

**COUNTY OF EL DORADO, CALIFORNIA
CHIEF ADMINISTRATIVE OFFICE
FACILITIES DIVISION**

CONTRACT DOCUMENTS

INCLUDING

**NOTICE TO BIDDERS,
PROPOSAL, CONTRACT,
AND CONDITIONS OF THE CONTRACT**

FOR

**COUNTY OF EL DORADO
ANIMAL SERVICES FACILITY**

6435 CAPITOL AVENUE, DIAMOND SPRINGS, CALIFORNIA

BID #14-968-042

Bid Opening Date: TBD

EDC Animal Services Facility

Project No. 13103

FOR: El Dorado County
ADDRESS: 6425 Capital Ave., Diamond Springs CA

ARCHITECT:

Charles D. Downs C-9717
Anova NEXUS Architects
1990 Third Street, Suite 500
Sacramento CA 95811



MECHANICAL:

David Huhn M-32545
GLUMAC
910 Glenn Dr.
Folsom CA 95630



ELECTRICAL:

Ryan Cartwright E-18298
GLUMAC
910 Glenn Dr.
Folsom CA 95630



STRUCTURAL:

Jay Reiser S-5172
Miyamoto International, Inc.
1450 Halyard Dr., Suite 1
West Sacramento CA 95691



**COUNTY OF EL DORADO, STATE OF CALIFORNIA
CHIEF ADMINISTRATIVE OFFICE
FACILITIES DIVISION**

**EL DORADO COUNTY
ANIMAL SERVICES FACILITY**

BID #14-968-042

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**COUNTY OF EL DORADO, CALIFORNIA
CHIEF ADMINISTRATIVE OFFICE
FACILITIES DIVISION**

NOTICE TO BIDDERS

NOTICE IS HEREBY GIVEN by the County of El Dorado, State of California, that sealed bids for work in accordance with the Project Plans (Plans) and Contract Documents designated:

**EL DORADO COUNTY
ANIMAL SERVICES FACILITY**

BID #14-968-042

will be received by the Chief Administrative Office, Procurement & Contracts Division, at **360 FAIR LANE, PLACERVILLE, CALIFORNIA**, until **3:00 p.m. on TBD**, at which time bids will be publicly opened and read by the Chief Administrative Office, Procurement & Contracts Division.

No Bid may be withdrawn after the time established for receiving bids or before the award and execution of the Contract, unless the award is delayed for a period exceeding sixty (60) calendar days. Bids shall be executed in accordance with the instructions given and on the forms provided in the bound Contract Documents furnished by the County of El Dorado, Chief Administrative Office, Procurement & Contracts Division. The proposal shall **NOT** be detached from the Contract Documents. All bids must be clearly marked on the envelope:

“EL DORADO COUNTY ANIMAL SERVICES FACILITY”

BID #14-968-042

TO BE OPENED AT 3:00 P.M. ON TBD

LOCATION/DESCRIPTION OF THE WORK: The project is located at 6435 Capitol Avenue, Diamond Springs California in El Dorado County. The Work to be done as shown on the Plans, generally consists of, but is not limited to:

- A. Bids are required for the entire work described herein. The work to be performed under this contract includes the furnishing of all labor, materials and equipment for construction of improvements to the interior of the Animal Services Facility as described in the Technical Specifications and in accordance with the Plans.
- B. The contract time shall be **180 CALENDAR DAYS**.
- C. For bonding purposes the estimated project cost is **approximately \$2,300,000**.
- D. A Pre-Bid / Site Visit Meeting is scheduled for this project on **TBD**. **ATTENDANCE AT THE PRE-BID MEETING IS MANDATORY AND ONLY THE BIDS OF FIRMS WITH REPRESENTATIVES IN ATTENDANCE WILL BE CONSIDERED FOR EVALUATION AND AWARD. BIDDERS OR THEIR REPRESENTATIVES SHALL MEET AT 6435 CAPITOL AVENUE, DIAMOND SPRINGS, CA 95619 SHARPLY AT TBD. ANY BIDDER WHO HAS NOT SIGNED THE SIGN-IN SHEET BY TBD WILL NOT BE ABLE TO PARTICIPATE IN THE JOB WALK AND WILL NOT BE ABLE TO SUBMIT A BID.** In order to limit the disruption to the conduct of business, the meeting date listed will be the only opportunity for bidders to visit the site. The Bidder's representative will be required to sign an attendance sheet and provide the name of the firm being represented. The County will post on the Procurement & Contract's website such Addenda as the County in its discretion considers necessary in response to questions arising and information presented at the Pre-Bid / Site Visit Meeting. Oral statements shall not be relied upon and will not be binding or legally effective. Addenda issued as a result of the Pre-Bid / Site Visit Meeting shall constitute the sole and exclusive record and statement of the results of the Pre-Bid / Site Visit Meeting.

QUESTIONS: Questions will be accepted in writing only, by email or in hard copy, until 5:00 p.m. on **TBD**. Questions can be emailed to: linda.smith@edcgov.us or delivered to: County of El Dorado, Procurement & Contracts, 360 Fair Lane, Placerville, CA 95667. Answers to questions deemed relevant and appropriate will be emailed to all eligible bidders by 5:00 p.m. on **TBD**.

OBTAINING SPECIFICATIONS AND PLANS: Specifications and Plans **WILL NOT** be provided at the Pre-Bid / Site Visit Meeting on **TBD** and **SHOULD BE OBTAINED BEFORE** the Pre-Bid / Site Visit Meeting:

- From Imperial Printing located at 259 Placerville Drive, Placerville, CA 95667 at a cost of **TBD**
- Online at <http://edcapps.edcgov.us/contracts/invite.asp>
- On CD format from the County of El Dorado, Chief Administrative Office, Procurement & Contract Division located at 360 Fair Lane, Placerville, California, 95667 (please call (530) 621-5417 to make arrangements)

OBTAINING OR INSPECTING CONTRACT DOCUMENTS: The Contract Documents may be examined:

- Online at <http://edcapps.edcgov.us/contracts/invite.asp>
- Will be distributed at Pre-Bid Meeting on **TBD**

ONLY CONTRACT DOCUMENTS DISTRIBUTED AT THE MANDATORY PRE-BID MEETING ON **TBD WILL BE ACCEPTABLE FOR BID SUBMITTAL.**

CONTRACTORS LICENSE CLASSIFICATION: Bidders shall be properly licensed to perform the Work pursuant to the Contractors' State License Law (Business and Professions Code Section 7000 et seq.) and shall possess a **Class B General Engineering Contractor's** license or equivalent combination of Classes required by the categories and type of Work included in the Contract Plans at the time bids are submitted, and shall maintain a valid license through completion and acceptance of the Work, including the guarantee and acceptance period. Failure of the successful Bidder to obtain proper adequate licensing shall constitute a failure to execute the Contract and shall result in the forfeiture of the Bidder's security.

BUSINESS LICENSE: The County Business License Ordinance provides that it is unlawful for any person to furnish supplies or services, or transact any kind of business in the unincorporated territory of El Dorado County without possessing a County business license unless exempt under County Ordinance Code Section 5.08.070. The Bidder to whom an award is made shall comply with all of the requirements of the County Business License Ordinance, where applicable, prior to beginning work under this Contract and at all times during the term of this Contract.

REQUIRED LISTING OF PROPOSED SUBCONTRACTORS: Each Proposal shall have listed therein the name and address of each subcontractor, to whom the Bidder proposes to subcontract portions of the work in an amount in excess of 1/2 of one percent of its total bid in accordance with the Subletting and Subcontracting Fair Practices Act, commencing with Section 4100 of the Public Contract Code. The Bidder shall also describe in the Subcontractor Listing the work to be performed by each subcontractor listed. The work to be performed by the subcontractor shall be shown by listing the description of the work, and portion of the work to be performed by the subcontractor in the form of a percentage calculated by dividing the work to be performed by the subcontractor by the lump sum bid price. At the time the bids are submitted all listed subcontractors shall be properly licensed to perform their designated portion of the work. The Bidder's attention is invited to other provisions of the Act related to the imposition of penalties for a failure to observe its provisions by using unauthorized subcontractors or by making unauthorized substitutions.

NONDISCRIMINATION: Attention is directed to the following Notice that is required by Chapter 5 of Division 4 of Title 2, California Code of Regulations.

**NOTICE OF REQUIREMENT FOR NONDISCRIMINATION PROGRAM
(GOVERNMENT CODE SECTION 12990)**

PREVAILING WAGE REQUIREMENTS: In accordance with the provisions of California Labor Code Sections 1770 et seq., the general prevailing rate of wages in the county in which the Work is to be done has been determined by the Director of the California Department of Industrial Relations. These wage rates appear in the California Department of Transportation publication entitled General Prevailing Wage Rates. Interested parties can obtain the current wage information by submitting their requests to the Department of Industrial Relations, Division of Labor Statistics and Research, P.O. Box 420603, San Francisco CA 94142-0603, Telephone (415) 703-4708 or by referring to the website at <http://www.dir.ca.gov/dlsr/PWD>. The rates at the time of the bid advertisement date of a project will remain in effect for the life of the project in accordance with the California Code of Regulations, as modified and effective January 27, 1997.

Copies of the general prevailing rate of wages in the county in which the Work is to be done are also on file at the Chief Administrative Office, Facilities Division, and are available upon request.

In accordance with the provisions of Labor Code 1810, eight (8) hours of labor shall constitute a legal day's work upon all work done hereunder, and Contractor and any subcontractor employed under this Contract shall conform to and be bound by the provisions of Labor Code Sections 1810 through 1815.

BID SECURITY: A bid security shall be provided with each bid. Bid security shall be in an amount of not less than ten percent (10%) of the total amount bid for the Work inclusive of any additive Alternative Bid Item(s) and shall be cash, a certified check or cashier's check drawn to the order of the County of El Dorado or a Bidder's Bond executed by a surety satisfactory to the County of El Dorado on the **form provided in the Proposal section of these Contract Documents (do not detach the form)**. Failure of any bid proposal to be accompanied by the required bid security shall render such bid proposal to be non-responsive and rejected.

BID PROTEST PROCEDURE: The protest procedure is intended to handle and resolve disputes related to the bid award for this project. This procedure shall be utilized only after all informal methods have failed to reach a resolution. A protestor must exhaust all administrative remedies with the County of El Dorado before pursuing any civil or administrative action.

The protest procedure is an extension of the formal bid process and allows those who wish to protest the recommendation of an award after bid opening the opportunity to be heard.

Policy: Upon completion of the bid evaluation, the Chief Administrative Office, Procurement & Contracts Division shall notify all bidders of the recommendation of award, the basis therefore, and the date and time on which the recommendation for award will be considered and acted upon by the Board of Supervisors. All bidders may attend the Board of Supervisors meeting at the time the agenda item is considered, address the Board of Supervisors, and be heard.

Procedure: If a bidder wishes to protest the award, the procedure shall be as follows:

1. The Chief Administrative Office, Procurement & Contracts Division will review the bids received in a timely fashion under the terms and conditions of the Notice to Bidders, and will post the Responsive, Responsible bidders on their website (<http://edcapps.edcgov.us/contracts/bidresults.asp>).
2. Within five (5) working days from the date of the posting of the Bid Summary, the bidder protesting the recommendation for award shall submit a letter of protest to and shall be received by the County of El Dorado, Chief Administrative Office, Procurement & Contracts Division, Attention Linda Silacci-Smith, 360 Fair Lane, Placerville, CA 95667, and state in detail the basis and reasons for the protest. The bidder must provide facts to support the protest, including any evidence it wishes to be considered, together with the law, rule, regulation, or criteria on which the protest is based.
3. If the Chief Administrative Office, Procurement & Contracts Division finds the protest to be valid, it may modify its award recommendations and notify all bidders of that decision. If the Chief Administrative Office, Procurement & Contracts Division does not agree with the protest, or otherwise fails to resolve the protest, the Chief Administrative Office, Procurement & Contracts Division will notify the bid protestor and all interested parties of its decision and the date and time that the recommendation for award will be heard for the Board of Supervisors' consideration and action. The Chief Administrative Office, Procurement & Contracts Division shall also include in its report to the Board of Supervisors the details of the bid protest.

The bidder may attend the Board of Supervisors meeting at which the recommendation and bid protest will be considered. The Board of Supervisors will take comment from the bidder, staff, and members of the public who wish to speak on the item. In the event that the bidder is not in attendance at that time, the bid protest may be dismissed by the Board of Supervisors without further consideration of the merits. In its discretion, the Board of Supervisors may determine to accept or reject any or all bids, to waive any informality or irregularities in a bid, or to make an award. The decision of the Board of Supervisors on the bid protest shall be final.

AWARD OF CONTRACT: Bids will be considered for award by the Board of Supervisor or Purchasing Agent, as applicable. The County of El Dorado reserves the right after opening bids to reject any or all bids, to waive any irregularity in a bid, or to make award to the lowest responsive, responsible Bidder and reject all other bids, as it may best serve the interests of the County.

As a condition of award, the successful Bidder will be required to submit bonds and evidence of insurance prior to execution of the Agreement by the County. Failure to meet this requirement shall constitute abandonment of the Bid by the Bidder and forfeiture of the Bidder's security. Award will then be made to the next lowest responsible Bidder.

PAYMENTS: Attention is directed to **ARTICLE 6.2 APPLICATIONS FOR PAYMENT** of the Conditions of the Contract.

RETAINAGE FROM PAYMENTS: The Contractor may elect to receive one hundred percent (100%) of payments due under the Contract from time to time, without retention of any portion of the payment by the County, by depositing securities of equivalent value with the County in accordance with the provisions of Section 22300 of the Public Contract Code. Securities eligible for deposit hereunder shall be limited to those listed in Section 16430 of the Government Code, or bank or savings and loan certificates of deposit.

PROJECT ADMINISTRATION: All communications relative to the Contract Documents and Plans shall be directed to Linda Silacci-Smith in the County of El Dorado Chief Administrative Office, Procurement & Contracts Division, 360 Fair Lane, Placerville, CA 95667, telephone: (530) 621-5417. No oral responses to any questions concerning the content of the Plans and Contract Documents will be given. All responses will be in the form of written addenda to the Plans and/or Contract Documents.

BY ORDER OF the Board of Supervisors, County of El Dorado, State of California.

Authorized by the Board of Supervisors on **TBD** at Placerville, California.

Dated: _____

By: _____

Chair, Board of Supervisors

James S. Mitrising
Clerk of the Board of Supervisors

By: _____
Deputy Clerk

Dated: _____

*** END OF DOCUMENT ***

THESE INSTRUCTIONS SUPPLEMENT THE NOTICE TO BIDDERS, PROPOSAL, DRAFT AGREEMENT, AND CONDITIONS OF THE CONTRACT

**EL DORADO COUNTY
ANIMAL SERVICES FACILITY**

BID #14-968-042

INSTRUCTIONS TO BIDDERS

1. The County of El Dorado will receive sealed bids from Bidders as stipulated in the Notice to Bidders.
2. The County of El Dorado reserves the right after opening bids to reject any or all bids, to waive any irregularity in a bid, or to make award to the lowest responsive, responsible Bidder and reject all other bids, as it may best serve the interests of the County.
3. Bidders must submit bids only on forms provided in the Contract Documents and all bids shall be accompanied by all documents and information required to be submitted by these Instructions to Bidders, the Notice to Bidders, and by law. Bids not submitted on the required forms shall be deemed nonresponsive and shall not be considered. The Proposal form is bound together with the Notice to Bidders, Instructions to Bidders, Agreement, and attendant documents. A Proposal shall be deemed "Non-Responsive" if the proposal is submitted without the entire Contract Document package attached.
4. Bidders must submit the Non-Collusion Affidavit form with their bids. Bids submitted without the affidavit will be deemed nonresponsive and will not be considered.
5. Bidders must supply all information required by Contract Documents and specifications. Bids must be full and complete. The County reserves the right at its sole discretion to reject any bid as nonresponsive as a result of any error or omission in the bid.
6. Bidders may not modify Proposal or qualify their bids.
7. Submittal of a bid signifies that the Bidder has done a careful examination of the Contract Documents and has a complete understanding of the nature, extent and location of Work to be performed. Bidder must complete the tasks listed below in subsections "a" and "b" as a condition to bidding ,and submission of bid shall constitute the Bidder's express representation to the County that Bidder has fully completed the following:
 - a. Bidder has attended the mandatory pre-bid meeting and has examined thoroughly and understands the nature and extent of the Contract Documents, Work, Site, locality, actual conditions, as-built conditions, and all local conditions and federal, state and local laws and regulations that in any manner may affect cost, progress, performance or furnishing of Work or which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Bidder and safety precautions and programs incident thereto;
 - b. Bidder has given the County representative during the bid period prompt written notice of all conflicts, errors, ambiguities or discrepancies that it has discovered in or among the Contract Documents and as built and actual conditions and the written resolution thereof by County is acceptable to Bidder.
8. Substitutions: If the Bidder lists a manufacturer in its Proposal that is a substitute (i.e. "or equal"), such listing shall be considered a substitution request by the Bidder. If the Bidder is the apparent low Bidder, the Bidder shall, within two (2) business days following the bid opening, submit data substantiating the request for the substitution with the "or equal" item. Failure to submit such substantiating data within two

(2) business days following the bid opening may result in the County deeming the apparent low Bidder non-responsive.

9. The following documents are to be executed and submitted by the apparent low Bidder after bids have been opened and duly inspected, and the County transmits the Notice of Award package to the successful Bidder. Failure to properly and timely submit these documents entitles the County to determine that the Bidder has abandoned the contract, and the bidder's security shall be forfeited to County.

Submit the following documents to Linda Silacci-Smith, Chief Administrative Office, Procurement & Contracts Division, 360 Fair Lane, Placerville, CA 95667 by 5:00 p.m. of the **TENTH** calendar day, following the date of the NOTICE OF AWARD OF CONTRACT letter. Execution of Contracts by the County depends upon approval of Insurance Certificates and Bonds, and associated contract documents.

- i. Contracts: The successful Bidder shall execute and submit the Agreements for the work associated with the Proposal Lump Sum Bid Price Schedule (See Draft Agreement). Submit two (2) originals of Agreement, each bearing an original signature.
- ii. County of El Dorado Performance Bond: To be executed by successful Bidder and surety each with notary acknowledgement.
- iii. County of El Dorado Payment Bond: To be executed by successful Bidder and surety each with notary acknowledgement.
- iv. Insurance certificates required by Contract Conditions and Article 8.
- v. California Form 590 – Withholding Exemption and County Payee Data Record Form

END OF DOCUMENT

THESE INSTRUCTIONS SUPPLEMENT THE NOTICE TO BIDDERS, PROPOSAL, DRAFT AGREEMENT, AND CONDITIONS OF THE CONTRACT

**EL DORADO COUNTY
ANIMAL SERVICES FACILITY**

BID #14-968-042

SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

1. The project may be referred to in the plans and technical specifications as EDC Animal Shelter Facility or EDC Animal Control Facility.
2. Any reference to a specific manufacturer or brand name or model number is for the purpose of illustrating the functional specification of the item or material desired, and will be construed to be followed by the words “or equal”. Bidders may propose an equivalent brand or manufacturer (“or equal”) that meets the functional specifications of the item specified by following the instructions for substitutions in the TECHNICAL SPECIFICATIONS, DIVISION 1 – GENERAL REQUIREMENTS, SECTION 01 33 00- PRODUCT SUBMITTALS AND SUBSTITUTIONS. Requests for substitution with the “or equal” item are subject to County approval at County’s sole discretion.
3. Bidders shall consider the phrase “or approved equal”, if used in the plans or technical specifications, to mean the same as “or equal”, as described above, for purposes of this bid solicitation. There is no list of approved equal materials or items.
4. Award to Lowest Responsive Responsible Bidder: The method for determining lowest bid will be on the basis of the lowest lump sum base bid amount plus those additive or deductive items specifically identified in the Alternate Bid Items Proposal, page P-4.

*** END OF DOCUMENT ***

**THE USE OF PENCIL OR CORRECTION FLUID OR TAPE IS NOT ACCEPTABLE.
BID DOCUMENTS COMPLETED IN PENCIL OR CONTAINING THE USE OF CORRECTION FLUID OR
TAPE WILL BE REJECTED.**

**ALL CHANGES MUST BE LINED OUT AND CORRECTIONS INSERTED ADJACENT TO THE CHANGE AND
INITIALED BY THE BIDDER'S AUTHORIZED REPRESENTATIVE**

PROPOSAL

DO NOT DETACH ANY PAGES FROM THIS BOUND BID DOCUMENT

**TO: CHIEF ADMINISTRATIVE OFFICE, PROCUREMENT & CONTRACTS DIVISION
COUNTY OF EL DORADO, STATE OF CALIFORNIA**

for the construction of

EL DORADO COUNTY ANIMAL SERVICES FACILITY

BID #14-968-042

NAME OF BIDDER: _____

BUSINESS MAILING ADDRESS: _____

CITY, STATE, ZIP: _____

BUSINESS STREET ADDRESS: _____
(Please include even if P.O. Box used)

CITY, STATE, ZIP: _____

TELEPHONE NO: AREA CODE () _____

FAX NO: AREA CODE () _____

The work for which this Proposal is submitted is for the construction in accordance with these Contract Documents (including the payment of not less than the State general prevailing wage rates set forth herein), the Project Plans described below, including any addenda thereto, the Contract annexed hereto, and also in accordance with the Labor Surcharge and Equipment Rental Rates in effect on the date the work is accomplished, and in accordance with the General Prevailing Wage rates. The Project Plans and other Contract Documents for the work to be done are entitled:

EL DORADO COUNTY ANIMAL SERVICES FACILITY

BID #14-968-042

Bids are to be submitted for the entire work. The work includes LUMP SUM BID. Failure to submit a bid for the entire work will result in the bid being deemed non-responsive.

The Bidder shall set forth a lump sum total for the BID, in clearly legible figures in the respective space provided for this purpose.

If the item total for the lump sum is unreadable or otherwise unclear, or is omitted, the bid may be deemed irregular.

