

Item #	Item Description	Contract Authorization				Previous Totals To Date		This Estimate		Totals to Date	
		Unit	Price	Qty	Extension	%/QTY	Amount	% / QTY	Amount	% / QTY	Amount
1					$ -		$ -		$ -	0.00%	$ -
2					$ -		$ -		$ -	0.00%	$ -
3					$ -		$ -		$ -	0.00%	$ -
4					$ -		$ -		$ -	0.00%	$ -
5					$ -		$ -		$ -	0.00%	$ -
6					$ -		$ -		$ -	0.00%	$ -
7					$ -		$ -		$ -	0.00%	$ -
8					$ -		$ -		$ -	0.00%	$ -
9					$ -		$ -		$ -	0.00%	$ -
10					$ -		$ -		$ -	0.00%	$ -
11					$ -		$ -		$ -	0.00%	$ -
12					$ -		$ -		$ -	0.00%	$ -
13					$ -		$ -		$ -	0.00%	$ -
14					$ -		$ -		$ -	0.00%	$ -
15					$ -		$ -		$ -	0.00%	$ -
16					$ -		$ -		$ -	0.00%	$ -
17	**Field Orders**				$ -		$ -		$ -	0.00%	$ -
18					$ -		$ -		$ -	0.00%	$ -
	CHANGE ORDER No.				$ -		$ -		$ -	0.00%	$ -
					$ -		$ -		$ -	0.00%	$ -
	Total Authorized Amount (including approved Change Order)				**$ -**		$ -		$ -	**Total Billed**	$ -

SUMMARY

A. Original Contract Amount	$ -
B. Approved Change Order #00 Thru #00	$ -
C. Total Authorized Amount (A+B)	$ -
D. Total Billed to Date	$ -
E. Less Total Retention (5% of D)	$ -
F. Less Total Previous Payments	$ -
G. Payment Due Less Retention	**$0.00**
H. Remaining Authorized Amount	$0.00

I certify that the materials have been received by me in the quality and quantity specified

Resident Engineer

Construction Engineer

Retention and/or Escrow Payment Schedule

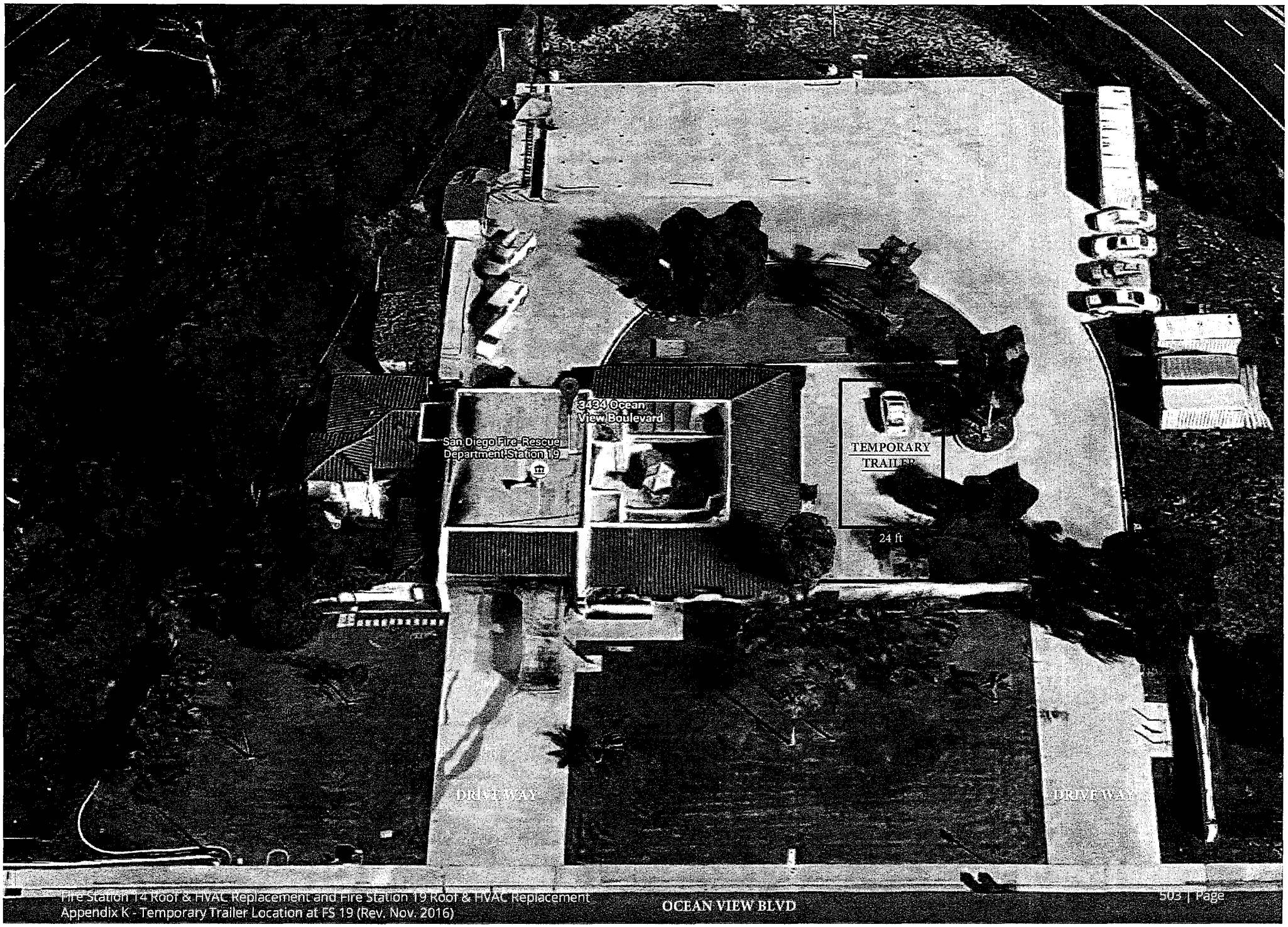
Total Retention Required as of this billing (Item E)	$0.00
Previous Retention Withheld in PO or in Escrow	$0.00
Add'l Amt to Withhold in PO/Transfer in Escrow:	***$0.00***
Amt to Release to Contractor from PO/Escrow:	

Contractor Signature and Date: _____

APPENDIX E

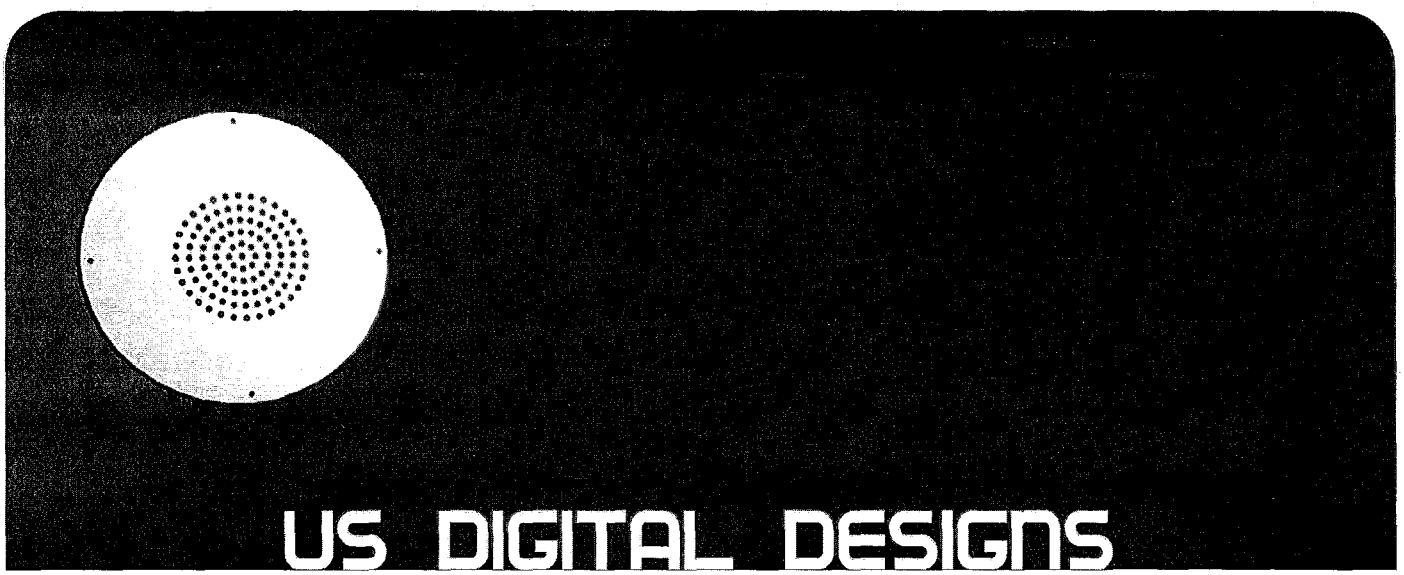
LOCATION MAPS

FIRE STATION 19 - TEMPORARY TRAILER LOCATION



APPENDIX L

ALERTING SPEAKERS SPECIFICATION



G2 Jupiter Illuminated Speakers

Phoenix G2 Jupiter HC (hard ceiling) and Jupiter DC (drop ceiling) Illuminated Speaker system offers soft-start, ramped night lighting at the time of dispatch. The Jupiter Illuminated Speakers are designed to assist firefighters out of bed, out of the room, and down the hall. The unique design incorporates a room speaker and long lasting, bright, and reliable LED lighting technology. Each speaker is fitted with 16 high-intensity red LEDs which offer exceptional luminosity without causing light blindness due to dark to bright transition.