Symbols such as commas and dollar signs will be ignored and have no mathematical significance in establishing lump sums. The written lump sum in numbers will be interpreted according to the number of digits and, if applicable, decimal placement. In the event of a discrepancy, the written lump sum in words will govern over the written lump sum in numbers.

The foregoing provisions for the resolution of specific irregularities cannot be so comprehensive as to cover every omission, inconsistency, error or other irregularity which may occur in a bid. Any situation not specifically provided for will be determined in the discretion of the County of El Dorado, and that discretion will be exercised in the manner deemed by the County of El Dorado to best protect the public interest in the prompt and economical completion of the work. The decision of the County of El Dorado respecting the amount of a bid, or the existence or treatment of any irregularity in a bid, shall be final.

If this Proposal is accepted and the undersigned Bidder shall fail to enter into the Contract and furnish the two bonds in the sums required by the State Contract Act, with surety satisfaction to the County of El Dorado in accordance with the Special Provisions within ten (10) days, not including Saturdays, Sundays, and legal holidays, of the date of the letter notice from the County of El Dorado that the Contract has been awarded, the County of El Dorado may, at its option, determine that the Bidder has abandoned the Contract, and thereupon this Proposal and the acceptance thereof shall be null and void and the forfeiture of such security accompanying this Proposal shall operate and the same shall be the property of the County of El Dorado.

Attention! The undersigned Bidder acknowledges that a bid security must be submitted in amount of not less than ten (10) percent of the Lump Sum Bid.

The undersigned, as Bidder, declares under penalty of perjury under the laws of the State of California that the only persons or parties interested in this Proposal, as principals, are those named herein; that this Proposal is made without collusion with any other person, firm, or corporation; that it has carefully examined the location of the proposed work, the annexed proposed form of Contract, and the Plans therein referred to; and that it proposes, and agrees if this Proposal is accepted, that it will contract with the County of El Dorado, in the form of the copy of the Draft Agreement annexed hereto, to provide all necessary machinery, tools, apparatus, and other means of construction, and to do all the work and furnish all the materials specified in the Contract, in the manner and time therein prescribed, and according to the requirements of the Engineer as therein set forth, and that it will take in full payment therefore the following item prices, to wit:

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**PROPOSAL BID PRICE SCHEDULE
El Dorado County Animal Services Facility
BID #14-968-042**

LUMP SUM BASE BID: (Figure) \$ _____

LUMP SUM BASE BID (Words):

NOTICE: Bidder's failure to execute the questionnaire and statements contained in this Bid as required by applicable laws and regulations, or the determinations by El Dorado County based upon those questionnaires and statements, may prohibit award of the subject Contract to the Bidder.

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ALTERNATE BID ITEMS PROPOSAL

BIDDER MUST PROVIDE A PROPOSAL PRICE FOR EACH ALTERNATE BID ITEM SET FORTH HEREIN.

Alternate 1.

ADD - Epoxy Floor Prep

Description of Work:

Bids shall be based on the assumption that water vapor emission rate is 15 pounds per 1000 square feet per 24 hours and that application rate is one gallon per 100 square feet. If emission rate is lower or higher than 15 pounds per 1000 square feet and material application rate is therefore increased or decreased, cost may be adjusted by Change Order.

Bid Amount: \$ _____

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SUBSTITUTIONS LISTING OF "OR EQUAL" ITEM

The Bidder shall list any proposed substitutions in accordance with Section 8 of the "Instructions to Bidders". See also Substitution Request Form (Contract Administration Forms Page CF-5).

Product Name (to be replaced)	Substitute With "Or Equal" Item	Indicate Technical Specification Section

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INITIALED BY THE BIDDER'S AUTHORIZED REPRESENTATIVE**

SUBCONTRACTORS LISTING

The Bidder shall list the name and address and license number of each subcontractor to whom the Bidder proposes to subcontract portions of the work, in an amount in excess of one-half of 1% of the total bid in accordance with the Subletting and Subcontracting Fair Practices Act, commencing with Section 4100 of the Public Contract Code and as required by the provisions in "Required Listing of Proposed Subcontractors" in the Notice to Bidders. **The Bidder shall list the description of work and express the percentage of work to be performed by each subcontractor as subcontracted amount divided by LUMP SUM BID amount.**

Name	Location of Business	License No.	Description of Work and Percentage of Work Subcontracted

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INITIALED BY THE BIDDER'S AUTHORIZED REPRESENTATIVE**

PUBLIC CONTRACT CODE SECTION 10285.1 STATEMENT

In accordance with Public Contract Code Section 10285.1 (Chapter 376, Stats. 1985), the Bidder hereby declares under penalty of perjury under the laws of the State of California that the Bidder has _____, has not _____ been convicted within the preceding three years of any offenses referred to in that Section, including any charge of fraud, bribery, collusion, conspiracy, or any other act in violation of any state or Federal antitrust law in connection with the bidding upon, award of, or performance of, any public works contract, as defined in Public Contract Code Section 1101, with any public entity, as defined in Public Contract Code Section 1100, including the Regents of the University of California or the Trustees of the California State University. The term "Bidder" is understood to include any partner, member, officer, director, responsible managing officer, or responsible managing employee thereof, as referred to in Section 10285.1.

NOTE: The Bidder must place a check mark after "has" or "has not" in one of the blank spaces provided.

The above Statement is part of the Proposal. Signing this Proposal on the signature portion thereof shall also constitute signature of this Statement.

Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

**THE USE OF PENCIL OR CORRECTION FLUID OR TAPE IS NOT ACCEPTABLE.
BID DOCUMENTS COMPLETED IN PENCIL OR CONTAINING THE USE OF CORRECTION FLUID OR
TAPE WILL BE REJECTED.**

**ALL CHANGES MUST BE LINED OUT AND CORRECTIONS INSERTED ADJACENT TO THE CHANGE AND
INITIALED BY THE BIDDER'S AUTHORIZED REPRESENTATIVE**

PUBLIC CONTRACT CODE SECTION 10162 QUESTIONNAIRE

In accordance with Public Contract Code Section 10162, the Bidder shall complete, under penalty of perjury under the laws of the State of California, the following questionnaire:

Has the Bidder, any officer of the Bidder, or any employee of the Bidder who has a proprietary interest in the Bidder, ever been disqualified, removed, or otherwise prevented from bidding on, or completing a federal, state, or local government project because of a violation of law or a safety regulation?

Yes: _____

No: _____

If the answer is yes, explain the circumstances in the following space:

PUBLIC CONTRACT CODE SECTION 10232 STATEMENT

In accordance with Public Contract Code Section 10232, the Bidder hereby states under penalty of perjury under the laws of the State of California, that no more than one final unappealable finding of contempt of court by a Federal Court has been issued against the Bidder within the immediate preceding two year period because of the Bidder's failure to comply with an order of a Federal Court which orders the Bidder to comply with an order of the National Labor Relations Board.

NOTE:

The above Questionnaire and Statement are part of the Proposal. Signing this Proposal on the signature portion thereof shall also constitute signature of this Questionnaire and Statement.

Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

NONCOLLUSION AFFIDAVIT
(Title 23 United States Code Section 112 and
Public Contract Code Section 7106)

In accordance with Title 23 United States Code, Section 112 and Public Contract Code Section 7106, the Bidder declares 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 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.

NOTE:

The above Noncollusion Affidavit is part of the Proposal. Signing this Proposal on the signature portion thereof shall also constitute signature of this Noncollusion Affidavit.

Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

Accompanying this proposal is _____

(NOTICE: INSERT THE WORDS "CASH (\$___)," "CASHIER'S CHECKS," "CERTIFIED CHECKS," OR "BIDDERS BONDS," AS THE CASE MAY BE)

in amount equal to at least ten percent of the total **amount of the Lump Sum Bid, inclusive of any additive Alternate Bid Item(s).**

The names of all persons interested in the forgoing Proposal as principals are as follows:

IMPORTANT NOTICE: If the Bidder or other interested person is a corporation, state legal name of corporation and place of incorporation, also names of the president, secretary, treasurer, and executive officer thereof; if a partnership, state name of partnership, also names of all individual partners; if Bidder or other interested person is an individual, state first and last names in full.

Licensed in accordance with an act providing for the registration of Contractors,

License No. _____ Classification(s) _____

A copy of the afore-referenced license must be attached hereto.

ADDENDA: This Proposal is submitted with respect to the changes to the Contract included in addenda number(s)

(Fill in addenda numbers if addenda have been received and insert, in this Proposal, any Proposal Pay Items and Bid Price Schedules that were received as part of the addenda)

By my signature on this Proposal I certify, under penalty of perjury under the laws of the State of California, that the foregoing questionnaire and statements of Public Contract Code Sections 10162, 10232, and 10285.1 are true and correct and that I have complied with the requirements of Section 8103 of the Fair Employment and Housing Commission Regulations (Chapter 5 of Division 4 of Title 2 of the California Code of Regulations). By my signature on this Proposal I further certify, under penalty of perjury under the laws of the State of California and the United States of America that the Noncollusion Affidavit required by Title 23 United States Code, Section 112 and Public Contract Code Section 7106 is true and correct.

The person or persons executing this Proposal on behalf of a corporation or partnership shall be prepared to demonstrate by resolution, article, or otherwise, that such person is or that such persons are appropriately authorized to act in these regards for such corporation or partnership. Such authority shall be demonstrated to the satisfaction of the County of El Dorado.

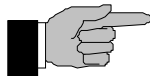
If the signature is by an agent other than an officer of a corporation or a member of a partnership, a power of attorney authorizing said act by the agent on behalf of his principal shall be submitted with the bid forms; otherwise, the bid may be disregarded as irregular and unauthorized.

The Bidder's execution on the signature portion of this Proposal shall constitute an endorsement and execution of those affidavits, declarations and certifications which are part of this Proposal.

Executed this _____ day of _____, 20__

at _____ County, State of _____

Date: _____



SIGN HERE _____

Name and Title of Bidder _____

Name of Firm _____

END OF PROPOSAL

COUNTY OF EL DORADO

BIDDER'S BOND

this form MUST be used

KNOW ALL PEOPLE BY THESE PRESENTS, THAT WE _____
_____, as **PRINCIPAL**, and

as Surety are held and firmly bound unto the County of El Dorado (Obligee), in the penal sum of **TEN (10) PERCENT OF THE AMOUNT OF THE TOTAL LUMP SUM BID PRICE** of the Principal above named, submitted by said Principal to the Obligee for the work described below, for the payment of which sum in lawful money of the United States, well and truly to be made to the Obligee, we the Principal and Surety bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents. In no case shall the liability of the Surety hereunder exceed the sum of

TEN PERCENT (10%) OF THE AMOUNT OF THE TOTAL LUMP SUM BID PRICE

THE CONDITION OF THIS OBLIGATION IS SUCH, THAT:

WHEREAS, the Principal has submitted the above-mentioned Bid to the Obligee, as aforesaid, for certain construction specifically described as follows, for which bids are to be opened at Placerville, El Dorado County, California, for the construction of the:

EL DORADO COUNTY ANIMAL SERVICES FACILITY
BID #14-968-042

NOW, THEREFORE, if the aforesaid Principal is awarded the Contract and, within the time and manner required under the Contract Documents, after the prescribed forms are presented to it for signature, enters into a written contract, in the prescribed form, in accordance with the Bid, and files two bonds with the County of El Dorado, one to guarantee faithful performance and the other to guarantee payment for labor and materials, as required by law, then this obligation shall be null and void; otherwise, it shall remain in full force and virtue.

In the event suit is brought upon this bond by the Obligee and judgment is recovered, the Surety shall pay all costs incurred by the Obligee in such suit, including a reasonable attorney's fee to be fixed by the Court.

IN WITNESS WHEREOF, we have set our hands and seals on this _____ day of _____ 20____

(seal) _____
Principal

(seal) _____
Surety

Address: _____

(NOTE: Signature of those executing for the Surety shall be properly acknowledged, and accompanied by a Certificate of Acknowledgment.)

PRINCIPAL

ACKNOWLEDGMENT

State of California

County of _____

On _____ before me, _____,
(here insert name and title of the officer)

personally appeared _____

_____ ,

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.

Signature _____

(Seal)

SURETY

ACKNOWLEDGMENT

State of California

County of _____

On _____ before me, _____,
(here insert name and title of the officer)

personally appeared _____

_____ ,

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.

Signature _____

(Seal)

County of El Dorado, State of California

BID #14-968-042

EL DORADO COUNTY ANIMAL SERVICES FACILITY

THIS AGREEMENT ("Agreement") approved by the County of El Dorado Board of Supervisors, this _____ day of _____, in the year of _____, made and concluded, in duplicate, between the **COUNTY OF EL DORADO**, a political subdivision of the State of California, by the Chief Administrative Office, Facilities Division thereof, the party of the first part hereinafter called "County," and _____ (Contractor) party of the second part hereinafter called "Contractor."

RECITALS

WHEREAS, County has caused the above-captioned project to be let to formal bidding process; and

WHEREAS, Contractor has duly submitted a bid response for the captioned project upon which County has awarded this Contract;

NOW, THEREFORE, the parties hereto have mutually covenanted and agreed, and by these presents do covenant and agree, each with the other, as follows:

Article 1. THE WORK

The improvement contemplated in the performance of this Contract is an improvement over which the County of El Dorado shall exercise general supervision. The County therefore, shall have the right, but not the duty to assume full and direct control over this Contract whenever the County at its sole discretion, shall determine that its responsibility is so required.

The Contractor shall complete the Work as specified or indicated under the County's Contract Documents entitled:

El Dorado County Animal Services Facility

The project is located at 6435 Capitol Avenue, Diamond Springs, California in El Dorado County. The Work to be done as described in the Technical Specifications section and as shown on the Plans, generally consists of, but is not limited to: furnishing of all labor, materials and equipment for construction of improvements to the interior of the Animal Services Facility.

Article 2. CONTRACT DOCUMENTS

The Contract Documents consist of: the Notice to Bidders; the bid forms which include the accepted Proposal, Proposal Bid Price Schedule, Subcontractors Listing, Section 10285.1 Statement, Section 10162 Questionnaire, Section 10232 Statement, and the Noncollusion Affidavit; the Contract which includes this Agreement with all Exhibits thereto, the Performance Bond and Payment Bond; Conditions of the Contract; the drawings listed and identified as the Project Plans; the Technical Specifications; all Addenda incorporated in those documents before their execution, all Contract Change Orders, Architect's Supplemental Instructions, and Construction Change Directives issued in accordance with the Contract Documents which may be delivered or issued after the Effective Date of this Agreement and are not attached hereto; the prevailing Labor Surcharge And Equipment Rental Rates (when required) as determined by the Department of Industrial Relations to be in effect on the date the Work is accomplished; all the obligations of County and of Contractor which are fully set forth and described therein; and all Contract Documents which are hereby specifically referred to and by such reference made a part hereof. All Contract Documents are intended to cooperate so that any work called for in one and not mentioned in the other is to be executed the same as if mentioned in all Contract Documents. Contractor agrees to perform all of its promises,

covenants, and conditions set forth in the Contract Documents, and to abide by and perform all terms and conditions set forth therein. In case of conflict between this Agreement and any other contract document, this Agreement shall take precedence.

Article 3. CONTRACT PRICE

As compensation agreed upon for said Work, County shall pay or cause to be paid to Contractor, in full, and for the full contract price and compensation for said completion of the Work, including without limitation, all bonds and insurance, THE NOT TO EXCEED SUM OF (insert dollar amount in words) DOLLARS (\$(insert dollar amount in numbers)) which sum constitutes the Contract Price for the complete Project (the "Contract Price").

Article 4. COMMENCEMENT AND COMPLETION

The Work to be performed under this Contract shall commence on the date specified in the Notice to Proceed issued by County. The work shall be diligently prosecuted to completion within **180 CALENDAR DAYS** commencing from the date shown on the Contractor Notice To Proceed.

County and Contractor recognize that time is of the essence of the Agreement and that County will suffer loss if the Work is not completed within the time specified in the above paragraph, plus any extensions thereof allowed in accordance with Article 4.3.5 of the Conditions of the Contract. They also recognize the delays, expense, and difficulties involved with proving in a legal proceeding the actual loss suffered by County if the Work is not completed on time. Accordingly, instead of requiring any such proof, County and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay County the sum of **ONE THOUSAND DOLLARS FIVE HUNDRED DOLLARS (\$1,500.00)** per day, as liquidated damages and not as a penalty, for each and every calendar day's delay in finishing the Work in excess of the contract time prescribed herein.

Article 5. PAYMENT

Payment shall be made to Contractor as follows:

Progress payments are to be made semi-monthly based on the percentage of completion method reached by the Contractor and invoiced using Exhibit "A", marked "Application and Certificate for Payment" incorporated herein and made by reference a part hereof.

Retention of 5% of the total Contract price will be held until the work is 50% complete, and thereafter at the option of County. Payment by County as herein provided shall not be construed as an absolute acceptance of defects in the work or improper materials.

Article 6. INDEMNITY

To the fullest extent allowed by law, Contractor shall defend, indemnify, and hold the County and its officers, directors, and employees harmless against and from any and all claims, suits, losses, damages, and liability for damages, including attorney's fees and other costs of defense brought for or on account of injuries to or death of any person, including but not limited to, workers and the public, or on account of injuries to or death of County employees, or damage to property, or any economic, consequential or special damages which are claimed or which shall in any way arise out of or be connected with Contractor's services, operations or performance hereunder, regardless of the existence or degree of fault or negligence on the part of the County, the Contractor, subcontractors or employees of any of these, except for the active, or sole negligence of the County, its officers and employees, or where expressly prescribed by statute.

The duty to indemnify and hold harmless the County specifically includes the duties to defend set forth in Section 2778 of the Civil Code. The insurance obligations of the Contractor are separate, independent obligations under the Contract Documents, and the provisions of this defense and indemnity are not intended to modify nor should they be construed as modifying or in any way limiting the insurance obligations set forth in the Contract Documents.

Article 7. NOTICE OF DISCOVERY OF HAZARDOUS WASTE OR UNUSUAL CONDITIONS

- A. Contractor shall promptly, and before the following conditions are disturbed, notify County in writing, in the event Contractor encounters, after excavating to a depth of greater than four (4) feet, any of the following:
 - 1. Material that Contractor believes may be hazardous waste, as defined in section 25117 of the Health and Safety Code, which is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law; or
 - 2. Subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents; or
 - 3. Unknown physical conditions at the site of any unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the Work provided for in the Contract.
- B. County shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, or cause a decrease or increase in Contractor's cost of, or time required for performance of any part of the Work, an adjustment, excluding loss of anticipated profits, will be made and the Contract will be modified by a Change Order. County will notify Contractor of County's determination as to whether or not an adjustment of the Contract is warranted.
- C. In the event a dispute arises between County and Contractor as to whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in Contractor's cost of, or time required for, performance of any part of the Work, Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all Work to be performed under the Contract. Contractor shall retain any and all rights provided either by contract or by law which pertain to the resolution of disputes and protests between Contractor and County.

Article 8. GUARANTEES

Contractor shall repair or replace any or all work provided hereunder which is defective due to faulty materials, poor workmanship, or defective equipment at no expense to County, ordinary wear or tear and unusual abuse or neglect excepted, during the term of the Contract and for a period of one (1) year after contract Acceptance. Contractor shall be required to repair or replace any and all adjacent facilities or areas which have been damaged or displaced due to Contractor work performed under this Agreement at no expense to County during the term of this Contract and for a period of one (1) year after Contract Acceptance.

If a warranty or guarantee exceeding one (1) year is provided by the supplier or manufacturer of any equipment or materials used in this Project, or if a warranty or guarantee exceeding one (1) year is required elsewhere in these Contract Documents, then the guarantee for such equipment or materials shall be extended for such term. Contractor expressly agrees to act as co-guarantor of such equipment and materials, and Contractor shall supply County with all warranty and guaranty documents relative to equipment and materials incorporated in the job and guaranteed by its suppliers or manufacturers.

The parties agree that this guarantee and the rights and obligations accruing therefrom shall be in addition to, and not by way of limitation in any manner whatsoever to, the rights, obligations, warranties or remedies otherwise provided for by law.

In the event of Contractor's failure to comply with the above mentioned conditions within ten (10) calendar days after being notified in writing by County, Contractor hereby authorizes County to proceed to have said defects repaired and made good at Contractor's expense, and Contractor will honor and pay all costs and charges therefore upon written demand.

Article 9. NOTICE

Any notice or other correspondence required to be given under this Agreement by either party to the other may be affected by personal delivery in writing or by mail, postage prepaid. Notices personally delivered during normal business hours shall be deemed received on the actual date of delivery; mailed notices shall be deemed received one (1) day after affixed postmark. Notices and correspondence to County shall be in duplicate and shall be delivered to it as follows:

To County:

County of El Dorado
Chief Administrative Office
3000 Fairlane Court, Suite One

Attn.: Russ Fackrell
Facilities Manager

Notices and correspondence to Contractor shall be delivered when personally delivered to, or if mailed, addressed to Contractor at:

Contractor's Business Name

Street Address
City, State Zip

Attn.: Name of Notices Recipient
Title of Notices Recipient

Either party may change its address for notices by giving written notice pursuant to this Article.

Article 10. VENUE

Any litigation arising out of this Contract shall be brought in El Dorado County.

Article 11. PERFORMANCE BOND

As a part of the execution of this Contract, Contractor shall furnish a bond of a surety company authorized to do business in the State of California, conditioned upon the faithful performance of all covenants and stipulations under this Contract. The amount of this bond shall be one hundred percent (100%) of the total Contract Price and shall be executed upon the form provided by County.

Article 12. PAYMENT BOND

As a part of the execution of this Contract, Contractor shall furnish a bond of a surety company authorized to do business in the State of California, conditioned upon the payment in full of all claims for labor and materials in accordance with the provisions of the law of the State of California. The amount of this bond shall be one hundred percent (100%) of the total Contract Price and shall be executed upon the form provided by County.

Article 13. NOTIFICATION OF SURETY COMPANY

The surety company shall familiarize itself with all of the conditions and provisions of this Contract, and shall waive the right of special notification of any change or modifications of this Contract or extension of time, or of decreased or increased work, or of the cancellation of the Contract, or of any other act or acts by County or its authorized agents, under the terms of this Contract; and failure to so notify the aforesaid surety company of changes shall in no way relieve the surety company of its obligation under this Contract.

Article 14. ASSIGNMENT OF ANTITRUST ACTIONS

In entering into a public works contract or a subcontract to supply goods, services, or materials pursuant to a public works contract, the Contractor offers and agrees and will require all of its subcontractors and suppliers to agree to assign to the awarding body all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the

Business and Professions Code), arising from purchases of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to Contractor, without further acknowledgment by the parties.

If an awarding body or public purchasing body receives, either through judgment or settlement, a monetary recovery for a cause of action assigned under Government Code Sections 4550-4554, the assignor shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the public body any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the public body as part of the bid price, less the expenses incurred in obtaining that portion of the recovery. Upon demand in writing by the assignor, the assignee shall, within one year from such demand, reassign the cause of action assigned under Government Code Sections 4550-4554 if the assignor has been or may have been injured by the violation of law for which the cause of action arose and (a) the assignee has not been injured thereby, or (b) the assignee declines to file a court action for the cause of action.

Article 15. TERMINATION BY COUNTY FOR CONVENIENCE

County reserves the right to terminate the Contract at any time upon determination by County's representative that termination of the Contract is in the best interest of County. County shall issue Contractor a written notice specifying that the Contract is to be terminated.

Upon receipt of said written notice, Contractor shall stop all work under the Contract except: (1) work specifically directed to be completed prior to termination, (2) work the Inspector deems necessary to secure the project for termination, (3) removal of equipment and plant from the site of the Work, (4) action that is necessary to protect materials from damage, (5) disposal of materials not yet used in the Work as directed by County, and (6) clean up of the site.

If the Contract is terminated for County's convenience as provided herein, all finished or unfinished work and materials previously paid for shall, at the option of County, become its property. Contractor shall be paid an amount which reflects costs incurred for work provided to the date of notification of termination. In addition, Contractor shall be paid the reasonable cost, as solely judged by County, and without profit, for all work performed to secure the project for termination.

Article 16. TERMINATION BY COUNTY FOR CAUSE

If Contractor is adjudged as bankrupt or insolvent, or makes a general assignment for the benefit of its creditors or if a trustee or receiver is appointed for Contractor or for any of its property, or if Contractor files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or on more than one occasion fails to supply sufficient skilled workmen or suitable material or equipment, or on more than one occasion fails to make prompt payments to subcontractors for labor, materials, or equipment, or disregards the authority of the County's representative, or the Engineer, if one is appointed, or otherwise violates any provision of the Contract Documents, then County may, without prejudice to any other right or remedy and after giving Contractor and its Surety a minimum of ten (10) days from delivery of a written termination notice, terminate the services of Contractor and take equipment and machinery thereon owned by Contractor and finish the Work by whatever method County may deem expedient. In such case, Contractor shall not be entitled to receive any further payment until the Work is finished.

Without prejudice to other rights or remedies County may have, if Contractor fails to begin delivery of materials and equipment, to commence Work within the time specified, to maintain the rate of delivery of material, to execute the Work in the manner and at such locations as specified, or fails to maintain a work program which will ensure County's interest, or, if Contractor is not carrying out the intent of the Contract, an Inspector's written notice may be served upon Contractor and the Surety on its faithful performance bond demanding satisfactory compliance with the Contract. If Contractor or its Surety does not comply with such notice within five (5) days after receiving it, or after starting to comply, fails to continue, County may exclude it from the premises and take possession of all material and equipment, and complete the Work by County's own forces, by letting the unfinished Work to another Contractor, or by a combination of such methods.

Where Contractor's services have been so terminated by County, said termination shall not affect any right of County against Contractor then existing or which may thereafter accrue. Any retention or payment of monies by County due Contractor will not release Contractor from compliance with the Contract Documents.

If the unpaid balance of the Contract price exceeds the direct and indirect costs of completing the Work, including compensation for additional professional services, such excess shall be paid to Contractor. If the sums under the Contract are insufficient for completion, Contractor or Surety shall pay to County within five (5) days after the completion, all costs in excess of the Contract price. In any event, the cost of completing the Work shall be charged against Contractor and its Surety and may be deducted from any money due or becoming due from County.

The provisions of this Article shall be in addition to all other rights and remedies available to County under law.

If after notice of termination, it is determined for any reason that Contractor was not in default, the rights and obligations of the parties shall be the same as if the notice of termination had not been issued. The Contract shall be equitably adjusted to compensate for such termination.

Article 17. SUCCESSORS AND ASSIGNS

This Agreement shall bind and inure to the heirs, devisees, assignees, and successors in interest of Contractor and to the successors in interest of County in the same manner as if such parties had been expressly named herein.

Article 18. REPORTING ACCIDENTS

Contractor shall prepare and submit (within 24 hours of such incidents) reports of accidents at the site and anywhere else the work is in progress in which bodily injury is sustained or property loss in excess of Five Hundred Dollars (\$500.00) occurs.

Article 19. WORKERS' COMPENSATION CERTIFICATION

Contractor shall comply with Labor Code Sections 3700 et seq., requiring it to obtain Workers' Compensation Insurance, and sign a certificate of knowledge thereof.

CERTIFICATE OF KNOWLEDGE - LABOR CODE SECTION 3700

I am aware of the provisions of Section 3700 of the 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 work of this Contract.

Signed: _____ Date: _____

Article 20. WARRANTY

Contractor warrants to County that materials and equipment furnished for the Work will be of good quality and new, unless otherwise required or permitted under the Contract Documents, that the Work will be free from defects or flaws and is of the highest quality of workmanship and that the Work will conform with the requirements herein. Work not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective.

Article 21. RETAINAGE

The retainage from payments is set forth in Section 6.4 "WITHHOLDINGS FROM PAYMENTS" of the Conditions of the Contract. Contractor may elect to receive one hundred percent (100%) of payments due as set forth in the Contract Documents, without retention, by depositing securities of equivalent value with County, in accordance with, and as set forth in Section 22300 of the Public Contract Code. Securities eligible for deposit hereunder shall be limited to those listed in Section 16430 of the Government Code, or bank or savings and loan certificates of deposit.

Article 22. PREVAILING WAGE REQUIREMENTS

Contractor shall pay and require payment of prevailing wage rates. In accordance with the provisions of California Labor Code Sections 1770 et seq., the general prevailing rate of wages in the county in which the Work is to be done has been determined by the Director of the California Department of Industrial Relations. These wage rates appear in the California Department of Transportation publication entitled General Prevailing Wage Rates. Interested parties can obtain the current wage information by submitting their requests to the Department of Industrial Relations, Division of Labor Statistics and Research, PO Box 420603, San Francisco CA 94142-0603, Telephone (415) 703-4708 or by referring to the website at <http://www.dir.ca.gov/dlsr/PWD>. The rates at the time of the bid advertisement date of a project will remain in effect for the life of the project in accordance with the California Code of Regulations, as modified and effective January 27, 1997.

Copies of the general prevailing rate of wages in the county in which the Work is to be done are also on file at the Chief Administrative Office, Facilities Division, and are available upon request.

In accordance with the provisions of Labor Code 1810, eight (8) hours of labor shall constitute a legal day's work upon all work done hereunder, and Contractor and any subcontractor employed under this Contract shall conform to and be bound by the provisions of Labor Code Sections 1810 through 1815.

Article 23. AUDIT BY CALIFORNIA STATE AUDITOR

Audit by California State Auditor: Contractor acknowledges that if total compensation under this agreement is greater than \$10,000.00, this Agreement is subject to examination and audit by the California State Auditor for a period of three (3) years, or for any longer period required by law, after final payment under this Agreement, pursuant to California Government Code §8546.7. In order to facilitate these potential examinations and audits, Contractor shall maintain, for a period of at least three (3) years, or for any longer period required by law, after final payment under the contract, all books, records and documentation necessary to demonstrate performance under the Agreement.

Article 24. BUSINESS LICENSE

The County Business License Ordinance provides that it is unlawful for any person to furnish supplies or services, or transact any kind of business in the unincorporated territory of El Dorado County without possessing a County business license unless exempt under County Ordinance Code Section 5.08.070. Contractor warrants and represents that it shall comply with all of the requirements of the County Business License Ordinance, where applicable, prior to beginning work under this Contract and at all times during the term of this Contract.

Article 25. TAXES

Contractor certifies that as of today's date, it is not in default on any unsecured property taxes or other taxes or fees owed by Contractor to County. Contractor agrees that it shall not default on any obligations to County during the term of this Agreement.

Article 26. CONTRACT ADMINISTRATOR

The County Officer or employee with responsibility for administering this Agreement is Russ Fackrell, Facilities Manager, 3000 Fairlane Court, Suite One, Placerville, CA, Chief Administrative Office, or successor.

Article 27. AUTHORIZED SIGNATURES

The parties hereto represent that the undersigned individuals executing this Agreement on their behalf are fully authorized to do so by law or other appropriate instrument and to bind upon said parties the obligations set forth herein.

Article 28. PARTIAL INVALIDITY

If any provision of this Agreement is held by a court of competent jurisdiction to be invalid, void or unenforceable, the remaining provisions will continue in full force and effect without being impaired or invalidated in any way.

Article 29. ENTIRE AGREEMENT

This document and the documents referred to herein or exhibits hereto are the entire Agreement between the parties and they incorporate or supersede all prior written or oral agreements or understandings.

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IN WITNESS WHEREOF, the said Chief Administration Office, Facilities Division of the County of El Dorado, State of California, has caused this Agreement to be executed by County's Board of Supervisors, on its behalf, and the said Contractor has signed this Agreement the day and year written below.

COUNTY OF EL DORADO

By: _____ Dated: _____
Chair
Board of Supervisors
County of El Dorado

James S. Mitrison, Clerk
Of the Board of Supervisors

By: _____ Dated: _____

CONTRACTOR

By: _____ Dated: _____
Name of Company

By: _____
Authorized Representative License No. Federal Employer Identification No.

NOTE: If Contractor is a corporation, the legal name of the corporation shall be set forth above together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation; if Contractor is a co-partnership, the true name of the firm shall be set forth above together with the signature of the partner or partners authorized to sign contracts on behalf of the co-partnership; and if Contractor is an individual, his/her signature shall be placed above. Contractor executing this document on behalf of a corporation or partnership shall be prepared to demonstrate by resolution, article, or otherwise that it is appropriately authorized to act in these regards. For such corporation or partnership, such authority shall be demonstrated to the satisfaction of County. If signature is by an agent, other than officer of a corporation or a member of a partnership, an appropriate Power of Attorney shall be on file with the Department prior to signing this document.

Mailing Address: _____

Business Address: _____

City, Zip: _____

Phone: _____ Fax: _____

*** END OF AGREEMENT ***

APPLICATION AND CERTIFICATE FOR PAYMENT - EXHIBIT A

TO OWNER: PROJECT:

El Dorado County
 360 Fair Lane
 Placerville, CA 95667
 FROM CONTRACTOR:

APPLICATION #: 1

PERIOD TO:
 PROJECT NOS:

CONTRACT DATE:

Distribution to:

County	
Cont Adm	
Contractor	

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet is attached.

- 1. ORIGINAL CONTRACT SUM----- \$
- 2. Net change by Change Orders-----\$
- 3. CONTRACT SUM TO DATE (Line 1 +/- 2)
- 4. TOTAL COMPLETED & STORED TO DATE-\$
 (Column G on Continuation Sheet)

- 5. RETAINAGE:
 - a. _____ of Completed Work
 (Columns D+E on Continuation Sheet) \$
 - b. _____ of Stored Material
 (Column F on Continuation Sheet) \$

Total Retainage (Line 5a + 5b or Total in Column 1 of Continuation Sheet) \$

- 6. TOTAL EARNED LESS RETAINAGE----- \$
- (Line 4 less Line 5 Total)

- 7. LESS PREVIOUS CERTIFICATES FOR PAYMENT
 (Line 6 from prior Certificate)----- \$

- 8. CURRENT PAYMENT DUE----- \$
- 9. BALANCE TO FINISH, INCLUDING RETAINAGE
 (Line 3 less Line 6) \$

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Contract Administrator		
Total approved this Month		
TOTALS		
NET CHANGES by Change Order		

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown therein is now due.

CONTRACTOR:

By: _____ Date: _____

State of: California
 County of: El Dorado

CERTIFICATE FOR PAYMENT

In accordance with Contract Documents, based on on-site observations and the data comprising application, the Contract Administrator certifies to El Dorado County that to the best of the Contract Administrator's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED ----- \$

(Attach explanation if amount certified differs from the amount applied for. Initial all figures on this application and on the Continuation Sheet that are changed to conform to the amount certified.)

CONTRACT ADMINISTRATOR

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner of Contractor under this Contract.

CONTINUATION SHEET

ATTACHMENT TO PAY APPLICATION

APPLICATION NUMBER: 1

PROJECT:

APPLICATION DATE:

PERIOD TO:

CONTRACTOR'S PROJECT NO:

A Item No.	B Description of Work	C Scheduled Value	D		E Work Completed This Period	F Materials Presently Stored (Not In D or E)	G Total Completed And Stored To Date (D + E + F)	H Balance To Finish (C - G)	I Retainage
			From Previous Application (D + E)	Work Completed This Period					
1									
2									
3									
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5									
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SUBTOTALS PAGE 2									

CONTRACTOR'S GUARANTEE

EL DORADO COUNTY ANIMAL SERVICES FACILITY

BID #14-968-042

As Contractor for the above referenced project, we hereby agree to repair or replace any or all work provided hereunder which is defective due to faulty materials, poor workmanship, or defective equipment at no expense to the County of El Dorado, ordinary wear and tear and unusual abuse or neglect excepted, during the term of the contract and provide the manufacturer one (1) year warranty period from the date of final acceptance of the work.

We further agree to repair or replace any and all adjacent areas which have been damaged or displaced due to our work performed under this contract at no expense to the County of El Dorado during the term of this contract for a period of one (1) year from the date of final acceptance of the work.

If a warranty or guarantee exceeding one (1) year is provided by the supplier or manufacturer of any equipment or materials used in this Project, or if a warranty or guarantee exceeding one (1) year is required elsewhere in these Contract Documents, then the guarantee for such equipment or materials shall be extended for such term. We expressly agrees to act as co-guarantor of such equipment and materials, and we shall supply County with all warranty and guaranty documents relative to equipment and materials incorporated in the job and guaranteed by its suppliers or manufacturers.

We agree that this guarantee and the rights and obligations accruing there from shall be in addition and not by way of limitation in any manner whatsoever to the rights, obligations, warranties or remedies otherwise provided for by law.

In the event of our failure to comply with the above mentioned conditions with (ten) 10 days after being notified in writing by the County of El Dorado, we hereby authorize the County of El Dorado to proceed to have said defects repaired and made good at our expense and we will honor and pay all costs and charges therefore upon written demand.

EXECUTED on this _____ day of _____, 2013.

CONTRACTOR

By _____

Title _____

By _____

Title _____

*** END OF DOCUMENT ***

COUNTY OF EL DORADO

PAYMENT BOND

(Section 3247, Civil Code)

Bond No. _____

WHEREAS, the County of El Dorado, a political subdivision of the State of California, hereafter referred to as "Obligee", has awarded to Contractor

_____ hereafter referred to as "Principal", a contract for the work described as follows:

**EL DORADO COUNTY ANIMAL SERVICES FACILITY
 BID #14-968-042**

AND, WHEREAS, said Principal is required to furnish a bond in connection with said contract, guaranteeing the faithful performance thereof:

NOW, THEREFORE, we the undersigned Principal and Surety are held and firmly bound unto the Obligee, in the sum of _____ Dollars, (\$ _____) to be paid to the Obligee, for which payment we bind ourselves, jointly and severally.

THE CONDITION OF THIS OBLIGATION IS SUCH,
 That if said Principal or its subcontractors shall fail to pay any of the persons named in Civil Code Section 3181, or amounts due under the Unemployment Insurance Code with respect to work or labor performed by such claimant, or any amounts required to be deducted, withheld, and paid over to the Franchise Tax Board from the wages of employees of the Principal and his subcontractors pursuant to Section 18806 of the Revenue and Taxation Code, with respect to such work and labor, that the Surety herein will pay for the same in an amount not exceeding the sum specified in this bond, otherwise the above obligation shall be void. In case suit is brought upon this bond, the Surety will pay a reasonable attorney's fee to be fixed by the court.

This bond shall inure to the benefit of any of the persons named in Civil Code Section 3181 as to give a right of action to such persons or their assigns in any suit brought upon this bond.

Dated: _____

Correspondence or Claims relating to this bond should be sent to the Surety at the following address:

 PRINCIPAL

 SURETY

 ATTORNEY-IN-FACT

NOTE: Signatures of those executing for the Principal and for the Surety must be properly acknowledged, and a Power of Attorney attached for the Surety.

NOTARY ACKNOWLEDGMENTS ATTACHED

PRINCIPAL

ACKNOWLEDGMENT

State of California

County of _____

On _____ before me, _____,
(here insert name and title of the officer)

personally appeared _____

_____ ,

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.

Signature _____

(Seal)

SURETY

ACKNOWLEDGMENT

State of California

County of _____

On _____ before me, _____,
(here insert name and title of the officer)

personally appeared _____

_____ ,

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.

Signature _____

(Seal)

COUNTY OF EL DORADO

PERFORMANCE BOND

Bond No. _____

KNOW ALL MEN BY THESE PRESENTS, that we _____

the Contractor in the Contract hereto annexed, as Principal, and _____

as Surety, are held firmly bound unto the County of El Dorado, a political subdivision of the State of California, hereinafter

called the "Obligee" in the sum of _____ DOLLARS,

(\$ _____) lawful money of the United States, for which payment, well and truly to be made, we

bind ourselves, jointly and severally, firmly by these presents.

Signed, sealed and dated: _____

The condition of the above obligation is such that if said Principal as Contractor in the Contract hereto annexed shall faithfully perform each and all of the conditions of said Contract to be performed by him, and shall furnish all tools, equipment, apparatus, facilities, transportation, labor and material, other than material, if any, agreed to be furnished by the Obligee, necessary to perform and complete, and to perform and complete in a good and workmanlike manner, the work of **BID #14-968-042 for the EL DORADO COUNTY ANIMAL SERVICES FACILITY** in strict conformity with the terms and conditions set forth in the Contract hereto annexed, then this obligation shall be null and void; otherwise this bond shall remain in full force and effect and the said Surety will complete the Contract work under its own supervision, by Contract or otherwise, and pay all costs thereof for the balance due under terms of the Contract, and the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work.

In the event suit is brought upon this bond by the Obligee and judgment is recovered, the Surety shall pay all costs incurred by the Obligee in such suit, including a reasonable attorney's fee to be fixed by the court.

This guarantee shall insure the Obligee during the work required by any Contract and for a period of one (1) year from the date of acceptance of the work against faulty or improper materials or workmanship that may be discovered during that time.

No right of action shall accrue under this bond to or for the use of any person other than the Obligee named herein.

Dated: _____, 20_____.

Correspondence or Claims relating to this bond should be sent to the Surety at the following address:

PRINCIPAL

SURETY

ATTORNEY-IN-FACT

NOTE: Signatures of those executing for the Principal and the Surety must be properly acknowledged, and a Power of Attorney attached for the Surety.

NOTARY ACKNOWLEDGMENTS ATTACHED

PRINCIPAL

ACKNOWLEDGMENT

State of California

County of _____

On _____ before me, _____,
(here insert name and title of the officer)

personally appeared _____

_____ ,

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.

Signature _____

(Seal)

SURETY

ACKNOWLEDGMENT

State of California

County of _____

On _____ before me, _____,
(here insert name and title of the officer)

personally appeared _____

_____ ,

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.

Signature _____

(Seal)

Withholding Exemption Certificate

2012

(This form can only be used to certify exemption from nonresident withholding under California Revenue and Taxation Code (R&TC) Section 18662. Do not use this form for exemption from wage withholding.)

590

File this form with your withholding agent. (Please type or print)

Withholding agent's name _____

Payee's name _____

Payee's SOS file no. SSN or ITIN CA corp. no. FEIN

Address (number and street, PO Box, or PMB no.) _____

Apt. no./ Ste. no. _____

City _____

State _____

ZIP Code _____

Read the following carefully and check the box that applies to the payee.

I certify that for the reasons checked below, the payee named on this form is exempt from the California income tax withholding requirement on payment(s) made to the entity or individual.

Individuals — Certification of Residency:

I am a resident of California and I reside at the address shown above. If I become a nonresident at any time, I will promptly notify the withholding agent. See instructions for General Information D, Who is a Resident, for the definition of a resident.

Corporations:

The above-named corporation has a permanent place of business in California at the address shown above or is qualified through the California Secretary of State (SOS) to do business in California. The corporation will file a California tax return and withhold on payments of California source income to nonresidents when required. If this corporation ceases to have a permanent place of business in California or ceases to do any of the above, I will promptly notify the withholding agent. See instructions for General Information F, What is a Permanent Place of Business, for the definition of permanent place of business.

Partnerships or limited liability companies (LLC):

The above-named partnership or LLC has a permanent place of business in California at the address shown above or is registered with the California SOS, and is subject to the laws of California. The partnership or LLC will file a California tax return and will withhold on foreign and domestic nonresident partners or members when required. If the partnership or LLC ceases to do any of the above, I will promptly inform the withholding agent. For withholding purposes, a limited liability partnership (LLP) is treated like any other partnership.

Tax-Exempt Entities:

The above-named entity is exempt from tax under California Revenue and Taxation Code (R&TC) Section 23701 _____ (insert letter) or Internal Revenue Code Section 501(c) _____ (insert number). The tax-exempt entity will withhold on payments of California source income to nonresidents when required. If this entity ceases to be exempt from tax, I will promptly notify the withholding agent. Individuals cannot be tax-exempt entities.

Insurance Companies, Individual Retirement Arrangements (IRAs), or Qualified Pension/Profit Sharing Plans:

The above-named entity is an insurance company, IRA, or a federally qualified pension or profit-sharing plan.