Jupiter DC is based on a Bogan SM4T drop ceiling speaker, which easily installs in common, synthetic tiled ceilings. Recommended installation locations include dorm rooms, hallways, and common areas.

Jupiter HC is based on a Bogan S86, installed in hard ceiling surface applications.

Each Jupiter DC & Jupiter HC can be powered by a USDD G2 Message Remote or G2 Room Remote. No external power connections are required.

Jupiter DC

- 8 ohm or 70v configuration
- 9.5" Diameter
- 90 dBspl sensitivity
- Easy install for drop ceiling panels

Jupiter HC

For 8 ohm or 70v configurations •
8" cone speaker for excellent audio quality •
Off-white enamel over steel grill •
Architectural standard speaker •

1835 E Sixth Street Suite 27 • Tempe, AZ 85281 • 602.828.6965 • 602.296.0424 (fax) • www.stationalerting.com

ATTACHMENT F

INTENTIONALLY LEFT BLANK

ATTACHMENT G

CONTRACT AGREEMENT

CONTRACT AGREEMENT

CONSTRUCTION CONTRACT

This contract is made and entered into between THE CITY OF SAN DIEGO, a municipal corporation, herein called "City", and Fordyce Construction, Inc., herein called "Contractor" for construction of **Fire Station 14 Roof & Hvac Replacement And Fire Station 19 Roof & Hvac Replacement**; Bid No. **K-17-1482-DBB-3**; in the amount of One Million Two Hundred Sixty Seven Thousand Eight Hundred Five Dollars and Zero Cents ($1,267,805.00), which is comprised of the Base Bid.

IN CONSIDERATION of the payments to be made hereunder and the mutual undertakings of the parties hereto, City and Contractor agree as follows:

1. The following are incorporated into this contract as though fully set forth herein:

   (a) The attached Faithful Performance and Payment Bonds.

   (b) The attached Proposal included in the Bid documents by the Contractor.

   (c) Reference Standards listed in the Instruction to Bidders and the Supplementary Special Provisions (SSP).

   (d) That certain documents entitled **Fire Station 14 Roof & Hvac Replacement And Fire Station 19 Roof & Hvac Replacement**, on file in the office of the Public Works Department as Document No. **B13189, B13190**, as well as all matters referenced therein.

2. The Contractor shall perform and be bound by all the terms and conditions of this contract and in strict conformity therewith shall perform and complete in a good and workmanlike manner **Fire Station 14 Roof & Hvac Replacement And Fire Station 19 Roof & Hvac Replacement**, Bid Number **K-17-1482-DBB-3,** San Diego, California.

3. For such performances, the City shall pay to Contractor the amounts set forth at the times and in the manner and with such additions or deductions as are provided for in this contract, and the Contractor shall accept such payment in full satisfaction of all claims incident to such performances.

4. No claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

5. This contract is effective as of the date that the Mayor or designee signs the agreement.

CONTRACT AGREEMENT (continued)

IN WITNESS WHEREOF, this Agreement is signed by the City of San Diego, acting by and through its Mayor or designee, pursuant to Municipal Code §22.3102 authorizing such execution.

THE CITY OF SAN DIEGO

By _____

Print Name: Stephen Samara
Principal Contract Specialist
Public Works Department

Date: 5-9-17

APPROVED AS TO FORM

Mara W. Elliott, City Attorney

By Christina L. Rae

Print Name: Christina L. Rae
Deputy City Attorney

Date: 5/10/17

CONTRACTOR

By _____

Title: President

Date: March 14, 2017

City of San Diego License No.: B1995003597

State Contractor's License No.: 608529

DEPARTMENT OF INDUSTRIAL RELATIONS (DIR) REGISTRATION NUMBER: 1000003113

CERTIFICATIONS AND FORMS

The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certifications, forms and affidavits submitted as part of this bid are true and correct.

Bidder's General Information

To the City of San Diego:

Pursuant to "Notice Inviting Bids", specifications, and requirements on file with the City Clerk, and subject to all provisions of the Charter and Ordinances of the City of San Diego and applicable laws and regulations of the United States and the State of California, the undersigned hereby proposes to furnish to the City of San Diego, complete at the prices stated herein, the items or services hereinafter mentioned. The undersigned further warrants that this 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.