California Trusts:

At least one trustee and one noncontingent beneficiary of the above-named trust is a California resident. The trust will file a California fiduciary tax return and will withhold on foreign and domestic nonresident beneficiaries when required. If the trustee becomes a nonresident at any time, I will promptly notify the withholding agent.

Estates — Certification of Residency of Deceased Person:

I am the executor of the above-named person's estate. The decedent was a California resident at the time of death. The estate will file a California fiduciary tax return and will withhold on foreign and domestic nonresident beneficiaries when required.

Nonmilitary Spouse of a Military Servicemember:

I am a nonmilitary spouse of a military servicemember and I meet the Military Spouse Residency Relief Act (MSRRA) requirements. See instructions for General Information E, MSRRA.

CERTIFICATE: Please complete and sign below.

Under penalties of perjury, I hereby certify that the information provided in this document is, to the best of my knowledge, true and correct. If conditions change, I will promptly notify the withholding agent.

Payee's name and title (type or print) _____ Daytime telephone no. _____

Payee's signature ► _____ Date _____

Instructions for Form 590

Withholding Exemption Certificate

References in these instructions are to the California Revenue and Taxation Code (R&TC).

General Information

For purposes of California income tax, references to a spouse, husband, or wife also refer to a Registered Domestic Partner (RDP) unless otherwise specified. For more information on RDPs, get FTB Pub. 737, Tax Information for Registered Domestic Partners.

Private Mail Box (PMB) – Include the PMB in the address field. Write “PMB” first, then the box number. Example: 111 Main Street PMB 123.

Foreign Address – Enter the information in the following order: City, Country, Province/Region, and Postal Code. Follow the country's practice for entering the postal code. **Do not** abbreviate the country's name.

A Purpose

Use Form 590, Withholding Exemption Certificate, to certify an exemption from nonresident withholding. California residents or entities should complete and present Form 590 to the withholding agent. The withholding agent is then relieved of the withholding requirements if the agent relies in good faith on a completed and signed Form 590 unless told by the FTB that the form should not be relied upon.

The following are excluded from withholding and completing this form:

- The United States and any of its agencies or instrumentalities
- A state, a possession of the United States, the District of Columbia, or any of its political subdivisions or instrumentalities
- A foreign government or any of its political subdivisions, agencies, or instrumentalities

Important – This form cannot be used for exemption from wage and real estate withholding.

- If you are an employee, any wage withholding questions should be directed to the FTB General Information number, 800.852.5711. Employers should call **888.745.3886** or go to **edd.ca.gov**.
- Sellers of California real estate use Form 593-C, Real Estate Withholding Certificate, to claim an exemption from real estate withholding.

B Requirement

R&TC Section 18662 requires withholding of income or franchise tax on payments of California source income made to nonresidents of California.

Withholding is required on the following, but is not limited to:

- Payments to nonresidents for services rendered in California.
- Distributions of California source income made to domestic nonresident S corporation

shareholders, partners and members and allocations of California source income made to foreign partners and members.

- Payments to nonresidents for rents if the payments are made in the course of the withholding agent's business.
- Payments to nonresidents for royalties with activities in California.
- Distributions of California source income to nonresident beneficiaries from an estate or trust.
- Prizes and winnings received by nonresidents for contests in California.

However, withholding is optional if the total payments of California source income are \$1,500 or less during the calendar year.

For more information on withholding get FTB Pub. 1017, Resident and Nonresident Withholding Guidelines. To get a withholding publication see General Information H, Publications, Forms, and Additional Information.

Backup Withholding – Beginning on or after January 1, 2010, with certain limited exceptions, payers that are required to withhold and remit backup withholding to the Internal Revenue Service (IRS) are also required to withhold and remit to the Franchise Tax Board (FTB). The California backup withholding rate is 7% of the payment. For California purposes, dividends, interests, and any financial institutions release of loan funds made in the normal course of business are exempt from backup withholding. For additional information on California backup withholding, go to **ftb.ca.gov** and search for **backup withholding**.

If a payee has backup withholding, the payee must contact the FTB to provide a valid Taxpayer Identification Number (TIN) before filing a tax return. The following are acceptable TINs: social security number (SSN); individual taxpayer identification number (ITIN); federal employer identification number (FEIN); California corporation number (CA Corp No.); or Secretary of State (SOS) file number. Failure to provide a valid TIN will result in the denial of the backup withholding credit. For more information go to **ftb.ca.gov** and search for **backup withholding**.

C Who Certifies this Form

Form 590 is certified by the payee. An incomplete certificate is invalid and the withholding agent should not accept it. If the withholding agent receives an incomplete certificate, the withholding agent is required to withhold tax on payments made to the payee until a valid certificate is received. In lieu of a completed certificate on the preprinted form, the withholding agent may accept as a substitute certificate a letter from the payee explaining

why the payee is not subject to withholding. The letter must contain all the information required on the certificate in similar language, including the under penalty of perjury statement and the payee's taxpayer identification number. The withholding agent must retain a copy of the certificate or substitute for at least four years after the last payment to which the certificate applies, and provide it upon request to the Franchise Tax Board.

For example, if an entertainer (or the entertainer's business entity) is paid for a performance, the entertainer's information must be provided. **Do not** submit the entertainer's agent or promoter information.

The grantor of a grantor trust shall be treated as the payee for withholding purposes. Therefore, if the payee is a grantor trust and one or more of the grantors is a nonresident, withholding is required. If all of the grantors on the trust are residents, no withholding is required. Resident grantors can check the box on Form 590 labeled “Individuals — Certification of Residency.”

D Who is a Resident

A California resident is any individual who is in California for other than a temporary or transitory purpose or any individual domiciled in California who is absent for a temporary or transitory purpose.

An individual domiciled in California who is absent from California for an uninterrupted period of at least 546 consecutive days under an employment-related contract is considered outside California for other than a temporary or transitory purpose.

An individual is still considered outside California for other than a temporary or transitory purpose if return visits to California do not total more than 45 days during any taxable year covered by an employment contract.

This provision does not apply if an individual has income from stocks, bonds, notes, or other intangible personal property in excess of \$200,000 in any taxable year in which the employment-related contract is in effect.

A spouse/RDP absent from California for an uninterrupted period of at least 546 days to accompany a spouse/RDP under an employment-related contract is considered outside of California for other than a temporary or transitory purpose.

Generally, an individual who comes to California for a purpose which will extend over a long or indefinite period will be considered a resident. However, an individual who comes to perform a particular contract of short duration will be considered a nonresident.

For assistance in determining resident status,

get FTB Pub. 1031, Guidelines for Determining Resident Status, and FTB Pub. 1032, Tax Information for Military Personnel, or call the FTB at 800.852.5711 or 916.845.6500.

E Military Spouse Residency Relief Act (MSRRA)

Generally, for tax purposes you are considered to maintain your existing residence or domicile. If a military servicemember and nonmilitary spouse have the same state of domicile, the MSRRA provides:

- A spouse shall not be deemed to have lost a residence or domicile in any state solely by reason of being absent to be with the servicemember serving in compliance with military orders.
- A spouse shall not be deemed to have acquired a residence or domicile in any other state solely by reason of being there to be with the servicemember serving in compliance with military orders.

Domicile is defined as the one place:

- Where you maintain a true, fixed, and permanent home
- To which you intend to return whenever you are absent

A military servicemember's nonmilitary spouse is considered a nonresident for tax purposes if the servicemember and spouse have the same domicile outside of California and the spouse is in California solely to be with the servicemember who is serving in compliance with Permanent Change of Station orders.

Note: California may require nonmilitary spouses of military servicemembers to provide proof that they meet the criteria for California personal income tax exemption as set forth in the MSRRA.

Income of a military servicemember's nonmilitary spouse for services performed in California is not California source income subject to state tax if the spouse is in California to be with the servicemember serving in compliance with military orders, and the servicemember and spouse have the same domicile in a state other than California.

For additional information or assistance in determining whether the applicant meets the MSRRA requirements, get FTB Pub. 1032.

F What is a Permanent Place of Business

A corporation has a permanent place of business in California if it is organized and existing under the laws of California or if it is a foreign corporation qualified to transact intrastate business by the SOS. A corporation that has not qualified to transact intrastate business (e.g., a corporation engaged exclusively in interstate commerce) will be considered as having a permanent place of business in California only if it maintains a permanent office in California that is permanently staffed by its employees.

G Withholding Agent

Keep Form 590 for your records. **Do not** send this form to the FTB unless it has been specifically requested.

For more information, contact Withholding Services and Compliance, see General Information H.

The payee must notify the withholding agent if any of the following situations occur:

- The individual payee becomes a nonresident.
- The corporation ceases to have a permanent place of business in California or ceases to be qualified to do business in California.
- The partnership ceases to have a permanent place of business in California.
- The LLC ceases to have a permanent place of business in California.
- The tax-exempt entity loses its tax-exempt status.

The withholding agent must then withhold and report the withholding using Form 592, Resident and Nonresident Withholding Statement, and remit the withholding using Form 592-V, Payment Voucher for Resident and Nonresident Withholding. Form 592-B, Resident and Nonresident Withholding Tax Statement, is retained by the withholding agent

and a copy is given to the payee.

H Publications, Forms, and Additional Information

You can download, view, and print California tax forms and publications at ftb.ca.gov.

To have publications or forms mailed to you or to get additional nonresident withholding information, contact the Withholding Services and Compliance.

WITHHOLDING SERVICES AND
COMPLIANCE MS F182
FRANCHISE TAX BOARD
PO BOX 942867
SACRAMENTO CA 94267-0651

Telephone: 888.792.4900
916.845.4900
Fax: 916.845.9512

OR to get forms by mail write to:

TAX FORMS REQUEST UNIT MS F284
FRANCHISE TAX BOARD
PO BOX 307
RANCHO CORDOVA CA 95741-0307

For all other questions unrelated to withholding or to access the TTY/TDD numbers, see the information below.

Internet and Telephone Assistance

Website: ftb.ca.gov
Telephone: 800.852.5711 from within the
United States
916.845.6500 from outside the
United States
TTY/TDD: 800.822.6268 for persons with
hearing or speech impairments

Asistencia Por Internet y Teléfono

Sitio web: ftb.ca.gov
Teléfono: 800.852.5711 dentro de los
Estados Unidos
916.845.6500 fuera de los Estados
Unidos
TTY/TDD: 800.822.6268 personas con
discapacidades auditivas
y del habla



County of El Dorado

OFFICE OF AUDITOR-CONTROLLER

360 FAIR LANE
PLACERVILLE, CALIFORNIA 95667
Phone: (530) 621-5487 FAX: (530) 295-2535

JOE HARN, CPA
Auditor-Controller

BOB TOSCANO
Assistant Auditor-Controller

PAYEE DATA RECORD

(Required in lieu of IRS W-9 when receiving payment from the County of El Dorado)
Version: June 2011

1	INSTRUCTIONS: Complete all information on this form. Sign, date, and return to the address shown at the bottom of this page. Prompt return of this fully completed form will prevent delays in processing payments. Information provided in this form will be used by the County of El Dorado to prepare Information Returns (1099), for withholding on payments to nonresident payees, and for reporting to the Employment Development Department (EDD). See reverse side for more information and Privacy Statement.		
2	PAYEE'S LEGAL BUSINESS NAME (Type or Print)		
	INDIVIDUALS AND SOLE PROPRIETORS – ENTER NAME AS SHOWN ON SSN (Last, First, M.I.)		PHONE NUMBER:
	MAILING ADDRESS		BUSINESS ADDRESS
	CITY, STATE, ZIP CODE		CITY, STATE, ZIP CODE
3	ENTER FEDERAL EMPLOYER IDENTIFICATION NUMBER (FEIN): <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>		NOTE: Individuals and sole proprietors are required to provide their SSN (FEIN may be provided in addition to but not in lieu of the SSN)
PAYEE ENTITY TYPE CHECK ONE BOX ONLY	<input type="checkbox"/> PARTNERSHIP CORPORATION: <input type="checkbox"/> ESTATE OR TRUST <input type="checkbox"/> MEDICAL (e.g., dentistry, psychotherapy, chiropractic, etc.) <input type="checkbox"/> LIMITED LIABILITY COMPANY <input type="checkbox"/> LEGAL (e.g., attorney services) <input type="checkbox"/> EXEMPT (nonprofit) <input type="checkbox"/> ALL OTHER		
<input type="checkbox"/> INDIVIDUAL OR SOLE PROPRIETOR ENTER SOCIAL SECURITY NUMBER: <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>			
(SSN required by authority of California Revenue and Tax Code Section 18646)			
4	Applicable <u>only</u> if the business address provided in Part 2 is <u>not</u> a physical California address NOTE: If you are a California nonresident providing services to County of El Dorado in California, seven percent (7%) of the payment will be withheld and remitted to the California Franchise Tax Board (FTB) unless you are exempt or have obtained a waiver from FTB. Mark if any of the following apply: <input type="checkbox"/> Exempt from withholding of California income (attach California Form 590) <input type="checkbox"/> Obtained Franchise Tax Board waiver of State withholding (attach a copy) If you are a California nonresident and charge California sales tax, a valid California sales tax permit number is required: <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>		
5	I hereby certify under penalty of perjury that the information provided on this document is true and correct. Should my residency status change, I will promptly notify the County of El Dorado at the address listed below.		
AUTHORIZED PAYEE REPRESENTATIVE'S NAME (Type or Print)		TITLE	
SIGNATURE		DATE	TELEPHONE
6	Please return completed form to: Department/Office: <u>County of El Dorado, Procurement & Contracts</u> Mailing Address: <u>360 Fair Lane</u> City/State/Zip: <u>Placerville, CA 95667</u> Telephone: <u>530 621 5830</u> Fax: <u>530 295 2537</u> 10-1235 21B 46 of 652		

PAYEE DATA RECORD

(REVERSE)

<p>1</p>	<p>Requirement to Complete Payee Data Record</p> <p>A completed Payee Data Record is required for payments to all non-governmental entities and will be kept on file at the County of El Dorado Auditor-Controller's Office.</p> <p>Payees who do not wish to complete the Payee Data Record may elect to not do business with the County of El Dorado. If the payee does not complete the form and the required payee data is not otherwise provided, payment may be reduced for federal backup withholding and nonresident State income tax withholding. Amounts reported on Information Returns (1099) are in accordance with the Internal Revenue Code and the California Revenue and Taxation Code.</p>
<p>2</p>	<p>Enter the payee's legal business name. Sole proprietorships must also include the owner's full name. An individual must list his/her full name. The mailing address should be the address at which the payee chooses to receive correspondence. Do not enter payment address or lock box information here.</p>
<p>3</p>	<p>Check the box that corresponds to the payee business type. Check only one box. Corporations must check the box that identifies the type of corporation. The County of El Dorado requires that all parties entering into business transactions that may lead to payment(s) from the County provide their Taxpayer Identification Number (TIN). The TIN is required by the California Revenue and Taxation Code Section 18646 to facilitate tax compliance enforcement activities and the preparation of Form 1099 and other information returns as required by the Internal Revenue Code Section 6109(a).</p> <p>The TIN for individuals and sole proprietorships is the Social Security Number (SSN). Only partnerships, estates, trusts, limited liability corporations and corporations will enter their Federal Employer Identification Number (FEIN).</p> <p>4 Are you a California resident or nonresident?</p> <p>A corporation will be defined as a "resident" if it has a permanent place of business in California or is qualified through the Secretary of State to do business in California.</p> <p>A partnership is considered a resident partnership if it has a permanent place of business in California. An estate is a resident if the decedent was a California resident at time of death. A trust is a resident if at least one trustee is a California resident.</p> <p>For individuals and sole proprietors, the term "resident" includes every individual who is in California for other than a temporary or transitory purpose and any individual domiciled in California who is absent for a temporary or transitory purpose. Generally, an individual who comes to California for a purpose that will extend over a long or indefinite period will be considered a resident. However, an individual who comes to perform a particular contract of short duration will be considered a nonresident.</p> <p>Payments to all nonresidents may be subject to withholding. Nonresident payees performing services in California or receiving rent, lease, or royalty payments from property (real or personal) located in California will have 7% of their total payments withheld for State income taxes. However, no withholding is required if total payments to the payee are \$1,500 or less for the calendar year. Nonresidents who have been granted a waiver on payments of California source income from the California Franchise Tax Board must submit a copy of the waiver.</p> <p>For information on Nonresident Withholding, contact the Franchise Tax Board at the numbers listed below: Withholding Services and Compliance Section: 1-888-792-4900 E-mail address: wscs.gen@ftb.ca.gov For hearing impaired with TDD, call: 1-800-822-6268 Website: www.ftb.ca.gov</p> <p>California nonresidents charging California sales tax are required to provide their California sales tax number.</p>
<p>5</p>	<p>Provide the name, title, signature, and telephone number of the authorized individual completing this form. Provide the date the form was completed.</p>
<p>6</p>	<p>This section must be completed by the department/office requesting the information.</p>
	<p>Privacy Statement</p> <p>Section 7(b) of the Privacy Act of 1974 (Public Law 93-579) requires that any federal, State, or local governmental agency, which requests an individual to disclose their social security account number, shall inform that individual whether that disclosure is mandatory or voluntary, by which statutory or other authority such number is solicited, and what uses will be made of it.</p> <p>It is mandatory to furnish the information requested. Federal law requires that payment for which the requested information is not provided is subject to federal backup withholding and State law imposes noncompliance penalties of up to \$20,000.</p> <p>You have the right to access records containing your personal information, such as your SSN. To exercise that right, please contact the County of El Dorado Auditor-Controller's Office in writing.</p> <p>All questions should be referred to the County of El Dorado Auditor-Controller's Office.</p>

CERTIFICATE OF INSURANCE FORM FOR CONTRACTORS, ARCHITECTS AND/OR ENGINEERS

CERTIFICATE ISSUER PHONE ()	DATE EXECUTED: THIS CERTIFICATE DOES NOT AMEND, EXTEND, OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. COMPANIES AFFORDING COVERAGE		
INSURED PHONE ()	COMPANY A LETTER COMPANY B LETTER COMPANY C LETTER	COMPANY RATING COMPANY RATING COMPANY RATING	
PROJECT DESCRIPTION PROJECT TITLE: PROJECT NUMBER: LOCATION:	COMPANY D LETTER COMPANY E LETTER	COMPANY RATING COMPANY RATING	

THIS IS TO CERTIFY that policies of insurance listed below have been issued to the insured named above for the policy period indicated. Notwithstanding any requirement, term or condition of any contract or other document with respect to which this certificate may be issued or may pertain, the insurance afforded by the policies described herein is subject to all the terms, exclusion and conditions of such policies.

CL	Type of Insurance Coverage	Policy Number	Policy Effective Date	Policy Expiration Date	Limits of Liability (in Thousands)
	GENERAL LIABILITY <input type="checkbox"/> Commercial General Liability <input type="checkbox"/> Occurrence <input type="checkbox"/> Claims Made <input type="checkbox"/> Owner's & Contractor's Protective <input type="checkbox"/> General Aggregate * <input type="checkbox"/> Per Project <input type="checkbox"/> Per Location				GENERAL AGGREGATE \$ PRODUCTS-COMP/OPS AGGREGATE \$ PERSONAL & ADVERTISING INJURY \$ EACH OCCURRENCE \$ FIRE DAMAGE (ANY ONE FIRE) \$ MEDICAL EXPENSES (ANY ONE PERSON) \$ DEDUCTIBLE \$
	ARCHITECT'S AND/OR ENGINEER'S PROFESSIONAL LIABILITY <input type="checkbox"/> Claims Made <input type="checkbox"/> Project				GENERAL AGGREGATE \$ EACH CLAIM \$ DEDUCTIBLE \$
	AUTOMOBILE LIABILITY <input type="checkbox"/> Any Auto <input type="checkbox"/> All Owned Autos <input type="checkbox"/> Scheduled Autos <input type="checkbox"/> Hired Autos <input type="checkbox"/> Non-Owned Autos <input type="checkbox"/> Garage Liability				COMBINED SINGLE LIMIT \$ BODILY INJURY (PER PERSON) \$ BODILY INJURY (PER ACCIDENT) \$ PROPERTY DAMAGE \$ DEDUCTIBLE \$
	EXCESS LIABILITY <input type="checkbox"/> Umbrella Form <input type="checkbox"/> Other Than Umbrella Form				EACH OCCURRENCE \$ AGGREGATE \$
	<input type="checkbox"/> WORKER'S COMPENSATION				-----STATUTORY-----
	EMPLOYER'S LIABILITY				(EACH ACCIDENT) \$ (DISEASE - POLICY LIMIT) \$ (DISEASE - EACH EMPLOYEE) \$
	OTHER <input type="checkbox"/> Installation Floater <input type="checkbox"/> Builder's Risk <input type="checkbox"/>				\$ \$ \$

* The General Aggregate limit, under Limits of Insurance, applies separately to each of the projects away from premises owned by or rented by you.

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS/ADDITIONAL INSURED: The County of El Dorado its officers, officials, employees and volunteers are made additional insured, but only insofar as the operations under this contract are concerned. OTHER ADDITIONAL ISSURED:

CERTIFICATE HOLDER	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED OR TERMINATED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL GIVE THIRTY (30) DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, IN ADVANCE OF THE EFFECTIVE DATE OF SUCH CANCELLATION OR TERMINATION.
	AUTHORIZED REPRESENTATIVE SIGNATURE, TITLE, TYPED NAME, SSN AND PHONE NUMBER:

EL DORADO COUNTY ANIMAL SERVICES FACILITY

BID #14-968-042

CONDITIONS OF THE CONTRACT

Article 1

GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 County: The County of El Dorado, a political subdivision of the State of California.

1.1.2 Owner: The County of El Dorado is the Owner and is identified as the Owner in the Contract and these Contract Conditions. The term Owner, and pronouns in place of the same shall mean the County of El Dorado acting by and through its duly authorized representative.

1.1.3 Owner's Representative: The Chief Administrative Office, Facilities Manager, or designated representative.

1.1.4 Architect: The person holding a valid California State Architect's license, whose firm has been designated within the Contract Documents as the Architect to provide services on the Project. When the Architect is referred to within the Contract Documents and no Architect has in fact been designated, then the matter shall be referred to the County and shall be interpreted as Owner's Representative.

1.1.5 Project Manager: Project Manager or such other designated representative of the Owner. The Project Manager has such duties and authority as may be set forth in the Contract Documents.

1.1.6 Contractor: The person or entity identified as such in the Contract and is referred to throughout the Contract Documents as if singular in number. The term Contractor refers to the Contractor or the Contractor's authorized representative.

1.1.7 Inspector: The individual designated by the Owner as the Inspector as set forth in Paragraph 2.1.2.

1.1.8 Subcontractor: Those contractors, of whatever tier, furnishing labor or material, or both, for the Work under the Contract with the Contractor.

1.1.9 Substantial Completion: The stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.

1.1.10 Final Acceptance: Conditions upon which the County will accept Work as satisfactorily completed in accordance with the Contract Documents. Requirements include, but are not limited to:

1. All Systems having been tested and accepted as having met requirements of the Contract Documents.
2. All as-built drawings 2 copies and 3copies of the manufacturer's product data and installation instructions having been submitted by the Contractor, reviewed by the Architect, and accepted by the Owner.
3. All punch list work, as directed by the Owner, having been completed by the Contractor.
4. Acceptance of the Work by the Purchasing Agent.

- 1.1.11 Final Payment: The Final Payment shall be the only Payment made to Contractor and shall not be considered to be the payment of any or all of the retention.
- 1.1.12 Architect’s Supplemental Instructions/Instruction Bulletins: A written order of the Architect and reviewed by the Owner's Representative directing the Contractor to provide supplemental instructions, interpretations, or conduct minor changes in work involving neither extra cost nor extra time and being consistent with the scope and functioning of the project.
- 1.1.13 Construction Change Directive: A written order issued by the Architect and signed by the Owner directing a change in the Work and stating a proposed basis for adjustment, if any, of Contract Time or Sum. The Owner may by Change Directive, without invalidating the Contract and without Contractor's agreement, order changes in the Work. This procedure will be used in the absence of agreement between Owner and Contractor, for subsequent inclusion in a Change Order.
- 1.1.14 Change Order: A Change Directive signed by the Owner and Contractor stating their agreement upon all of the following: 1) a change in the Work, 2) the amount of the adjustment in the Contract Price, if any, and 3) the extent of the adjustment in the Contract Time, if any.
- 1.1.15 Contract Documents: The Contract Documents shall include the documents described in Article 2 of the Contract, including Architect’s Supplemental Instructions, Construction Change Directives, and Change Orders.
- 1.1.16 Work: The construction and services required by the Contract Documents, including all labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations.
- 1.1.17 Project: The total construction of the Work performed under the Contract Documents.
- 1.1.18 Plans: The graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams, specifically the Plans entitled “County of El Dorado Generator Project”.
- 1.1.19 Technical Specifications: That portion of the Contract Documents Division 1 through 26 consisting of the technical written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.
- 1.1.20 Claim: A demand or assertion by the Contractor seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time, or other relief with respect to the terms of the Contract. Claims must be made by written notice and shall include a demand for the Owner's decision. The responsibility to substantiate claims and to resolve the claims of subcontractors of whatever tier shall rest with the Contractor.
- 1.1.21 Work Not Included: Except for such auxiliary work as shown or specified, or is necessary as part of the construction, the following is NOT included in this contract: Any work shown but marked “Not in Contract” (NIC) or otherwise designated to be done under another contract or by Owner.
- 1.1.22 Furnish (material): To supply and deliver to the project ready for installation and in operating condition.
- 1.1.23 Install (service or labor): To place in final position, complete, anchored, connected, and in operable condition with respect to required codes and/or governing agency requirements.
- 1.1.24 Provide: To furnish and install complete. When “Furnish”, “Install”, or “Provide” is stated, “Provide” is implied.
- 1.1.25 Construct: To “Furnish” materials to “Install” in final position, complete, anchored, and connected with respect to required codes, requirements, Contract Documents, and details.

1.1.26 Day(s): All references to “day” or “days” in these Contract Documents shall be defined as calendar-day or calendar-days.

1.2 CONTRACT DOCUMENTS

1.2.1 One Document: The Contract Documents are one document and any work shown or mentioned shall be performed or furnished. The Contractor admits and agrees that the Contract Documents exhibit the intent and purpose of the Owner in regard to the Work, and that they are not complete in every detail and are to be considered as showing the purpose and intent only; and he further agrees to furnish all labor or material for any detail that is necessary to carry out the intent and purpose of the Specifications without extra charge.

1.2.2 Misuse of Words or Punctuation: The misplacement, addition, or omission of any word, letter, or punctuation mark will not in any way change the intent or meaning of the Contract Documents. Any part of the Work, or any article pertaining thereto which is not specifically set forth in these Contract Documents, but which is necessary for the proper completion of the Work, is to be supplied and set in place at the Contractor's expense, the same as if it had been mentioned in these Contract Documents. The Contractor shall furnish all things necessary to make a good and workmanlike job in accordance with the intent and purpose of the Contract Documents.

1.3 ASSIGNMENT OF CONTRACT

1.3.1 Mutual Consent: Neither party to the Contract shall assign the Contract without the written consent of the other party, nor shall the Contractor assign any moneys due or to become due to him hereunder without the written consent of the Owner.

1.3.2 Assignment Under Anti-Trust Claims: In accordance with Section 4552 of the California Government Code, and Section 7103 of the Public Contract Code, Contractor and subcontractors shall conform to the following requirements:

1. In entering into a public works contract or a subcontract to supply goods, services, or materials pursuant to a public works contract, Contractor or subcontractors offers and agrees to assign to the Owner all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C Section 15) or under the Cartwright Act, [Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code], arising from purchases of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the Owner tenders Final Payment to the Contractor, without further acknowledgment by the parties.
2. If an awarding body or public purchasing body receives, either through judgment or settlement, a monetary recovery for a cause of action assigned under Government Code Sections 4550-4554, the assignor shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the public body any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the public body as part of the bid price, less the expenses incurred in obtaining that portion of the recovery. Upon demand in writing by the assignor, the assignee shall, within one year from such demand, reassign the cause of action assigned under Government Code Sections 4550-4554 if the assignor has been or may have been injured by the violation of law for which the cause of action arose and (a) the assignee has not been injured thereby, or (b) the assignee declines to file a court action for the cause of action.

1.4 WAIVER OF "COMMON PRACTICE"

1.4.1 The Contractor shall waive "common practice" and "common usage" as construction criteria wherever the Contract Documents details, plans, technical specifications, governing codes, or ordinances require greater quantity or better quality than common practice or common usage would require.

1.5 EXCESSIVE COSTS

- 1.5.1 Failure to Comply with Contract: If Contractor fails to comply with any Contract requirements, including any required coordination with other contractors, and that failure results in additional costs to Owner, then Contractor shall be liable for such additional costs.
- 1.5.2 Construction Methods: If Contractor's construction methods and techniques result in additional costs to Owner, after notice, such Contractor shall be responsible for cost attributable to his methods and techniques.

Article 2

OWNER

2.1 OWNER'S REPRESENTATIVE

- 2.1.1 Owner Representative: The Owner will be represented by the Owner's Representative who shall oversee the performance of the Contract on behalf of the Owner.
- 2.1.2 Owner May Appoint Inspector: Owner shall be entitled to appoint an agent as Inspector who shall see that the performance of the Work is in strict accordance with the Contract Documents on behalf of the Owner.
- 2.1.3 Communication: In order that the Owner may act upon expert advice and upon good procedure, all communications from the Contractor shall be in writing and will be through said Owner's Representative or Inspector, as the Owner may direct, and all communications and instructions from the Owner to the Contractor will be so routed. The Owner reserves the right to alter this procedure without the consent of the Contractor. All communications not in compliance herewith, shall be considered non-binding on the Owner.

2.2 RIGHTS OF OWNER

- 2.2.1 Right to Clean Up: Subject to the strict prohibition against maintaining a nuisance, if a dispute arises between the Contractor, Subcontractors, or separate contractors as to the responsibility under their respective Contracts for maintaining the premises and surrounding area free from waste materials and rubbish the Owner may, but need not, clean up and allocate the cost among those responsible as the Inspector determines to be just.
- 2.2.2 Right to Accept Imperfect Work: If any part or portion of the Work completed under this Contract is defective and not in accordance with the Plans or Contract Documents, and if the imperfection is judged by Owner to be not of sufficient magnitude or importance so as to make the Work unacceptable, then Owner shall have the right and authority to retain such Work but will make such deductions in Contract Price as may be equitable and reasonable. However, Owner does not by this section; waive any other rights provided for herein.
- 2.2.3 Right to do Adjacent Work: The Owner reserves the right to perform construction or operations on the site of the Work. In doing this Owner may use its own forces or award separate contracts in connection with other construction or operations on the site but not covered by the Contract Documents. Contractor shall defend, indemnify, and hold Owner harmless for costs incurred by Owner that are payable to a separate contractor because of delays, improperly timed activities, or defective construction by the Contractor, unless such costs are incurred due to the sole or active negligence of Owner.
- 2.2.4 Right to Finish Contractor's Work: If the Contractor defaults or neglects to carry out all or any part of the Work in accordance with the Contract Documents, the Owner has the right, exercisable solely at Owner's discretion, to commence and continue completion of the Work with diligence and promptness. In such an event, if the

Owner's cost to complete to Work exceeds the remaining balance of the Contract with the Contractor, Contractor shall reimburse the Owner for such excess costs.

2.2.5 Right of Partial Use of Project: The Owner may occupy or use any completed or partially completed portion of the Work at any stage, upon agreement of Owner and Contractor.

1. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents.
2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld.
3. Immediately prior to such partial occupancy or use, the Owner and Contractor shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.
4. Unless otherwise agreed upon in writing, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of work not complying with the requirements of the Contract Documents.
5. No claim for acceleration, delay, or hindrance, may be made by Contractor on his own behalf or that of any of his subcontractors, for any delays, accelerations, or hindrances that may arise out of Owner's partial occupancy of the Project.

2.2.6 Right to Audit: Contractor shall maintain and make available to the County, State Auditor, or to any of their duly authorized representatives all books, papers, job cost records, detailed cost estimates, claims, and accounts, including payment, property, payroll, personnel, subcontractor records, and financial records related to or which arise out of the Work or under terms of this Contract. Contractor shall maintain such books, records, data and documents in accordance with generally accepted accounting principles and in accordance with these Contract Conditions and federal and state requirements. These books, papers, records, claims, and accounts shall be made available for examination during normal business hours and shall be readily available and accessible at Contractor's principal place of business in California, for audit during normal business hours at such place of business. Contractor shall provide office space, photocopies and other assistance to enable audit or inspection representatives to conduct such audits or inspections. This right to audit books and records directly related to this Contract shall also extend to any first-tier subcontractors employed under this Contract. Contractor shall incorporate this provision in any subcontract entered into as a result of this Contract and shall require its subcontractors to agree to cooperate with the above-listed agencies by making all appropriate and relevant Project records available to those agencies for audit and copying.

All of Contractor's books, papers, job cost records, detailed cost estimates, claims, and accounts, including payment, property, payroll, personnel, subcontractor records, and financial records related to or which arise out of the work or under terms of this Contract shall be retained for access, inspection and/or audit by the County, the State Auditor, or their duly authorized representatives for at least three (3) after County's final payment to Contractor and/or the final resolution of any claims under this Contract. Contractor shall incorporate this provision in any subcontract entered into as a result of this Contract.

2.3 RESPONSIBILITIES OF OWNER

2.3.1 Removal, Relocation, or Protection of Underground Infrastructure: If the Contractor while performing the contract discovers utility facilities not identified by the Owner in the contract plans or specifications, Contractor shall immediately notify the Owner in writing. Owner shall have the sole discretion to perform the repairs or relocation work itself, or to permit the Contractor to do such repairs or relocation work at a reasonable price. In the event that the Owner authorizes the Contractor to perform the work, the parties shall proceed with a written Change Order as set forth in Article 5 herein. Compensation to the Contractor for said costs shall be in accordance with

Section 4215 of the Government Code.

Nothing herein shall be construed to require the Owner to locate the presence of any existing services not expressly included in Government Code Section 4215, nor to limit the Owner's rights or remedies set forth therein.

In accordance with the provisions of Section 4215 of the California Government Code, Contractor shall not be assessed liquidated damages for delay in completion of the project, when such delay was caused by the failure of the Owner or owner of the utility to provide for the removal or relocation of such utility facilities.

Article 3

CONTRACTOR'S RESPONSIBILITIES

3.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS

3.1.1 Reporting Errors in Contract Documents: The Contractor shall carefully study and compare the Contract Documents with each other and shall at once report to the Inspector errors, inconsistencies, or omissions discovered. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency, or omission in the Contract Documents without such notice to the Owner, the Contractor shall assume responsibility for such performance and shall bear all costs for correction.

3.1.2 Reporting Errors in Field Conditions: The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies, or omissions discovered shall be reported to the Owner at once.

3.1.3 No Implied Warranty: No warranty is to be implied nor shall any warranty arise by operation of law, or by interpretation of this Contract, that the Plans and Contract Documents are adequate and sufficient to construct the Project.

3.2 SUPERVISION AND CONSTRUCTION PROCEDURES

3.2.1 Supervision of Work: The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work under the Contract, unless Contract Documents give other specific instructions concerning these matters.

3.2.2 Acts of Employees and Agents: The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor.

Acts Do Not Waive Contractor's Obligation: The Contractor shall not be relieved of obligations to perform the Work in strict accordance with the Contract Documents either by activities or duties of the Owner's Representative or the Inspector in the administration of the Contract, or by tests, inspections, or approvals required or performed by persons other than the Contractor.

3.3 PROSECUTION OF WORK

3.3.1 Time of the Essence: It is expressly understood and agreed that the time of beginning, rate of progress, and time of completion of the Work are of the essence. The time for completion of this contract shall be 75 calendar days commencing from the date shown on the Contractor Notice To Proceed.

3.3.2 Owner and Contractor recognize that time is of the essence of the Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified, plus any extensions thereof. They also recognize the delays, expense, and difficulties involved with proving in a legal proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that Contractor shall pay Owner the sum of **One Thousand dollars (\$1,500) per day**, as liquidated damages and not as a penalty, for each and every calendar day's delay in finishing the Work in excess of the contract time prescribed herein.

3.3.3 Work During Operational Hours: The Facility will be operational during the Work. The Contractor shall not interfere or hinder government center operations. The Contractor shall keep all equipment and materials within designated work areas and out of hallways and doorways. Emergency exit routes shall be maintained at all times.

3.3.4 Construction Schedule: The Contractor shall coordinate the final critical path method (CPM) construction schedule with the Owner. The CPM schedule is required to be submitted within five (5) days of issuance of Notice to Proceed. The CPM schedule will be for Owner's information only. Silence or inaction with regard to Contractor's schedule shall not be construed as acquiescence or acceptance of the schedule as being binding on Owner. Contractor's schedule shall provide for the completion date not to exceed nor shall it provide for the completion date earlier than the time limits for completion set forth in the Contract Documents. Float, whether for the entire Project or for specific tasks therein, shall be deemed to be for the benefit of the Owner. The Contractor shall keep the construction schedule current, and shall submit weekly updates to the Owner's Representative and Inspector, if any. The Contractor shall further prepare and keep current a schedule of submittals which is coordinated with the construction schedule, and which allows the Owner reasonable time to review the submittals.

3.4 SUBMITTALS

3.4.1 Use of Listed Manufacturers; Review of "Or Equals": Contractor shall utilize only the manufacturer designated in its Proposal for major equipment items listed therein. In accordance with the provisions of Section 3400 of the California Public Contract Code, but subject to Subsection (b) thereof, if requesting approval of an "or equal" product, Contractor shall within two (2) business days following the bid opening submit data substantiating its request. Failure to submit such substantiating data within two (2) business days following the bid opening shall constitute submission of a non-responsive bid.

3.5 STATE AND FEDERAL LABOR REQUIREMENTS

3.5.1 Hours of Work:

1. Eight (8) hours of labor shall constitute a legal day's work upon all work done hereunder, and it is expressly stipulated that no workman employed at any time by the Contractor, or by any subcontractor under this Contract, upon the Work, shall be required or permitted to work thereon more than eight (8) hours in any one (1) calendar day and/or more than forty (40) hours in any one (1) calendar week except as provided in Section 1815 of the Labor Code of California, and it is further expressly stipulated that for each and every violation of said last named stipulation, said Contractor shall forfeit, as penalty to the said Owner, \$25.00 for each workman employed in the execution of this Contract, or by any subcontractor under this Contract, for each calendar day during which said workman is required or permitted to labor more than eight (8) hours in any one (1) calendar day or more than forty (40) hours in any one (1) calendar week in violation of the provisions of said Labor Code.
2. In accordance with the provisions of Section 1776 of the Labor Code of the State of California, the Contractor, and each subcontractor, shall also keep an accurate record showing the names and actual hours worked for all workers employed by him in connection with the Work contemplated by the Agreement, which record shall be open at all reasonable hours to the inspection of the Owner or its officers or agents, and to the Chief of the

Division of Labor Statistics and Law Enforcement or the Department of Industrial Relations, his deputies or agents.

3.5.2 Apprentice Employment:

1. Pursuant to the provisions of Section 1777.5 of the Labor Code as amended, the Contractor or subcontractor employing tradesmen in any apprenticeable occupation shall apply to the joint apprenticeship committee nearest the site of the public works project and which administers the apprenticeship program in that trade for a Certificate of Approval. The certificate will also fix the ratio of apprentices to journeymen that will be used in the performance of the Contract. All requirements and exceptions to those requirements set forth herein for Apprenticeship Employment are contained in Labor Code Section 1777.5 and are available from the applicable Joint Apprenticeship Committee.
2. The Contractor shall make contributions to funds established for the administration of the apprenticeship programs if he employs registered apprentices or journeymen in any apprenticeable trade on such contracts and if other contractors on the public works site are making such contributions.
3. The Contractor and any subcontractor under him shall comply with the requirements of Sections 1777.5 and 1777.6 in the employment of apprentices. Information relative to apprenticeship standards, wage schedules, and other requirements may be obtained from the Director of Industrial Relations, ex officio the Administrator of Apprenticeship, San Francisco, California, or from the Division of Apprenticeship Standards and its branch offices.

3.5.3 Wage Rates:

1. Pursuant to Labor Code Section 1770 et seq., each laborer or mechanic of Contractor or any subcontractor engaged in work on the Project under this Contract shall be paid not less than the hourly wage rate of per diem wages set forth in the prevailing wage rate schedule published by the Director of Industrial Relations regardless of any contractual relationship which may be alleged to exist between Contractor or any subcontractor and such laborers and mechanics.
2. Any laborer or mechanic employed to perform work on the Project under this Contract, which work is not covered by any of the foregoing classifications, shall be paid not less than the prevailing rate of per diem wages specified herein for the classification which most nearly corresponds to the work to be performed by him.
3. The foregoing specified prevailing wage rates are minimum rates only, and the Contractor may pay any wage rate in excess of the applicable rate contained in this Contract.
4. Pursuant to Labor Code Section 1775, the Contractor as a penalty to the Owner shall forfeit \$50.00 for each calendar day, or portion thereof for each worker paid less than prevailing rate established by the Department of Industrial Relations for such work or craft in which such worker is employed. The difference between such prevailing wage rates and the amount paid to each worker for each calendar day or portion thereof for which the worker was paid less than the prevailing wage rate shall be paid to each worker by the Contractor.
5. An error on the part of an awarding body does not relieve the Contractor from responsibility for payment of the prevailing rate of per diem wages and penalties pursuant to Labor Code Sections 1770 - 1775.
6. All Contractors and subcontractors are subject to the provisions of Sections 1810-1814 of the California Labor Code which provide that the maximum hours a worker is to be employed is limited to eight (8) hours a day and forty (40) hours a week and the Contractor or subcontractor shall forfeit, as a penalty, \$25.00 for each worker employed in the execution of the Contract for each calendar day during which a worker is required or permitted to labor more than eight (8) hours in any calendar day or more than forty (40) hours in any calendar week and is not paid overtime.

7. Section 1815 of the California Labor Code requires that notwithstanding the provisions of Sections 1810-1814, employees of Contractors who work in excess of eight (8) hours per day and forty (40) hours per week shall be compensated for all hours worked in excess of eight (8) hours per day at not less than 1-1/2 times the basic rate of pay.
8. In the case of federally funded projects, where federal and state prevailing wage requirements apply, compliance with both is required. This project is funded in whole or part by federal funds. Contractor's attention is directed to the requirements of, and compliance with the Copeland Act (18 U.S.C. 874 and 29 CFR Part 3), the Davis-Bacon Act (40 U.S.C. 276a to 276a-7 and 29 CFR Part 5), and the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-330 and 29 CFR Part 5). (NOT APPLICABLE)
9. If there is a difference between the minimum wage rates predetermined by the Secretary of Labor and the general prevailing wage rates determined by the Director of the California Department of Industrial Relations for similar classifications of labor, Contractor and subcontractors shall pay not less than the higher wage rate. The Department will not accept lower State wage rates not specifically included in the Federal minimum wage determinations. This includes "helper" (or other classifications based on hours of experience) or any other classification not appearing in the Federal wage determinations. Where Federal wage determinations do not contain the State wage rate determination otherwise available for use by Contractor and subcontractors, Contractor and subcontractors shall pay not less than the federal minimum wage rate which most closely approximates the duties of the employees in question. (NOT APPLICABLE)
10. Interested parties can obtain the current wage information by submitting requests to the Department of Industrial Relations, Division of Labor Statistics and Research, PO Box 420603, San Francisco CA 94142-0603, Telephone (415) 703-4708 or by referring to the website at <http://www.dir.ca.gov/dlsr/PWD>. The rates at the time of the bid advertisement date of a project will remain in effect for the life of the project in accordance with the California Code of Regulations, as modified and effective January 27, 1997.
11. Copies of the applicable state prevailing wage rates are on file with the County of El Dorado, Chief Administrative Office, Facilities Division, 3000 Fairlane Court, Placerville, CA 95667, and they are available to any interested party on request.