The undersigned bidder(s) further warrants that bidder(s) has thoroughly examined and understands the entire Contract Documents (plans and specifications) and the Bidding Documents therefore, and that by submitting said Bidding Documents as its bid proposal, bidder(s) acknowledges and is bound by the entire Contract Documents, including any addenda issued thereto, as such Contract Documents incorporated by reference in the Bidding Documents.

NON-COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID UNDER 23 UNITED STATES CODE 112 AND PUBLIC CONTRACT CODE 7106

State of California

County of San Diego

The bidder, being first duly sworn, deposes and says that he or she is authorized by 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.

CONTRACTOR CERTIFICATION

DRUG-FREE WORKPLACE

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-17 regarding Drug-Free Workplace as outlined in the WHITEBOOK, Section 7-13.3, "Drug-Free Workplace", of the project specifications, and that;

This company has in place a drug-free workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of subdivisions a) through c) of the policy as outlined.

CONTRACTOR CERTIFICATION

AMERICAN WITH DISABILITIES ACT (ADA) COMPLIANCE CERTIFICATION

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-4 regarding the American With Disabilities Act (ADA) outlined in the WHITEBOOK, Section 7-13.2, "American With Disabilities Act", of the project specifications, and that:

This company has in place workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of the policy as outlined.

CONTRACTOR CERTIFICATION

CONTRACTOR STANDARDS – PLEDGE OF COMPLIANCE

I declare under penalty of perjury that I am authorized to make this certification on behalf of the company submitting this bid/proposal, that as Contractor, I am familiar with the requirements of City of San Diego Municipal Code § 22.3004 regarding Contractor Standards as outlined in the WHITEBOOK, Section 7-13.4, ("Contractor Standards"), of the project specifications, and that Contractor has complied with those requirements.

I further certify that each of the Contractor's subcontractors whose subcontracts are greater than $50,000 in value has completed a Pledge of Compliance attesting under penalty of perjury of having complied with City of San Diego Municipal Code § 22.3004.

AFFIDAVIT OF DISPOSAL

(To be submitted upon completion of Construction pursuant to the contracts Certificate of Completion)

WHEREAS, on the _____ DAY OF _____, 2_____ the undersigned entered into and executed a contract with the City of San Diego, a municipal corporation, for:

_____

(Name of Project or Task)

as particularly described in said contract and identified as Bid No. _____; SAP No. (WBS/IO/CC) _____ ; and **WHEREAS**, the specification of said contract requires the Contractor to affirm that "all brush, trash, debris, and surplus materials resulting from this project have been disposed of in a legal manner"; and **WHEREAS**, said contract has been completed and all surplus materials disposed of:

_____

_____

NOW, THEREFORE, in consideration of the final payment by the City of San Diego to said Contractor under the terms of said contract, the undersigned Contractor, does hereby affirm that all surplus materials as described in said contract have been disposed of at the following location(s)

_____

_____

and that they have been disposed of according to all applicable laws and regulations.

Dated this _____ DAY OF _____, _____.

By:_____
Contractor

ATTEST:

State of _____ County of _____

On this_____ DAY OF _____, 2_____, before the undersigned, a Notary Public in and for said County and State, duly commissioned and sworn, personally appeared_____ known to me to be the _____ Contractor named in the foregoing Release, and whose name is subscribed thereto, and acknowledged to me that said Contractor executed the said Release.

Notary Public in and for said County and State

CONTRACTOR CERTIFICATION

Equal Benefits Ordinance Certification

I declare under penalty of perjury that I am familiar with the requirements of and in compliance with the City of San Diego Municipal Code § 22.4300 regarding Equal Benefits Ordinance.

LIST OF SUBCONTRACTORS

***** PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY *** TO BE SUBMITTED IN ELECTRONIC FORMAT ONL Y*** SEE INSTRUCTIONS TO BIDDERS, FOR FURTHER INFORMATION**

In accordance with the requirements of the "Subletting and Subcontracting Fair Practices Act", Section 4100, of the California Public Contract Code (PCC), the Bidder is to list below the name, address and license number of each Subcontractor who will perform work, labor, render services or specially fabricate and install a portion [type] of the work or improvement, in an amount of or in excess of 0.5% of the Contractor's total Bid. Failure to comply with this requirement may result in the Bid being rejected as non-responsive. The Contractor is to list only one Subcontractor for each portion of the Work. The Bidder's attention is directed to the Special Provisions - General; Paragraph 2-3 Subcontracts, which stipulates the percentage of the Work to be performed with the Bidder's own forces. The Bidder is to also list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors for which the Bidders are seeking recognition towards achieving any mandatory, voluntary, or both subcontracting participation percentages.

NAME, ADDRESS AND TELEPHONE NUMBER OF SUBCONTRACTOR	CONSTRUCTOR OR DESIGNER	SUBCONTRACTOR LICENSE NUMBER	TYPE OF WORK	DOLLAR VALUE OF SUBCONTRACT	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB①	WHERE CERTIFIED②	CHECK IF JOINT VENTURE PARTNERSHIP
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____ Email:							
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____ Email:							

① As appropriate, Bidder shall identify Subcontractor as one of the following and shall include a valid proof of certification (except for OBE, SLBE and ELBE):

Certified Minority Business Enterprise	MBE	Certified Woman Business Enterprise	WBE
Certified Disadvantaged Business Enterprise	DBE	Certified Disabled Veteran Business Enterprise	DVBE
Other Business Enterprise	OBE	Certified Emerging Local Business Enterprise	ELBE
Certified Small Local Business Enterprise	SLBE	Small Disadvantaged Business	SDB
Woman-Owned Small Business	WoSB	HUBZone Business	HUBZone
Service-Disabled Veteran Owned Small Business	SDVOSB		

② As appropriate, Bidder shall indicate if Subcontractor is certified by:

City of San Diego	CITY	State of California Department of Transportation	CALTRANS
California Public Utilities Commission	CPUC		
State of California's Department of General Services	CADoGS	City of Los Angeles	LA
State of California	CA	U.S. Small Business Administration	SBA

The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.

NAMED EQUIPMENT/MATERIAL SUPPLIER LIST

***** PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY *** TO BE SUBMITTED IN ELECTRONIC FORMAT ONLY *** SEE INSTRUCTIONS TO BIDDERS FOR FURTHER INFORMATION**

NAME, ADDRESS AND TELEPHONE NUMBER OF VENDOR/SUPPLIER	MATERIALS OR SUPPLIES	DOLLAR VALUE OF MATERIAL OR SUPPLIES	SUPPLIER (Yes/No)	MANUFACTURER (Yes/No)	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB①	WHERE CERTIFIED②
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____ Email:						
Name:_____ Address:_____ City:_____ State:_____ Zip:_____ Phone:_____ Email:						

① As appropriate, Bidder shall identify Vendor/Supplier as one of the following and shall include a valid proof of certification (except for OBE,SLBE and ELBE):

Certified Minority Business Enterprise	MBE	Certified Woman Business Enterprise	WBE
Certified Disadvantaged Business Enterprise	DBE	Certified Disabled Veteran Business Enterprise	DVBE
Other Business Enterprise	OBE	Certified Emerging Local Business Enterprise	ELBE
Certified Small Local Business Enterprise	SLBE	Small Disadvantaged Business	SDB
Woman-Owned Small Business	WoSB	HUBZone Business	HUBZone
Service-Disabled Veteran Owned Small Business	SDVOSB		

② As appropriate, Bidder shall indicate if Vendor/Supplier is certified by:

City of San Diego	CITY	State of California Department of Transportation	CALTRANS
California Public Utilities Commission	CPUC		
State of California's Department of General Services	CADoGS	City of Los Angeles	LA
State of California	CA	U.S. Small Business Administration	SBA

The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.

ELECTRONICALLY SUBMITTED FORMS

THE FOLLOWING FORMS MUST BE SUBMITTED IN PDF FORMAT WITH BID SUBMISSION

The following forms are to be completed by the bidder and submitted (uploaded) electronically with the bid in PlanetBids.

A. **BID BOND – See Instructions to Bidders, Bidders Guarantee of Good Faith (Bid Security) for further instructions**

B. **CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS**

Bids will not be accepted until ALL forms are submitted as part of the bid submittal

BID BOND

See Instructions to Bidders, Bidder Guarantee of Good Faith (Bid Security)

KNOW ALL MEN BY THESE PRESENTS,

That _____ as Principal, and

_____ as Surety, are

held and firmly bound unto The City of San Diego hereinafter called "OWNER," in the sum of **10% OF THE TOTAL BID AMOUNT** 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.

WHEREAS, said Principal has submitted a Bid to said OWNER to perform the WORK required under the bidding schedule(s) of the OWNER's Contract Documents entitled

_____

NOW THEREFORE, if said Principal is awarded a contract by said OWNER and, within the time and in the manner required in the "Notice Inviting Bids" enters into a written Agreement on the form of agreement bound with said Contract Documents, furnishes the required certificates of insurance, and furnishes the required Performance Bond and Payment Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect. In the event suit is brought upon this bond by said OWNER and OWNER prevails, said Surety shall pay all costs incurred by said OWNER in such suit, including a reasonable attorney's fee to be fixed by the court.