3.5.4 Certified Payroll: As required under the provisions of Labor Code Section 1776 Contractor and subcontractors shall keep accurate payroll records:

1. The payroll records shall show the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee by him or her in connection with the Project.
2. A certified copy of all payroll records enumerated above shall be available for inspection at all reasonable hours at the principal office of the Contractor as follows:
 - a. Make available or furnish to the employee or his or her authorized representative on request.
 - b. Make available for inspection or furnished upon request to a representative of the Owner, the Division of Labor Standards Enforcement, and the Division of Apprenticeship Standards of the Department of Industrial Relations.
 - c. Make available upon request by the public for inspection or copies thereof made; provided, however, that a request by the public shall be made through either the Owner, the Division of Labor Standards Enforcement, or the Division of Apprenticeship Standards. The requesting party shall, prior to being provided the records, reimburse the costs of preparation by the Contractor, subcontractor, and the entity through which the request was made. The public shall not be given access to the records at the principal office of the Contractor.

3.5.5 **Discrimination In Employment:** No discrimination shall occur in the employment of persons upon the Work because of race, color, sex, national origin, or ancestry or religion of such persons.

3.5.6 **Convict-Made Materials:** Except as may be provided by law, the Contractor agrees that no materials manufactured or produced in a penal or correctional institution shall be incorporated in the construction under this Contract.

3.6 TAXES

3.6.1 **Contractor Pays Taxes:** The Contractor and subcontractors shall pay all local, state, and federal taxes upon labor or materials involved in their branch of the Work, cost of same to be included in the Contract price.

3.7 COMPLIANCE WITH LAW AND LOCAL REQUIREMENTS

3.7.1 **Regulations:** The Contractor and all subcontractors shall conform to and abide by all city, county, and state laws, ordinances, rules, and regulations, as the same pertain to the Work contemplated by said Plans and Contract Documents.

3.7.2 **Permits, Licenses, and Fees:** The County shall procure and pay for all permits and inspection fees that may be required to commence, carry on, and complete the Contract. Contractor shall be responsible for all applicable license fees.

The County has received a building permit for this project. The Contractor shall be responsible for following the provisions of the permit. See Appendix A for a copy of the permit.

3.7.3 **Patent Rights, Copyrights, Trade Names, and Royalties:** The Contractor shall indemnify and save harmless the Owner and all persons acting under him for all liability on account of any patent rights, copyrights, or trade names which may affect the articles or materials or their application under the Contract Documents. The Contractor shall pay all royalties, or other charges that may arise, due to methods, types of construction, processes, materials or use of equipment, and shall hold the Owner harmless from any charges whatsoever which may arise, and shall furnish written assurance, satisfactory to the Owner, that such charges have been paid.

3.8 GUARANTEE

3.8.1 **Final Guarantee:** The Contractor shall guarantee all materials and equipment furnished and work performed for a period of one (1) year. Contractor warrants and guarantees for a period of one year from the date of the Notice of Acceptance that the Work is free from all defects due to faulty materials or workmanship and Contractor shall promptly make such corrections as may be necessary, including repairs of any damage to other parts of the Work resulting from such defects. Owner will give notice of observed defects with reasonable promptness. In the event that Contractor should fail to make such repairs, adjustments, or other work that may be made necessary by such defects within ten (10) calendar days after being notified in writing by Owner, Owner may do so and charge Contractor the cost thereby incurred.

3.8.2 **Extended Guarantees:** If a guaranty exceeding one year is provided by the supplier or manufacturer of any equipment used in this Project, then the guarantee for such materials shall be extended for such term. Contractor expressly agrees to act as co-guarantor of such equipment and materials, and Contractor shall supply Owner with all warranty and guaranty documents relative to equipment and materials incorporated in the job and guaranteed by their suppliers or manufacturers.

3.9 WARRANTY

3.9.1 Contract Warranty: The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new, unless otherwise required or permitted by the Contract, that the Work will be free from defects or flaws and is of the highest quality of workmanship and that the Work will conform with the requirements of the Contract. Work not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective.

3.10 INDEMNIFICATION

3.10.1 Owner Not Liable for Damages: The Owner or its authorized representative shall not in any way or manner be answerable or suffer loss, damage, expense, or liability for any loss or damage that may happen to said Work, or part thereof, or in or about the same during its construction and before acceptance and the said Contractor shall assume all liabilities of every kind or nature arising from said Work, either by accident, negligence, theft, vandalism, or any cause whatever; and shall hold the Owner and its authorized representatives harmless from all liability of every kind and nature arising from accident, negligence, or any cause whatever, other than for the active negligence of the Owner, its officers, agents and employees.

3.10.2 Owner Not Liable for Debts: Indebtedness incurred for any cause in connection with this Work must be paid by the Contractor, and the Owner is hereby relieved at all times from any indebtedness or claim other than the Contract price.

3.10.3 Indemnity: To the fullest extent allowed by law, Contractor shall defend, indemnify, and hold the County and its officers, directors, and employees, harmless against and from any and all claims, suits, losses, damages, and liability for damages, including attorney's fees and other costs of defense brought for or on account of injuries to or death of any person, including but not limited to, workers and the public, or on account of injuries to or death of County employees or damage to property, or any economic, consequential or special damages which are claimed or which shall in any way arise out of or be connected with Contractor's services, operations or performance hereunder, regardless of the existence or degree of fault or negligence on the part of the County, the Contractor, subcontractors or employees of any of these, except for the active, or sole negligence of the County its officers and employees, or where expressly prescribed by statute.

The duty to indemnify and hold harmless the County specifically includes the duties to defend set forth in Section 2778 of the Civil Code. The insurance obligations of Contractor are separate, independent obligations under the Contract Documents, and the provisions of this defense and indemnity are not intended to modify nor should they be construed as modifying or in any way limiting the insurance obligations set forth in the Contract Documents.

3.10.4 Environmental Indemnification: To the fullest extent allowed by law, from and after recording of the Notice of Acceptance, Contractor shall indemnify, defend, and save harmless Owner from all losses or damages resulting from injury to or death of any person and damage to property, and any fine, which is occasioned by or arises out of any breach of Environmental and Toxics Warranty, representations, or covenants of Contractor under this Contract. Contractor further agrees to indemnify and hold harmless Owner, its officers, employees, and agents, from and against any and all liability as follows:

1. Including all foreseeable and all unforeseeable consequential damages, directly or indirectly arising out of the use, generation, storage, or disposal of hazardous materials in any location by Contractor, and
2. Including, without limitation, the cost of any required or necessary repair, cleanup, or detoxification and the preparation of any closure or other required plans, whether such action is required or necessary prior to or following filing of the Notice of Acceptance to the full extent that such action is attributable, directly or indirectly, to the presence or use, generation, storage, release, threatened release, or disposal of hazardous materials by any person on the Project prior to filing of the Notice of Acceptance. Contractor's obligations pursuant to the foregoing indemnity shall survive the filing of the Notice of Acceptance of the Project.

3. This agreement as to indemnity and reimbursement as above set forth to be undertaken by the Contractor shall survive the performance of the remainder of said Contract and shall remain in full force and effect notwithstanding such performance.
4. The foregoing duties of indemnity shall not apply to loss, damage, expense, or liability caused solely by the active negligence of the Owner or the Owner's agents, servants or independent contractors.

3.11 WORK REQUIREMENTS

3.11.1 Conduct of Work: The Contractor shall confine the storage of his equipment and materials to limits as designated. He shall at all times exercise due caution and provide all necessary barricades and other safety equipment around the Work to protect the general public from injury to person and property during the entire time of performance of the Work. The Contractor shall not create excessive dust or noise.

3.11.2 Maintenance of Site: Strict prohibition against committing nuisances in or about the Work shall be maintained, and the Contractor shall not in any way obstruct or interfere with movements of traffic on any public right of way without first obtaining the necessary approval of the proper public agency.

3.11.3 Clean Up of Site: The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials. If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor.

3.11.4 Cutting and Patching:

1. The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly.
2. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

3.12 SUBCONTRACTORS

3.12.1 Contractor Responsible for Subcontractor's Acts: Contractor shall be fully responsible to Owner for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

3.12.2 Contractor's Subcontract: Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind subcontractors to Contractor by the terms of the Contract Documents insofar as applicable to the Work of subcontractors and to give Contractor the same power as regards terminating any subcontract that Owner may exercise over Contractor under any provisions of the Contract Documents. The percentage of retention withheld from any subcontractor by the Contractor shall not exceed the percentage of retention withheld from the Contractor as provided herein.

3.12.3 Ineligible Subcontractor: Contractor is prohibited from performing work with a subcontractor who is ineligible to perform work pursuant to Labor Code Section 1777.1 or 1777.7.

3.13 SUPERINTENDENT

3.13.1 Work Superintendent: The Contractor will employ and maintain on the worksite a qualified supervisor or Superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the sites. The Superintendent shall have full authority to act on behalf of the Contractor, and all communications given to the Superintendent shall be as binding as if given to the Contractor. The Superintendent shall be present on the site at all times as required to perform adequate supervision and coordination of the Work.

3.14 LABOR AND MATERIALS

3.14.1 Skilled Labor: All labor must be especially skilled for each kind of work, and must be thorough and first class in all respects. Any person whom the Inspector or Owner may deem incompetent or disorderly shall be promptly discharged from the Project and not re-employed.

3.14.2 Quality of Materials: All materials used on this Contract shall be new and the best market quality, unless specified or shown otherwise. All Work executed under this Contract shall be done in the best, most thorough, substantial and workmanlike manner and without flaws. All materials and labor shall be subject to the approval of the Inspector as to its quality and fitness, and shall be immediately removed if it does not meet with his approval. The Inspector may refuse to issue the Certificate for Payment until all defective materials or work have been removed and other material of proper quality substituted therefore. All removal and replacement with same shall be done at the Contractor's expense. Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the manufacturer.

Article 4

ADMINISTRATION OF CONTRACT

4.1 ADMINISTRATION OF CONTRACT

4.1.1 Contract Communications: Unless otherwise provided in the Contract or when direct communications have specifically been authorized, all parties shall communicate through the Owner's Representative or the Inspector if the Owner so directs. Communications by and with the subcontractors and material suppliers shall be through the Contractor. Communications by Contractor to separate contractors, architect, or Project Manager shall be through the Owner's Representative.

4.1.2 Control of Work: The Owner's Representative or the Inspector will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility. The Owner's Representative or the Inspector will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Owner's Representative or the Inspector will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

4.1.3 Recommendation for Payments: Based on his or her observations and evaluations of the Contractor's Applications for Payment, the Owner's Representative will review amounts due the Contractor and will recommend to Owner, payments to Contractor as set forth in the section entitled CERTIFICATION FOR PAYMENTS.

4.1.4 Inspector's Authority: The Inspector will have the authority to stop work whenever necessary to ensure a proper execution of the Work. The Inspector will also have authority to reject Work which does not conform to the Contract Documents. Whenever the Inspector considers it necessary or advisable for implementation of the

intent of the Contract Documents, the Inspector will have authority to require additional inspection or testing of the Work in accordance with the following section whether or not such Work is fabricated, installed, or completed. However, neither this authority of the Inspector nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Inspector to the Contractor, subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the Work. In the event an Inspector is not appointed by the Owner, the Owner's Representative shall have the authority set forth herein.

4.2 INSPECTION AND TESTING

4.2.1 Advance Notice: Contractor shall provide Owner's Representative seventy-two (72) hours notice prior to beginning work at a specific location and for a specific department. Contractor shall notify Owner's Representative and Inspector twenty four (24) hours prior to any day in which Contractor will 1) require an inspection of any portion of the Work, and 2) work in excess of eight (8) hours or any time Contractor intends to work weekends. Any work not performed subject to inspection will not be accepted and will be rejected and/or ordered removed by Owner, or Inspector.

4.2.2 Access to Work: The Owner's Representative, the Architect, the Project Manager, and the Inspector will at all times have access to the Work. In addition, authorized representatives and agents of any participating Federal or State Agency shall be permitted to inspect all Work, materials, payrolls, and records on personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any inspection or testing thereof.

4.2.3 Costs of Tests: The Owner shall bear all costs related to testing for conformance of the Work to the Contract requirements. However, if the Contractor has called for any testing, and that test fails, subsequent tests, and all related costs, shall be borne by the Contractor.

4.2.4 Preparation of Change Directives/Orders: The Owner's Representative or the Inspector, if one is appointed, will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in the section entitled CHANGES IN WORK.

4.3 CLAIMS

4.3.1 Concealed or Unforeseen Conditions: It is understood by both parties that Contractor has made a pre-contract investigation of the site. All concealed, unforeseen, or materially differing conditions are the responsibility of the Contractor in the absence of an actual material, intentional misrepresentation by the Owner as to the conditions on the site. Contractor shall give written notice of any conditions encountered at the site which are unforeseen, concealed, or materially different from those set forth in the Plans or Contract Documents, or ordinarily encountered and generally recognized as inherent in the Work. Such written notice shall be given within five (5) days of his discovery of any such facts.

4.3.2 Notice of Discovery of Hazardous Waste or Unusual Conditions:

1. The Contractor shall promptly, and before the following conditions are disturbed, notify the Owner in writing, in the event the Contractor encounters any of the following:
 - a. Material that the Contractor believes may be hazardous waste, as defined in Section 25117 of the Health and Safety Code that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.
 - b. Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in the work of the character provided for in the contract.

2. The Owner shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the work shall issue a change order under the procedures described herein.
3. In the event a dispute arises between the Owner and the Contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the work, the Contractor shall not be excused from any scheduled completion date provided for in the contract, but shall proceed with all work to be performed under the Contract. The Contractor shall retain any and all rights provided either by contract or by law which pertain to the resolution of disputes and protests between the Contractor and the Owner.

4.3.3 Time Limits on Claims: Claims by Contractor must be made within ten (10) calendar-days after occurrence of the event giving rise to such Claim, except that claims made due to delay or hindrances which Contractor claims was caused by Owner shall be made within five (5) calendar-days after occurrence of the event giving rise to such Claim. Claims must be made by written notice. Failure to make such claim in writing in the time set forth herein shall bar Contractor from recourse for such claim. All claims must be filed on or before the payment date of Final Payment.

4.3.4 Claims for Additional Costs:

1. If Contractor wishes to make a Claim for an increase in the Contract Price, he shall give the Owner written notice thereof within the time set forth in Paragraph 4.3.3. This notice shall be given by the Contractor before proceeding to execute the work, except in an emergency endangering life or property in which case the Contractor shall, as soon as possible, advise Owner of his intent to do the Work.
2. Increases in Contract Price due to Claims shall be calculated based on the Cost Reimbursement method detailed in Paragraph 5.4.1.3.
3. Under no circumstances shall Contractor recover any administrative overhead costs or recover on the basis of any "Home Office" damages formula, "Total Cost" recovery formula, or any other such formula.

4.3.5 Claims for Additional Time:

1. If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate probable effect of delay on progress of the Work.
2. If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the scheduled construction.
3. The Owner shall not be liable for any damages on account of any reasonable delay or hindrance of the Owner. However, Contractor shall be entitled to an extension of time for any delay or hindrance caused by the Owner. Any delay or hindrance by Owner which is unreasonable and not within the contemplation of the parties may subject Owner to a claim for damages. Contractor shall make any claims in writing within the time set forth in Paragraph 4.3.3., for any unreasonable delay or hindrance caused by Owner, and specifying the cause thereof as required in paragraph "Submittal of Claims".

4.3.6 Submittal of Claims: Any disputes relating to this Contract, or its breach, which is not disposed of by agreement shall be promptly submitted as a claim to the Owner's Representative who shall issue a written response on the dispute. Claims shall be submitted by the Contractor to the Owner's Representative with adequate supporting data and include a demand for the Owner's Representative's decision. Adequate supporting data shall include, but is not limited to, a statement of the reasons for the asserted entitlement, the certified payroll, invoice for material and equipment rental, and an itemized breakdown of any adjustment sought.

4.3.7 **Submission Under Penalty of Perjury:** The Contractor shall certify, at the time of submission of a claim, as follows:

"I certify under penalty of perjury under the laws of the State of California, that the claim is made in good faith, that the supporting data are accurate and complete, and that the amount requested accurately reflects the contract adjustment for which the Owner is liable.

By: _____
“(Contractor's signature)”

4.3.8 **Third Party Claims:** Owner will notify Contractor of receipt of any third party claim relating to the contract within 5 business days of receipt of such claim.

4.4 DISPUTES RESOLUTION

4.4.1 **Continue Work During Dispute:** In the event of any dispute between the Owner and the Contractor, the Contractor will not stop Work but will prosecute the work diligently to completion in the manner directed by the Owner, and the dispute shall be resolved as set forth herein after completion of the Work. However, all disputes must be submitted by Contractor in accordance with the subsequent provisions of this section.

4.4.2 **Requirements for Filing a Claim:** For any claim subject to this Article, the following requirements apply: the claim shall be in writing and include the documents necessary to substantiate the claim. Claims must be filed on or before the date of final payment. Nothing in this subdivision is intended to extend the time limit or supersede notice requirements otherwise provided by this contract for the filing of claims.

1. For claims of less than fifty thousand dollars (\$50,000.00), the Owner shall respond in writing to any written claim within forty five (45) days of receipt of the claim, or may request, in writing, within thirty (30) days of receipt of the claims or relating to defenses or claims the Owner may have against the Contractor, any additional documentation supporting the claim or relating to defenses to the claim the Owner may have against the Contractor.

If additional information is thereafter required, it shall be requested and provided pursuant to this subdivision, upon mutual agreement of the Owner and the Contractor.

The Owner's written response to the claim, as further documented, shall be submitted to the Contractor within fifteen (15) days after receipt of the further documentation or within a period of time not greater than that taken by the Contractor in producing the additional information, whichever is greater.

2. For claims of over fifty thousand dollars (\$50,000.00) and less than or equal to three hundred seventy-five thousand dollars (\$375,000.00), the Owner shall respond in writing to all written claims within sixty (60) days of receipt of the claim, or may request, in writing, within thirty (30) days of receipt of the claim, any additional documentation supporting the claim or relating to the defenses or claims the Owner may have against the Contractor.

If additional information is thereafter required, it shall be requested and provided pursuant to this subdivision, upon mutual agreement of the Owner and the Contractor.

The Owner's written response to the claim, as further documented, shall be submitted to the Contractor within thirty (30) days of receipt of the further documentation, or a period of time no greater than that taken by the Contractor in producing the additional information or requested documentation, whichever is greater.

3. If the Contractor disputes the Owner's written response, or the Owner fails to respond within the time prescribed, the Contractor may so notify the Owner, in writing, either within fifteen (15) days of receipt of the

Owner's written response or within fifteen (15) days of Owner's failure to respond within the time prescribed, respectively, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon a demand, the Owner shall schedule a meet and confer conference within thirty (30) days for settlement of the dispute.

4. If following the meet and confer conference the claim or any portion remains in dispute, the Contractor may file a claim pursuant to Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code, and in accordance with Section 20104.2 of the Public Contract Code.

4.4.3 Owner's Review of Claim: The Owner's Representative shall review the facts pertinent to the claim, secure assistance from legal and other advisors, coordinate with the contract administrators, and promptly provide a written response. The response shall be furnished to the Contractor by certified mail, return receipt requested, or any other method that provides evidence of receipt. The Owner's Representatives' response shall be final and conclusive except as is otherwise provided herein.

4.4.4 Claims Exempt from Review: The procedures and remedies provided in this Section 4.4 do not apply to:

1. Any claims by the Owner.
2. Any claim for or respecting personal injury or death or reimbursement or other compensation arising out of or resulting from liability for personal injury or death.
3. Any claim or dispute relating to stop payment requests or stop notices.
4. Any claim related to the approval, refusal to approve, or substitution of subcontractors, regardless of tier, and suppliers.

4.4.5 Suit in El Dorado County Only: Any litigation arising out of this Contract shall be brought in El Dorado County. The Owner and the Contractor shall follow procedures established for all civil actions filed to resolve claims pursuant to Public Contract Code Section 20104 et seq., including but not limited to Section 20104.4.

4.4.6 Payment of Undisputed Portion of Claim: Payment by Owner of undisputed portion of claim; interest on arbitration award or judgment.

1. Owner shall pay Contractor such portion of a claim which is undisputed except as otherwise provided in the contract.
2. In any suit filed pursuant to Public Contract Code Section 20104.4, the provisions of Section 20104.6 shall apply.
3. The rate of interest payable on unpaid and undisputed claims shall be 6 percent per annum. Interest shall begin to accrue 61 days after the Contractor submits to the Owner information in sufficient detail to enable the Owner to accept the claim statement.
4. The rate of interest payable on any judgment or award in arbitration shall not exceed 6% per annum in accordance with Civil Code Section 3287 et seq.

Article 5

CHANGES IN WORK

5.1 WAIVER

5.1.1 Waivers of Contract Provisions: It is expressly understood and agreed that no waiver granted by the Inspector or the Owner of any term, provision, or covenant of this Contract shall constitute a precedent for breach of the same or any other terms, provisions, or covenants of this Contract.

5.2 CHANGES

5.2.1 Owner May Order Changes in Work: The Contractor agrees that the Owner, without invalidating the Contract, may order changes in Work by altering, adding to, or deducting from the Work, the Contract Amount and Time being adjusted according to the provisions of Section 5.4 and Section 5.5. Contractor agrees to enter into a modification of his original Contract for such changes.

5.2.2 Cost Proposals: Upon request of the Owner for a quotation on the change to the Work, the Contractor shall promptly submit to Owner's Representative, and the Inspector, if one is appointed, in writing a detailed breakdown of the work and of the amount of deduction or addition claimed. In no case shall Cost Proposals be provided later than ten (10) calendar days from the date requested. The Owner's request for quotations on alterations to the Work shall not be considered authorization to proceed with the work prior to issuance of a Change Order, nor shall such request justify any delay in existing work. If Contractor fails to provide Cost Proposals within ten (10) calendar days, Owner may prepare the Cost Proposal based on estimates of labor, materials, and equipment. This proposal, prepared by Owner, shall be binding on the Contractor, will become the basis for Contract Price adjustment, and shall not be subject to dispute or claim.