SIGNED AND SEALED, this _____ day of _____, 20_____

_____ (SEAL)	_____ (SEAL)
(Principal)	(Surety)
By: _____	By: _____
(Signature)	(Signature)

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against the Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

CHECK ONE BOX ONLY.

☐ The undersigned certifies that within the past 10 years the Bidder has NOT been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers.

☐ The undersigned certifies that within the past 10 years the Bidder has been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers. A description of the status or resolution of that complaint, including any remedial action taken and the applicable dates is as follows:

Date of Claim	Location	Description of Claim	Litigation (Y/N)	Status	Resolution/Remedial Action Taken

Contractor Name:_____

Certified By _____ Title _____
Name

_____ Date _____
Signature

USE ADDITIONAL FORMS AS NECESSARY

BID BOND

See Instructions to Bidders, Bidder Guarantee of Good Faith (Bid Security)

KNOW ALL MEN BY THESE PRESENTS,

That Fordyce Construction, Inc. as Principal, and

International Fidelity Insurance Company as Surety, are

held and firmly bound unto The City of San Diego hereinafter called "OWNER," in the sum of **10% OF THE TOTAL BID AMOUNT** 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.

WHEREAS, said Principal has submitted a Bid to said OWNER to perform the WORK required under the bidding schedule(s) of the OWNER's Contract Documents entitled

Fire Station 14 Roof & HVAC Replacement and Fire Station 19 Roof & HVAC Replacement / K-17-1482-DBB-3

NOW THEREFORE, if said Principal is awarded a contract by said OWNER and, within the time and in the manner required in the "Notice Inviting Bids" enters into a written Agreement on the form of agreement bound with said Contract Documents, furnishes the required certificates of insurance, and furnishes the required Performance Bond and Payment Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect. In the event suit is brought upon this bond by said OWNER and OWNER prevails, said Surety shall pay all costs incurred by said OWNER in such suit, including a reasonable attorney's fee to be fixed by the court.

SIGNED AND SEALED, this 5th day of January, 20 17

Fordyce Construction, Inc. (SEAL)

(Principal)

By: _____

(Signature)

International Fidelity Insurance Company (SEAL)

(Surety)

By: _____

Bart Stewart, Attorney-in-Fact

(Signature)

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

Tel (973) 624-7200

POWER OF ATTORNEY

INTERNATIONAL FIDELITY INSURANCE COMPANY
ALLEGHENY CASUALTY COMPANY

ONE NEWARK CENTER, 20TH FLOOR NEWARK, NEW JERSEY 07102-5207

KNOW ALL MEN BY THESE PRESENTS: That **INTERNATIONAL FIDELITY INSURANCE COMPANY**, a corporation organized and existing under the laws of the State of New Jersey, and **ALLEGHENY CASUALTY COMPANY** a corporation organized and existing under the laws of the State of New Jersey, having their principal office in the City of Newark, New Jersey, do hereby constitute and appoint

MOLLY CASHMAN, BART STEWART

Encinitas, CA.

their true and lawful attorney(s)-in-fact to execute, seal and deliver for and on its behalf as surety, any and all bonds and undertakings, contracts of indemnity and other writings obligatory in the nature thereof, which are or may be allowed, required or permitted by law, statute, rule, regulation, contract or otherwise, and the execution of such instrument(s) in pursuance of these presents, shall be as binding upon the said INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY, as fully and amply, to all intents and purposes, as if the same had been duly executed and acknowledged by their regularly elected officers at their principal offices.

This Power of Attorney is executed, and may be revoked, pursuant to and by authority of the By-Laws of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY and is granted under and by authority of the following resolution adopted by the Board of Directors of INTERNATIONAL FIDELITY INSURANCE COMPANY at a meeting duly held on the 20th day of July, 2010 and by the Board of Directors of ALLEGHENY CASUALTY COMPANY at a meeting duly held on the 15th day of August, 2000:

"RESOLVED, that (1) the President, Vice President, Chief Executive Officer or Secretary of the Corporation shall have the power to appoint, and to revoke the appointments of, Attorneys-in-Fact or agents with power and authority as defined or limited in their respective powers of attorney, and to execute on behalf of the Corporation and affix the Corporation's seal thereto, bonds, undertakings, recognizances, contracts of indemnity and other written obligations in the nature thereof or related thereto; and (2) any such Officers of the Corporation may appoint and revoke the appointments of joint-control custodians, agents for acceptance of process, and Attorneys-in-fact with authority to execute waivers and consents on behalf of the Corporation; and (3) the signature of any such Officer of the Corporation and the Corporation's seal may be affixed by facsimile to any power of attorney or certification given for the execution of any bond, undertaking, recognizance, contract of indemnity or other written obligation in the nature thereof or related thereto, such signature and seals when so used whether heretofore or hereafter, being hereby adopted by the Corporation as the original signature of such officer and the original seal of the Corporation, to be valid and binding upon the Corporation with the same force and effect as though manually affixed."