5.2.3 Contract Change Instrument: Changes in work involving a change in Contract Price or Contract Time shall be done only pursuant to an Architect's Supplemental Instructions, Change Order, or Construction Change Directive as set forth below in this article.

5.2.4 Changes Shall Conform to Contract: Changes in work shall be performed in conformance with applicable provisions of the Contract Documents, and the Contractor shall proceed promptly unless otherwise provided in the Architect's Supplemental Instructions, Change Order, or Change Directive.

5.3 CONTRACT CHANGE INSTRUMENTS

5.3.1 Architect's Supplemental Instructions (ASI): The Owner's Representative or the Architect may order minor changes in work by use of an Architect's Supplemental Instruction. These minor changes will involve neither changes in the Contract Price or Contract Time. If the Contractor disagrees that the change does not involve a change in cost or time, then a Change Order or Change Directive shall be used.

5.3.2 Change Order (CO): The Change Order shall be used in cases where Owner and Contractor agree on the change in work, the amount of or method of computing the Contract Amount, and the amount of adjustment in Contract Time.

5.3.3 Construction Change Directive (CCD): In the event that the Owner and Contractor do not agree on the proposed change in work, and/or the proposed adjustment of Contract Price and Time, or in the event it is essential that the Contractor proceed expeditiously and without delay, then Owner may, by issuance of a Construction Change Directive, order changes in work, and the Contractor shall promptly proceed with the change in work involved.

1. **Acceptance of Change Directive:** If Contractor agrees with the Change Directive, the Contractor shall by his signature thereon, indicate his acceptance of the terms of the Directive, including adjustments to price and time, and the Change Directive shall then be followed by a Change Order.
2. **Non-Acceptance of Change Directive:** If the Contractor disagrees with the method of computing an increase in Contract Price, then the amount of adjustment shall be computed by the Cost Reimbursement method detailed in Basis for Adjustment. Disagreements with amounts or credits, under the Cost Reimbursement method, or time, shall be considered a dispute, and processed under the section on Disputes Resolution.

5.4 BASIS OF ADJUSTMENT

5.4.1 Methods of Adjustment: The amount of adjustments to Contract Price, whether a credit or payment, shall be computed by one of the methods detailed below. The method used shall be at the sole determination of the Owner.

1. **Unit Prices:** Those prices stipulated in the Bid Proposal shall be utilized where they are applicable. In the event the change in original quantity is in excess of twenty five (25) percent of the original bid quantity, and the total dollar value of that bid is greater than \$5,000, the Owner shall review the unit price to determine if a new unit price shall be renegotiated. Unit prices for new items shall be negotiated and mutually agreed upon.
2. **Lump Sum:** A total lump sum for the Work negotiated and mutually acceptable to the Contractor and Owner. Lump sum quotations for modifications to the Work shall include substantiating documentation with an itemized breakdown of Contractor's and subcontractor's costs, including labor, materials, rentals, approved services, overhead, and profit all calculated as specified in the Cost Reimbursement method which follows.
3. **Cost Reimbursement (Extra Work):** In this method, the payment for Extra Work shall be made on a time and expense basis that is on an accounting of the Contractor's forces, materials, equipment, and other items of cost as required and used to do the Work. Payment will be made for the documented actual cost of the following:
 - a. Costs of direct labor, excluding supervisory personnel, including social security, old age and unemployment insurance, fringe benefits required by agreement, labor insurance and labor taxes established by law.
 - b. Costs of materials, supplies, and equipment, including cost of transportation and sales tax, whether incorporated if paid for by the Contractor or his subcontractor.
 - c. Rental costs, prevailing in the area, of machinery and equipment for the actual time used, and including transportation costs for items having value in excess of \$100.00.
 - d. Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work.

To the above cost the Contractor shall be allowed a markup of twenty (20) percent on direct labor charges and fifteen (15) percent for all other cost items. When any or all of the Extra Work is done by one of the Contractor's subcontractors, the markups set forth above shall be applied to the subcontractor's actual costs to which a five (5) percent markup shall be allowed the Contractor. These markups shall be considered to be full compensation, covering the cost of general supervision, administration, overhead, profit, and any and all other general expenses, including, but not limited to, uniforms, hand tools, safety equipment, travel and lodging.

5.5 EXTENSION OF TIME FOR COMPLETION

5.5.1 Contractor Delayed or Hindered: Should the Contractor be delayed or hindered in the completion of the Work by the neglect of the Owner, or by fire, by strikes, lockouts, embargoes or earthquakes, and any other causes the

Inspector approves as not having been reasonably foreseeable at the time of execution of the Contract Documents, then the time allowance herein fixed for the completion of the Work shall be extended for a period equivalent to the time lost by reason of any or all of the causes aforesaid. Time extensions must be requested in accordance with Section 4.3.

5.5.2 Agreement on Time Extension: In addition, the Contractor and the Owner reserve the right to mutually agree in writing upon an extension of time for completion for causes other than enumerated above.

5.5.3 Time Extension Not Waiver: The granting of an extension of time by the Owner for performance by the Contractor shall not operate as a waiver or stop the Owner from claiming damages due to any other delays, prior or subsequent, which were not approved by the Owner as provided herein.

Article 6

PAYMENTS AND COMPLETION

6.1 GENERAL

6.1.1 Contract Price: The Contract Price is stated in the Contract is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

6.1.2 Waiver: Neither the acceptance of the Work by the Owner nor the payment of any part or all of the sum due the Contractor hereunder shall constitute a waiver by the Owner of any claim which the Owner may have against the Contractor or Surety under this Contract or otherwise.

6.1.3 Manner of Paying Warrants: Payment becomes due under the terms of this Contract in the manner prescribed by law. The Auditor shall cause a warrant for the Certified amount to be drawn upon the proper fund of the Treasurer of the Owner, which warrant shall be approved and issued to Contractor within that period of time customarily required to process said warrants in the ordinary course of Owner's business..

6.2 APPLICATIONS FOR PAYMENT

6.2.1 Submittal of Applications: The Contractor shall submit to the Owner OR Owner's Representative, an Application for Payment form, which will be provided by the Owner. Such application shall be supported by such data substantiating the Contractor's right to payment as the Owner may require, such as copies of requisitions from subcontractors and material suppliers.

6.2.2 Basis for Payment: The Payment shall be based upon the total Contract price and upon percentage of completion of the Work at the time of the submittal of the application for payment.

6.2.3 Work Free of Liens: The Contractor warrants that upon submittal of an Application for Payment, all work for which Certificates for Payment have been previously issued and payments received from the Owner shall be free and clear of liens, claims, security interests, or encumbrances against Contractor by subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials, and equipment in relation to the Work.

6.3 CERTIFICATION FOR PAYMENT

6.3.1 Certification Determination: The Owner's Representative will review as soon as practicable for the purpose of determine whether it is a proper payment request and shall within seven (7) days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certification for Payment, with a copy to the Contractor, for such amount as determined to be properly due, or notify the Contractor of the reasons why the payment

request is not proper and for withholding certification of payment in whole or in part as provided in Section 6.4.1.

6.3.2 The Owner shall pay or cause to be paid to Contractor, an amount equal to ninety five percent (95%) as noted in Section 6.4.3 of the amount set forth in the approved Certificate for Payment within thirty (30) days of receipt of an Application for Payment approved by the Owner's representative as provided for in Paragraph 6.3.1 above, and shall retain the remaining five percent (5%) as noted in 6.4.3 until the time provided for in Section 6.6.4. The Owner shall withhold amounts pursuant to stop notices received in addition to the retainage. Failure of Owner to make payments provided herein in a timely manner shall not constitute a default by the Owner of the Contract, but may entitle the Contractor to interest as provided by law.

6.4 WITHHOLDING FROM PAYMENTS

6.4.1 Reasons for Withholding: The Owner, upon recommendation of the Inspector, may withhold payments, or on account of subsequently discovered evidence nullify the whole or a part of any progress or retention payments to such extent as may be necessary to protect the Owner from loss on account of:

1. Defective work or material not remedied or replaced.
2. The filing of claims or Stop Notices to withhold, or reasonable evidence indicating probable filing of such claims or notices.
3. Failure of the Contractor to make payments properly to subcontractors, or for materials or labor.
4. Failure to make payments to any person or entity for financial obligations of the Contractor under terms of this Contract.
5. A reasonable doubt that the Contract can be completed for the balance then unpaid.
6. Damage to another contractor.
7. Performance of work in violation of the terms of the Contract Documents.
8. Excessive costs to Owner.
9. Failure of Contractor to comply with requirements for timely submittal of specified documentation, including but not limited to construction schedules, cost proposals, and submittals.

6.4.2 Release of Payment: When the above grounds for withholding are removed, payment shall be made for amounts withheld because of them.

6.4.3 Method of Retainage: The Department will retain 5% of the value of each progress payment from each progress payment. The retained funds shall be retained until thirty five (35) days after recordation of the Notice of Acceptance.

6.5 SUBSTITUTE SECURITIES FOR RETENTION

6.5.1 Substitution of Securities: Bidders are hereby put on notice that the successful bidder may substitute securities for any monies withheld by the County of El Dorado to insure performance of the Contract pursuant to Public Contract Section 22300. This section provides that the Contractor may elect to receive 100 percent of payments due under the Contract Documents from time to time, without retention from any portion of the payment by the County of El Dorado, by depositing eligible securities of equivalent value with the County of El Dorado or qualified escrow agent in accordance with the provisions of Public Contract Code Section 22300. Eligible

securities shall be limited to those listed in Section 16430 of the Government Code, or bank or savings and loan certificates of deposit from a qualified institution. Any such escrow agreement shall follow the form set forth in Public Contract Code Section 22300(f) and provided by the Owner.

6.6 FINAL COMPLETION AND PAYMENT OF RETAINAGE

- 6.6.1 Affidavit of Payment:** After the date of Substantial Completion of the Work, and before final acceptance of the Work, the Contractor shall file with the Owner his affidavit, sworn to before a Notary Public, stating that all workmen and persons employed, all firms supplying materials, and all subcontractors upon the project for either labor or material have been paid in full, except certain items, if any, to be set forth in such affidavit covering disputed claims, including claims for acceleration, disruption, delays, inefficiencies, and hindrance, or items in connection with which Stop Notices have been filed under the provisions of the Statutes of the State of California. The filing of such affidavit by the Contractor shall be one of the prerequisites to the making, by the Owner, of the final retainage payment on the Contract.
- 6.6.2 Final Inspection:** Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of the Application for Payment, the Owner will promptly make such inspection. The Contractor shall complete all punch list items within two days of receipt of the written punch list. When the Owner's Representative finds the work acceptable under the Contract Documents and the Contract fully performed, the Owner's Representative will promptly recommend to Owner that Owner may consider the Project complete, that the Purchasing Agent may accept the project and that the Notice of Acceptance may be issued.
- 6.6.3 Final Certification:** Before issuance of payment, Contractor shall file, with Owner, a certificate in which he certifies that to the best of the Contractor's knowledge, information, and belief, and on the basis of observations and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents.
- 6.6.4 Payment of Retention:** Thirty-five (35) days after the Notice of Acceptance has been filed, provided the Work is fully completed and the Contract fully performed, the balance due under the Contract shall be paid, less any monies held for stop notices. Payment shall not be construed as an absolute acceptance of the work done up to the time of such payment. The Contractor, if requested by the Owner, shall furnish receipts or other vouchers showing his payments for materials and labor. Owner may withhold from payment an amount not to exceed 150 percent of any amount in dispute.
- 6.6.5 Notice of Acceptance:** The Work shall be accepted in writing in the form of a Notice of Acceptance when the whole of the work has been completed satisfactorily to the Owner. In judging the Work, no allowance for deviations from the original Contract Documents will be made unless already approved in writing at the proper times and in the manner as called for herein.

Article 7

PROTECTION OF PERSONS AND PROPERTY

7.1 PROTECTION OF WORK, PROPERTY, AND PERSONS

- 7.1.1 Responsible for Damage to Owner's Property:** The Contractor shall be entirely responsible for any damage to the property of the Owner due to careless handling of tools and/or materials or other causes attributed to the Contractor's Work in performing this Contract.
- 7.1.2 Responsible for Safety:** The Contractor will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury, or loss to all employees on the Work and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks,

pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

7.1.3 Safety and Convenience: The Contractor will comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction. The Contractor will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. The Contractor will notify owners of adjacent utilities when prosecution of the Work may affect them.

7.1.4 Remedy Damages: The Contractor will remedy all damage, injury, or loss to any property caused, directly or indirectly, in whole or part, by the Contractor, any subcontractor, or anyone directly or indirectly employed by any of them or anyone of whose acts any of them would be liable, except damage or loss attributable to the sole or active negligence of the Owner or the Inspector or anyone employed by them and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the Contractor.

Article 8 INSURANCE AND BONDS

8.1 INSURANCE

GENERAL INSURANCE REQUIREMENTS

The Contractor shall provide proof of a policy of insurance satisfactory to the El Dorado County Risk Management Division and documentation evidencing that the Contractor maintains insurance that meets the following requirements:

1. Full Workers' Compensation and Employers' Liability Insurance covering all employees of the Contractor as required by law in the State of California.
2. Commercial General Liability Insurance of not less than Two Million Dollars (\$2,000,000) combined single limit per occurrence for bodily injury and property damage, including but not limited to endorsements for the following coverage: Premises, personal injury, operations, products and completed operations, blanket contractual, and independent contractors liability. This insurance can consist of a minimum \$1 Million primary layer of CGL and the balance as an excess/umbrella layer, but only if the County is provided with written confirmation that the excess/umbrella layer "follows the form" of the CGL policy.
3. Automobile Liability Insurance of not less than One Million Dollars (\$1,000,000) is required in the event motor vehicles are used by the Contractor in performance of the contract.
4. In the event Contractor is a licensed professional and is performing professional services under this contract, Professional Liability Insurance is required with a limit of liability of not less than One Million Dollars (\$1,000,000).
5. Explosion, Collapse and Underground coverage is required when the scope of work includes XCU exposures. For the purpose of this contract, XCU coverage is not required.

PROOF OF INSURANCE REQUIREMENTS

1. Contractor shall furnish proof of coverage satisfactory to the El Dorado County Risk Management Division as evidence that the insurance required herein is being maintained. The insurance will be issued by an insurance company acceptable to the Risk Management Division, or be provided through partial or total self-insurance likewise acceptable to the Risk Management Division.
2. The County of El Dorado, its officers, officials, employees, and volunteers shall be included as additional insureds, but only insofar as the operations under this Contract are concerned. This provision shall apply to all general liability and excess liability policies. Proof that the County is named additional insured shall be made by providing the Risk

Management Division with a certified copy, or other acceptable evidence, of an endorsement to Contractor's insurance policy naming the County additional insured.

3. In the event Contractor cannot provide an occurrence policy, Contractor shall provide insurance covering claims made as a result of performance of this contract for not less than three (3) years following completion of performance of this Contract.
4. Any deductibles or self-insured retentions must be declared to and approved by the County. At the option of the County, either: the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the County, its officers, officials, employees and volunteers; or the Contractor shall procure a bond guaranteeing payment of losses and related investigations, claim administration and defense expenses.
5. Contractor shall require each of its subcontractors to procure and maintain commercial general liability insurance, automobile liability insurance, and workers compensation insurance of the types and in the amounts specified above, or shall insure the activities of its subcontractors in its own policy in like amounts. Contractor shall also require each of its subcontractors to name Contractor and County of El Dorado as additional insureds.

INSURANCE NOTIFICATION REQUIREMENTS

1. Contractor agrees no cancellation or material change in any policy shall become effective except upon thirty (30) days prior written notice to the County of El Dorado, Chief Administrative Office, Facilities Division, Russ Fackrell at 3000 Fairlane Court, Placerville, CA 95667.
2. Contractor agrees that the insurance required herein shall be in effect at all times during the term of this agreement. In the event said insurance coverage expires at any time or times during the term of this Contract, Contractor shall immediately provide a new certificate of insurance as evidence of the required insurance coverage. In the event Contractor fails to keep in effect at all times insurance coverage as herein provided, County may, in addition to any other remedies it may have, terminate this Contract upon the occurrence of such event. New certificates of insurance are subject to the approval of the Risk Management Division.

ADDITIONAL STANDARDS

Certificates shall meet such additional standards as may be determined by the Department either independently or in consultation with the Risk Management Division, as essential for protection of the County.

COMMENCEMENT OF PERFORMANCE

Contractor shall not commence performance of this Contract unless and until compliance with each and every requirement of the insurance provisions is achieved.

MATERIAL BREACH

Failure of Contractor to maintain the insurance required herein, or to comply with any of the requirements of the insurance provisions, shall constitute a material breach of the entire Contract.

REPORTING PROVISIONS

Any failure to comply with the reporting provisions of the policies shall not affect coverage provided to the County, its officers, officials, employees or volunteers.

PRIMARY COVERAGE

The Contractor's insurance coverage shall be primary insurance as respects the County, its officers, officials, employees and volunteers. Any insurance or self-insurance maintained by the County, its officers, officials, employees or volunteers shall be in excess of the Contractor's insurance and shall not contribute with it.

PREMIUM PAYMENTS

The insurance companies shall have no recourse against the County of El Dorado its officers, agents, employees, or any of them for payment of any premiums or assessments under any policy issued by any insurance company.

CONTRACTOR'S OBLIGATIONS

Contractor's indemnity and other obligations shall not be limited by the insurance required herein and shall survive the expiration of this Contract.

8.2 BONDS

8.2.1 General Requirements for Bonds: Before commencing any Work under the Contract, the Contractor shall provide all bonds to the Owner. These bonds shall be in the amounts and for the purposes specified below. They shall be Surety bonds and shall be issued by corporations duly and legally licensed and qualified to transact business in the State of California. They shall be maintained by him and at his expense during the entire life of the Contract or later as provided.

8.2.2 Performance Bond: One bond shall be in the amount of 100 percent of the Awarded Contract and shall guarantee the faithful performance of the Contract and shall insure the Owner during the life of the Contract and the Guarantee period. The Contractor may provide, subject to approval by the Owner, a separate guarantee bond upon completion of and acceptance of the work.

8.2.3 Payment Bond: One bond shall be in the amount of 100 percent of the Awarded Contract and shall guarantee the payment in full of all claims for labor and materials in accordance with the provisions of the laws of the State of California.

8.2.4 Change of Surety: If, at any time a Surety on such bonds becomes irresponsible or loses its right to do business in the State of California, the Owner may require another Surety which the Contractor shall furnish within ten (10) calendar days after receipt of written notice to do so.

8.2.5 Authentication of Bonds: Evidence of authority of an attorney-in-fact acting for the corporate Surety must be provided in the form of a certificate as to his power of attorney and to the effect that it is not terminated and remains in full force and effect on the date of the bonds. The form of the bonds shall be in accordance with those provided in the Draft Agreement.

Article 9

UNCOVERING AND CORRECTION OF WORK

9.1 DEVIATION FROM CONTRACT DOCUMENTS

9.1.1 Improper Work: If the Contractor shall vary from the Contract Documents in the form or quality of the Work, or the amount or value of the materials herein provided for, the Owner shall have the right to order such improper work or materials removed, remade, or replaced. In the event that the Work is ordered changed, any other work disturbed or damaged by such alteration shall be made good at the Contractor's expense.

9.2 CORRECTION OF WORK

9.2.1 Covered or Completed Work: If any work is covered contrary to the written instructions of the Owner's Representative, or the Inspector, if one is appointed, it must, if requested, be uncovered for observation and replaced at the Contractor's expense.

9.2.2 Inspection of Covered Work: If the Owner's Representative or the Inspector, if one is appointed, considers it necessary or advisable that covered Work be inspected or tested by others, the Contractor, upon request, will uncover, expose, or otherwise make available for observation, inspection, or testing as the Inspector may require, that portion of the Work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such Work is defective, the Contractor will bear all the expenses of such uncovering, exposure,

observation, inspection, and testing and of satisfactory reconstruction; if, however, such Work is not found to be defective, the Contractor will be allowed an increase in the Contract price or an extension of the Contract time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, and construction, and an appropriate Change Order shall be issued.

9.2.3 **Rejected Work:** The Contractor shall promptly remove from the premises all Work rejected by Owner for failure to comply with the Contract Documents, whether incorporated in the construction or not, and the Contractor shall promptly replace and re-execute the work either during the term of the Contract or during the warranty period, in accordance with the Contract Documents and without expense to the Owner and shall bear the expense of making good all Work of other contractors destroyed or damaged by such removal or replacement.

9.2.4 **Cost of Correction:** All removal and replacement Work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected Work within ten (10) days after receipt of written notice, the Owner may remove such Work and store the materials at the expense of the Contractor. Owner also may perform such Work or repairs itself and charge the expense to the Contractor.

Article 10

SUSPENSION OF CONTRACT

10.1 SUSPENSION OF WORK

10.1.1 **Owner May Suspend:** The Owner may suspend the Work or any portion thereof for a period of not more than ninety (90) days or such further time as agreed upon by the Contractor, by written notice to the Contractor and the Inspector which shall fix the date on which work shall be resumed.

10.1.2 **Resumption of Work:** The Contractor shall resume that Work on the dates so fixed. The Contractor shall be allowed an increase in the Contract price or an extension of the Contract time, or both, directly attributed to any suspension.