IN WITNESS WHEREOF, INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY have each executed and attested these presents on this 31st day of December, 2015.

INTERNATIONAL FIDELITY INSURANCE COMPANY CORPORATE SEAL 1904 NEW JERSEY

STATE OF NEW JERSEY
County of Essex

ROBERT W. MINSTER
Chief Executive Officer (International Fidelity Insurance Company) and President (Allegheny Casualty Company)

ALLEGHENY CASUALTY COMPANY 1936 NEW JERSEY

On this 31st day of December 2015, before me came the individual who executed the preceding instrument, to me personally known, and, being by me duly sworn, said he is the therein described and authorized officer of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY; that the seals affixed to said instrument are the Corporate Seals of said Companies; that the said Corporate Seals and his signature were duly affixed by order of the Boards of Directors of said Companies.

IN TESTIMONY WHEREOF, I have hereunto set my hand affixed my Official Seal, at the City of Newark, New Jersey the day and year first above written.

CATHY CRUZ NOTARY PUBLIC STATE OF NEW JERSEY MY COMMISSION EXPIRES 04-16-2019

A NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 16, 2019

CERTIFICATION

I, the undersigned officer of INTERNATIONAL FIDELITY INSURANCE COMPANY and ALLEGHENY CASUALTY COMPANY do hereby certify that I have compared the foregoing copy of the Power of Attorney and affidavit, and the copy of the Sections of the By-Laws of said Companies as set forth in said Power of Attorney, with the originals on file in the home office of said companies, and that the same are correct transcripts thereof, and of the whole of the said originals, and that the said Power of Attorney has not been revoked and is now in full force and effect.

IN TESTIMONY WHEREOF, I have hereunto set my hand this 5th day of January 2017

MARIA BRANCO, Assistant Secretary

ALL- PURPOSE
CERTIFICATE OF ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California }

County of San Diego }

On 01/05/2017 before me, Brittany Aceves, Notary Public,
(Here insert name and title of the officer)

personally appeared Bart Stewart,
who proved to me on the basis of satisfactory evidence to be the person(~~s~~) whose name(~~s~~)(is)/are subscribed to the within instrument and acknowledged to me that (he)/she/they executed the same in(his)/her/their authorized capacity(~~ies~~), and that by (his)/her/their signature(~~s~~) on the instrument the person(~~s~~), or the entity upon behalf of which the person(~~s~~) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Notary Public Signature (Notary Public Seal)

BRITTANY ACEVES
Commission No. 2044569
NOTARY PUBLIC - CALIFORNIA
SAN DIEGO COUNTY
Commission Expires October 7, 2017

ADDITIONAL OPTIONAL INFORMATION

DESCRIPTION OF THE ATTACHED DOCUMENT

(Title or description of attached document)

(Title or description of attached document continued)

Number of Pages _____ Document Date_____

CAPACITY CLAIMED BY THE SIGNER

- ☐ Individual (s)
- ☐ Corporate Officer
  _____
  (Title)
- ☐ Partner(s)
- ☐ Attorney-in-Fact
- ☐ Trustee(s)
- ☐ Other _____

2015 Version www.NotaryClasses.com 800-873-9865

INSTRUCTIONS FOR COMPLETING THIS FORM

This form complies with current California statutes regarding notary wording and, if needed, should be completed and attached to the document. Acknolwedgents from other states may be completed for documents being sent to that state so long as the wording does not require the California notary to violate California notary law.

- State and County information must be the State and County where the document signer(s) personally appeared before the notary public for acknowledgment.
- Date of notarization must be the date that the signer(s) personally appeared which must also be the same date the acknowledgment is completed.
- The notary public must print his or her name as it appears within his or her commission followed by a comma and then your title (notary public).
- Print the name(s) of document signer(s) who personally appear at the time of notarization.
- Indicate the correct singular or plural forms by crossing off incorrect forms (i.e. ~~he~~/she/~~they,~~ is /~~are~~) or circling the correct forms. Failure to correctly indicate this information may lead to rejection of document recording.
- The notary seal impression must be clear and photographically reproducible. Impression must not cover text or lines. If seal impression smudges, re-seal if a sufficient area permits, otherwise complete a different acknowledgment form.
- Signature of the notary public must match the signature on file with the office of the county clerk.
  - Additional information is not required but could help to ensure this acknowledgment is not misused or attached to a different document.
  - Indicate title or type of attached document, number of pages and date.
  - Indicate the capacity claimed by the signer. If the claimed capacity is a corporate officer, indicate the title (i.e. CEO, CFO, Secretary).
- Securely attach this document to the signed document with a staple.

CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS

As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against the Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

CHECK ONE BOX ONLY.

[x] The undersigned certifies that within the past 10 years the Bidder has NOT been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers.

[ ] The undersigned certifies that within the past 10 years the Bidder has been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers. A description of the status or resolution of that complaint, including any remedial action taken and the applicable dates is as follows:

DATE OF CLAIM	LOCATION	DESCRIPTION OF CLAIM	LITIGATION (Y/N)	STATUS	RESOLUTION/REMEDIAL ACTION TAKEN
n/a					

Contractor Name: Fordyce Construction, Inc.

Certified By Brian Fordyce Title President

Name

Date January 10, 2017

Signature

USE ADDITIONAL FORMS AS NECESSARY

Bid Results for Project Fire Station 14 and 19 Roof & HVAC Replacement (K-17-1482-DBB-3)
Issued on 12/09/2016
Bid Due on January 11, 2017 2:00 PM (Pacific)
Exported on 01/11/2017

VendorID	Company Name	Address	City	ZipCode	Country	Contact	Phone	Fax	Email	Vendor Type
287209	**Fordyce Construction, Inc.**	9932 Prospect Ave #138	Santee	92071	United States	Brian Fordyce	619-449-4272	619-449-1930	admin@fordyceconstruction.com	PQUAL,SLBE,SDB,Local

Respondee	Respondee Title	Respondee Phone	Respondee Email
Brian Fordyce	Presdient	619-449-4272	admin@fordyceconstruction.com

Bid Format	Submitted Date	Status	Confirmation #	Ranking
Electronic	January 11, 2017 1:59:26 PM (Pacific)	Submitted	95580	0

Attachments

File Title	File Name	File Type
Bid Bond	Bid Bond.pdf	General Attachments
Contractors Certification of Pending Actions	Contractors Certification of Pending Actions.pdf	General Attachments

Line Items

Item Num	Section	Item Code	Description	Unit of Measure	Quantity	Reference Code	Unit Price	Line Total
1	Main Bid	524126	Bonds (Payment and Performance)	LS	1	2-4.1	$19,017.00	$19,017.00
2	Main Bid	236220	Building Permits (EOC Type I) and Staging Required Permits	AL	1	7-5.3	$3,000.00	$3,000.00
3	Main Bid	238220 238160	Construction of Fire Station 19 Roof & HVAC Replacement	LS	1	9-3.1	$534,507.00	$534,507.00
4	Main Bid	238220 238160	Construction of Fire Station 14 Roof & HVAC Replacement	LS	1	9-3.1	$647,726.00	$647,726.00
5	Main Bid	237310	Mobilization	LS	1	9-3.4.1	$13,200.00	$13,200.00
6	Main Bid	237110	Handling and Disposal of Non-friable Asbestos (Mastic for Fire Station 19) (EOC Type I)	AL	1	9-3.1	$9,000.00	$9,000.00
7	Main Bid		Field Orders (EOC Type II)	AL	1	9-3.5	$25,000.00	$25,000.00
8	Main Bid	541330	Water Pollution Control Program Development	LS	1	7-8.6.4.2	$690.00	$690.00
9	Main Bid	237990	Water Pollution Control Program Implementation	LS	1	7-8.6.4.2	$1,265.00	$1,265.00
10	Main Bid	238210	Communication Alerting Systems	LS	1	9-3.1	$8,400.00	$8,400.00
11	Main Bid	562910	Termite Treatment / Structural Damage Replacement (EOC Type I)	AL	1	9-3.1	$6,000.00	$6,000.00
							Subtotal	**$1,267,805.00**
							Total	**$1,267,805.00**

Subcontractors

Name	Description	License Num	Amount	Type	DIR #	Address	Address 2	City	ZipCode	Country
Cacy Electric	Electrical	780158	$33,444.00		1000001728	10744 Prospect Ave, Ste B		Santee	92071	United States
AAIR Purification System	Plymovent - Vehicle Exhaust	621360	$78,060.00		1000030031	9040 Kenamar Drive	Ste 402	San Diego	92121	United States
Weather Machines, Inc.	HVAC	620758	$297,752.00	CADIR	1000011339	9858 Hawley Road		El Cajon	92021	United States
ACCI Roofing Services	Roofing	840297	$91,499.00	LAT,FEM,CADIR	1000002422	11325 Santa Maria Avenue		Lakeside	92040	United States
Dave Whipple Sheet Metal, Inc.	Sheet Metal	736812	$36,906.00		1000002501	1077 North Cuyamaca St		El Cajon	92020	United States

Prime Self-Performance
WAIVED - CLASS B