*** END OF DOCUMENT ***

COUNTY OF EL DORADO

ANIMAL SERVICES FACILITY

DIAMOND SPRINGS, CALIFORNIA

BID #14-968-042

CONTRACT ADMINISTRATION FORMS

CONTRACT ADMINISTRATION FORMS

SUBMITTAL COVER SHEET FORM

REQUEST FOR INTERPRETATION (RFI) FORM

SUBSTITUTION REQUEST FORM

WARRANTY FORM

SUBMITTAL COVER SHEET

PROJECT NAME: EL DORADO COUNTY ANIMAL SERVICES FACILITY	ARCHITECT'S JOB NO. 13103	CONTRACTOR'S JOB NO.	SUBMITTAL NO.
SUBCONTRACTOR NAME: ADDRESS: PHONE: CONTACT:	CONTRACTOR CERTIFICATION I hereby certify that I have reviewed the attached, and have verified field requirements and compliance with the Contract Documents. CONTRACTOR: ADDRESS: SIGNED: _____ DATE: _____		
PRODUCT OR SYSTEM:		SECTION NUMBER:	
CHECK ONE ONLY: <input type="checkbox"/> SPECIFIED PRODUCT <input type="checkbox"/> SUBSTITUTION (ATTACH SUBSTITUTION REQUEST FORM) <input type="checkbox"/> SPECIFIED ALTERNATE <input type="checkbox"/> RESUBMITTAL: PREVIOUS SUBMITTAL NO.			
SUBMITTAL HISTORY			
DATE REC'D. FROM CONTR.	CONSULTANT REVIEW <input type="checkbox"/> Civil <input type="checkbox"/> Mechanical <input type="checkbox"/> Structural <input type="checkbox"/> Electrical <input type="checkbox"/> Landscape <input type="checkbox"/> Other Date Sent: _____ Date Due: _____ Date Rec'd: _____	DISTRIBUTION DATE _____ Copies to: Contr. _____ Insp. _____ File _____ Owner _____ Other _____	
REMARKS:	COUNTY OF EL DORADO <input type="checkbox"/> Reviewed, No Exceptions Taken <input type="checkbox"/> Revise & Submit <input type="checkbox"/> Reviewed, Comply w/ Exceptions Noted <input type="checkbox"/> Rejected This review and noted exceptions do not relieve the contractor from compliance with any requirement of the contract documents. This review is only for conformance with the design intent, consistency with specified requirements, and to promote the planning of the work by the contractor in sufficient detail to allow for proper coordination and execution of the Work. Shop drawings typically require information which is more detailed or specific than that shown in the contract documents. Contractor is solely responsible for such specific or detailed information. Contractor is solely responsible for completeness, dimensions, quantities, coordination with other work, selection of fabrication processes and techniques of construction, and any omissions or deviations from contract documents not so identified in the submittal. BY: _____ DATE: _____		

REQUEST FOR INTERPRETATION

PROJECT NAME: EL DORADO COUNTY ANIMAL SERVICES FACILITY, 6425 CAPITAL AVENUE, DIAMOND SPRINGS, CA		JOB NO. 13103	
		RFI NO.	
TO: ANOVA ARCHITECTS 778 PACIFIC STREET PLACERVILLE, CA 95667		FROM:	
SUBJECT:			
CATEGORY:			
<input type="checkbox"/> NEED CLARIFICATION		<input type="checkbox"/> REQUEST FOR DEVIATION FROM DOCUMENTS	
<input type="checkbox"/> UNFORESEEN CONDITION		<input type="checkbox"/> CONSTRUCTION CONFLICT	
<input type="checkbox"/> CONFLICT BETWEEN DOCUMENTS		<input type="checkbox"/> OTHER	
SPEC. SECTION	PARAGRAPH NO.	DRAWING NO.	DETAIL NO.
DESCRIPTION:			
CONTRACTOR'S PROPOSED RESOLUTION:			
<input type="checkbox"/> ATTACHMENTS:			
<input type="checkbox"/> COST IMPACT:		<input type="checkbox"/> TIME IMPACT:	
CONTRACTOR SIGNATURE:		DATE:	
RESPONSE:			
<input type="checkbox"/> ATTACHMENTS:			
ARCHITECT SIGNATURE:		DATE:	

SUBSTITUTION REQUEST FORM

PROJECT NAME: EL DORADO COUNTY ANIMAL SERVICES FACILITY	EDC JOB NO. <b style="color: red;">13103	CONTRACTOR'S JOB NO.	SUBMITTAL NO.
<p>PRODUCT OR SYSTEM:</p> <p>SECTION NUMBER:</p> <p>SPECIFIED ITEM:</p> <p>PROPOSED SUBSTITUTION:</p> <p>REASON FOR REQUEST:</p> <p>REDUCTION OF CONTRACT SUM OR TIME WITH THIS SUBSTITUTION:</p>			
<p>Attached data includes product description, specifications, illustrations, performance and test data of specified and proposed product or system required for a side-by-side comparison. Applicable portions of data are clearly identified.</p> <p>Attached data also includes a description of changes to other work which proposed substitution will require for its proper installation.</p> <p>The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:</p> <ol style="list-style-type: none"> 1. The proposed substitution does not affect dimensions shown on drawings. 2. The undersigned will pay for changes to the building design, including engineering design, detailing and construction costs caused by the requested substitution. 3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements. 4. Maintenance and service parts will be readily available for the proposed substitution. <p>The undersigned further states that the function, appearance, and durability of the proposed substitution are equivalent or superior to the specified item.</p>			
Submitted by: Signature: Contractor: Telephone: Date: Attachments:	For use by County of El Dorado: <input type="checkbox"/> Acceptable, see submittal review comments <input type="checkbox"/> Rejected, see remarks below. By: Date: Remarks:		

WARRANTY FORM

Project Name _____

Description of Work _____

Specification Section _____

Date of Acceptance by Owner _____

We hereby guarantee that the workmanship and materials that we installed in the above named project have been in accordance with the Drawings and Project Manual and that the work as installed will fulfill the requirements of the guarantee included in the Project Manual. We agree to repair or replace any or all work, together with any other adjacent work that we may displace in so doing, that may prove to be defective in its workmanship or material within a period of _____ (____) years from date of acceptance by the Owner, without any expense whatsoever to Owner, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of our failure to comply with the above-mentioned conditions within 10 days after being notified in writing by the Architect or Owner, we collectively or separately do hereby authorize Owner to proceed to have said defects repaired and made good at our expense and we will honor and pay the costs and charges therefore upon demand. This guarantee is a supplement to the General Conditions of the Contract and not in lieu of any provision thereof.

SUBCONTRACTOR:

Signed Date

Name Title

Company Name License No.

Address

GENERAL CONTRACTOR:

Counter signed Date

Name Title

Company Name and License No.

COUNTY OF EL DORADO

ANIMAL SERVICES FACILITY

DIAMOND SPRINGS, CALIFORNIA

BID #14-968-042

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS

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DIVISION 1 – GENERAL REQUIREMENTS

SECTION 01 11 00 SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 GENERAL

- A. The Project: The name of the Project is ANIMAL SERVICES FACILITY. The project site is located at **6435 CAPITOL AVENUE, DIAMOND SPRINGS, CALIFORNIA.**
- B. Responsible Parties: Construction of this Project is governed by the agreement between the Owner and the Contractor. Statements in the specifications are directed to this contractor, who has overall responsibility for the subcontractors.

1.3 WORK COVERED BY THE CONTRACT DOCUMENTS

- A. Construction of Improvement to the interior of the ANIMAL SERVICES FACILITY in conformance with Drawings and Specifications prepared by ANOVA Architects, Inc., Sacramento, California, and bound herewith.

1.4 EXISTING SITE CONDITIONS AND RESTRICTIONS:

- A. Prior to commencement of Work, Contractor, Owner's representative and Architect shall jointly survey the site and existing buildings, paving, plant life and other items. Contractor shall note and record existing damage such as cracks, sags, loose materials, and other damage.
- B. This record shall serve as a basis for determination of subsequent damage to these items due to settlement or movement due to demolition and construction operations.
- C. Such damage, as noted, shall be suitably marked on the item, if possible and the official record of existing damage shall be signed by the parties making the survey.
- D. Cracks, sags or other damage to the site and adjacent building areas, paving, plant life and other items not noted in the original survey, but subsequently observed shall be reported immediately to the Architect.

1.5 REQUIREMENTS FOR SEQUENCING OR SCHEDULING:

- A. General: Begin work as identified in DIVISION 1 – GENERAL REQUIREMENTS; proceed as shown in the Progress Schedule as required under SECTION 01 32 16 - PROGRESS SCHEDULE - DRYOUT, and complete work within the limits designated in Document OWNER-CONTRACTOR AGREEMENT.
- B. Coordination: Coordinate work to accommodate the Owner's operations and use of premises during construction period; coordinate construction schedule and operations with Owner's Representative; indicate all special requirements in the Progress Schedule as specified.

PART 2 - PRODUCTS

2.1 HAZARDOUS MATERIALS

- A. General: No asbestos or products containing asbestos have been knowingly specified for this Project.
- B. Notification: If materials containing asbestos are brought to the site for use or installation in the Work; or if such materials are encountered in existing work upon which new work is being performed, notify the Architect immediately so that appropriate action may be taken.
- C. Certification: Submit CERTIFICATION OF COMPLIANCE FOR BUILDING MATERIALS certifying that no new materials containing asbestos have been included in the Work is required at the completion of the Project.

PART 3 - EXECUTION

3.1 CONTRACTOR'S USE OF PREMISES

- A. General: Confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents; do not unreasonably encumber the site with materials or equipment.
- B. Coordination with Occupants: Do not interfere with activities in and about adjacent tenant facilities. Disruption of adjacent tenant operations will be acceptable only with prior agreement with the Owner. 10 days minimum notice will be required, including establishment of a firm schedule for operations.
- C. Access to Site: Roads for access to and from building site, loading areas and parking space shall be as indicated. Confine traffic and materials delivery to these roads and locations.
- D. Storage: Contractor is responsible for protection and safekeeping of products stored on the site. Specific areas for storage of materials and site fabrication shall be as indicated by the Architect.

3.2 PROTECTION

- A. General: Erect temporary barricades, warning signs and substantial handrails to protect persons in and around the work areas and observe safety precautions. Conform to applicable OSHA rules and regulations and State Safety Regulations and Orders.

END SECTION 01 11 00

SECTION 01 23 00 ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Description: This Section includes administrative and procedural requirements governing Alternates. Each Alternate is identified by number and describes the basic changes to be made in the Work.
- B. Definition: An alternate is an amount proposed by bidders and stated on the BID FORM for work defined in the Bidding Requirements that the Owner may elect to add or deduct. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate the Alternate into the Work including any incidental work required to make the change. No other adjustments are made to the Contract Sum.

PART 2 - PRODUCTS

2.1 ALTERNATE BIDS

- A. General: Alternates will be accepted at the discretion of the Owner. See INSTRUCTIONS TO BIDDERS located in the BID document for identification of Alternates (Proposal Page P-4).
- B. Time of Acceptance: Bid amounts for alternates shall be fixed until the date at which the work described in the alternate would be incorporated into the Work, based on the contractors CPM schedule.

2.2 SCHEDULE OF ALTERNATES

NOT USED AT THIS TIME.

PART 3 - EXECUTION

3.1 MODIFICATIONS TO WORK

- A. General: Execute accepted alternates under the same conditions as other Work of this Contract.
- B. Notification: Immediately following the award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate whether alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Coordination: Modify or adjust affected adjacent Work as required to completely and fully integrate that Work into the Project.

END SECTION 01 23 00

SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for documentation of changes in the Work, as defined in DIVISION 1 – GENERAL REQUIREMENTS.
- B. Change Procedures:
 - 1. Authorized Agent: Submit to Architect the name of the individual authorized to receive change documents and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
 - 2. Proposal Request: Architect upon Owner's approval may issue a Proposal Request on AIA Document G709 - Proposal Request, which includes a detailed description of a proposed change in the Work. Contractor will prepare and submit an estimate within 10 days.
 - 3. Request for Change: Contractor may propose a change by submitting a written request to the Architect, describing the proposed change and its full effect on the Work; include a statement describing the reason for the change, the effect on the Contract Sum/Price and Contract Time with full documentation, and a statement describing the effect on work by separate or other contractors. Document any requested substitutions in accordance with SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.

1.3 CHANGE ORDERS

- A. Format: Issued by Architect upon Owner's approval to order changes to the work which involve a change in Contract Price and/or Contract Time; signed by Architect, Owner and Contractor, and approved by the County of El Dorado Building Department as applicable.
- B. Documentation of Change in Contract Price and/or Contract Time:
 - 1. General: Maintain detailed records of work done on a time and material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs of changes in the Work.
 - 2. Quotation Breakdown: Itemize each quotation for a change in cost or time in sufficient detail to allow evaluation of the quotation. As a minimum, itemize separately each significant material and equipment purchase and the work of each trade and subcontractor.
 - 3. Supporting Data:
 - a. Costs: Separate costs for products, labor, equipment, and subcontractor quotations.
 - b. Quantities: Products, labor, and equipment.
 - c. Taxes, Insurance and Bonds: As required.
 - d. Overhead and Profit: As required, not to exceed limits set in DIVISION 1 – GENERAL REQUIREMENTS.

- e. Justification: Change in Contract Time.
 - f. Additional Data: On request, as required to support computations.
4. Claim for Additional Costs:
- a. General: Support each claim for additional costs, and for work done on a time and material basis, with the following additional information:
 - b. Origin and Date of Claim: State name and originator and date.
 - c. Dates and Times: When work was performed and by whom.
 - d. Time Records and Wage Rates: As recorded and paid.
 - e. Invoices and Receipts: For products, equipment, and subcontracts.
- C. Execution of Change Orders: Architect upon Owner's approval will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.4 CONSTRUCTION CHANGE DIRECTIVE

- A. General: Issued by Architect on Architects - Construction Change Directive form, signed and approved by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. The document will describe changes in the Work, and will designate method of determining any change in Contract Price or Contract Time. Promptly execute the change in Work.

1.5 ARCHITECT'S SUPPLEMENTAL INSTRUCTIONS

- A. General: Issued by Architect on Architect's - Architect's Supplemental Instructions form to provide supplemental instructions, interpretations, or order minor changes in the Work, signed and approved by the Owner, not involving an adjustment to Contract Price or Contract Time.

PART 2 - PRODUCTS

2.1 TYPES OF CHANGE ORDERS

- A. Stipulated Price Change Order: Based on Proposal Request and Contractor's maximum price quotation or Contractor's request for a Change Order approved by Owner.
- B. Unit Price Change Order:
 - 1. General: For unit costs or quantities of units of work which are not pre-determined, execute Work under a Construction Change Directive.
 - 2. Pre-determined Unit Prices and Quantities: Change Order will be executed on a fixed unit price basis.
 - 3. Changes in Contract Price or Contract Time: Computed as specified for Time and Material Change Order.
- C. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract. Owner will determine the change allowable in Contract Price and/or Contract Time as provided in the Contract Documents. Maintain detailed records of work done on time and material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

PART 3 - EXECUTION

3.1 CORRELATION OF CONTRACTOR SUBMITTALS

- A. General: Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum/Price.
- B. Progress Schedule: Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust time for other items of work affected by the change, and resubmit.
- C. Record Documents: Record authorized changes in Project Record Documents.

END SECTION 01 26 00

SECTION 01 29 00 PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing the Contractor's Applications for Payment.

1.3 GENERAL REQUIREMENTS

- A. Submit Applications for Payment to the Owner in accordance with the schedule established by Document OWNER-CONTRACTOR AGREEMENT.
- B. Related Requirements Specified Elsewhere:
 - 1. Schedule of Values: SECTION 01 29 73 - SCHEDULE OF VALUES.
 - 2. Contract Closeout: SECTION 01 77 00 - CLOSEOUT PROCEDURES.

1.4 SUBMITTALS

- A. Form:
 - 1. General: Prepare itemized applications typed on AIA Document G702 - Application and Certificate for Payment and Continuation Sheet AIA Document G703.
 - 2. Format: Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
 - 3. Change Orders: List each authorized Change Order as an extension on AIA G703 - Continuation Sheet, listing Change Order number and dollar amount as for an original item of work.
 - 4. Final Payment: Prepare Application for Final Payment as specified in SECTION 01 77 00 - CLOSEOUT PROCEDURES.
- B. Record Drawings: Update Record Drawings as required in DIVISION 1 – GENERAL REQUIREMENTS and SECTION 01 77 00 - CLOSEOUT PROCEDURES.
- C. Procedure:
 - 1. Required Copies: Submit 4 copies of each Application for Payment.
 - 2. Payment Period: Submit at intervals stipulated in Document OWNER-CONTRACTOR AGREEMENT.

PART 2 - PRODUCTS

NOT USED AT THIS TIME.

PART 3 - EXECUTION

NOT USED AT THIS TIME.

END SECTION 01 29 00

SECTION 01 29 73 SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Description: Submit to the Owner 3 copies of Schedule of Values within 7 days of the date of commencement. Schedule of Values will be used as basis for, and review of, Contractor's Applications for Payment.
- B. Substantiation: Upon request by the Architect, support values given with data that will substantiate their correctness.
- C. Quantities: Submit quantities of designated materials, if applicable.
- D. Payment for Materials: Materials stored on or off site will be limited to those materials listed in Schedule of Unit Material Values.

PART 2 - PRODUCTS

2.1 FORM OF SUBMITTAL

- A. General: Submit typed schedule on AIA Document G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form of electronic media printout will be considered as an alternative.
- B. Format:
 - 1. Major Categories: Break total contract amount into subtotals by Building Unit Designations with a separate category for sitework.
 - 2. Line Items: Use the Table of Contents of this Project Manual as the basis for format for listing costs of work specified in DIVISIONS 2 through DIVISION 33 within each major category. Identify each line item with the number and title of its specification section.

PART 3 - EXECUTION

3.1 PREPARING SCHEDULE OF VALUES

- A. Installed Costs: Break down installed costs into the delivered cost of product, with taxes paid, and the total installed cost, with overhead and profit.
- B. Major Items: For each line item which has an installed value of more than \$25,000, break down the costs to list major products or operations under each item.
- C. Figures: Round off to the nearest dollar.
- D. Sum: Make the sum of total costs of all items listed in the schedules equal to the total Contract Sum.

- E. General Cost Items: Itemize separate line item costs for each of the following:
1. Performance and payment bonds.
 2. Field supervision and layout.
 3. Scheduling.
 4. Temporary facilities and controls.
 5. Other documentable general cost items as applicable. (No mobilization line item will be allowed.)

3.2 PREPARING SCHEDULE OF UNIT MATERIAL VALUES

- A. Stored Materials: Submit a separate schedule of unit prices for materials to be stored on which progress payments will be made.
- B. Identification: Make the form of submittal parallel to the Schedule of Values, with each line item identified the same as the line item in the Schedule of Values.
- C. Unit Costs: Include in the unit costs only the value of material, delivery and unloading at site, including sales taxes.
- D. Unit Material Item Total: Make sure that the unit prices multiplied by quantities are given an equal material cost of that item in the Schedule of Values.

3.3 REVIEW AND RESUBMITTAL

- A. After review by the Owner, revise and resubmit the schedule (and the Schedule of Unit Material Values) as required. Revise schedule to list approved Change Orders, with each Application for Payment.

END SECTION 01 29 73

SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Coordinate scheduling, submittals, and work of the various sections of these Specifications to assure the efficient and orderly sequence of installation of each part of the work. Coordinate construction operations included under different sections that depend on each other for proper installation, connection, and operation.

1.3 SUBMITTALS

- A. General: Within 7 days of date of commencement, submit a list of the Contractor's principal staff assignments, including the superintendent and other key personnel in attendance at the Project Site. Identify each individual by name, title, and provide a description of their duties and responsibilities. Update list within 7 calendar days of any staff change.
- B. Communications: Submit written procedures for Project communications including submittals, reports and records, schedules, coordination drawings, and recommendations.
- C. Coordination Drawings:
 - 1. General: Submit as required under SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS. Prepare where careful coordination is required for installation of products and materials fabricated by separate entities and/or where limited space availability requires maximum utilization of space for efficient installation of different components. Show the relationship of components and required installation sequences.
 - 2. Site Utilities: Show piping and conduit for underground drainage, sewer, gas, power, signal, and water under fire access road and at major crossings and congested areas.
 - 3. Attic/Ceiling spaces: Show piping, ductwork, conduit and equipment for HVAC, electrical, plumbing, and fire sprinklers in congested areas or where there is the potential for routing conflicts.

1.4 SCHEDULING

- A. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures such as preparation of schedules, installation and removal of temporary facilities, delivery and processing of submittals, progress meetings, and Project closeout activities, with other construction activities to avoid conflicts and assure orderly progress of the Work.

1.5 MEETINGS

- A. Pre-Construction Conference:
 - 1. Prior to start of construction, a conference will be called for the purpose of reviewing the construction program. At this conference, procedures for implementing the communication and administration requirements of these construction documents agreeable to Contractor, Owner, and Architect shall be established.

2. Schedule for progress meetings shall be established at pre-construction conference.
3. Attendance: Job superintendent, major subcontractors and suppliers, owner's representative, Architect, and Architect's consultants.

B. Progress Meetings:

1. Attendance: Job superintendent, Architect, Owner, and others as required.
2. Architect's Responsibility: Preside at meetings and distribute minutes to all attendees for review. Minutes will be assumed to accurate if no revisions are requested by attendees within 10 days or by the next meeting whichever is later. Minutes are not a part of the contract documents and cannot change the contract documents.
3. Contractor's responsibility: Make physical arrangements for meetings. Assure attendance of any subcontractors or suppliers required at the meetings. Review minutes of meeting for accuracy and completeness. Completion: All Progress Meetings within 30 days of planned or required date of substantial completion shall address the following items:
 - a. Outstanding work required to be completed before inspection for substantial completion. Refer to SECTION 01 77 00 - CLOSEOUT PROCEDURES for minimum list of requirements prior to inspection.
 - b. Scheduled date of inspection for substantial completion.
 - c. Scheduled date of final completion.

1.6 CONSTRUCTION PLANNING

- A. Coordinate the use of the site and facilities. Allocate areas of site for field offices and sheds, staffing, access, traffic, and parking facilities.

PART 2 - PRODUCTS

NOT USED AT THIS TIME.

PART 3 - EXECUTION

NOT USED AT THIS TIME.

END SECTION 01 31 00

SECTION 01 31 26 ELECTRONIC COMMUNICATION PROTOCOLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Description: This section provides procedures for Contractor's use certain of the Architect's computer aided design (CAD) files as background drawings preparation of submittals.

1.2 BACKGROUND DRAWINGS

- A. Purpose: Use of electronic background drawing is optional and is offered only as a convenience to the Contractor to save the expense of redrawing the backgrounds.
- B. Drawings: Background drawings will include only floor plans, interior and exterior elevations, reflected ceiling plans, roof plans, site plan, and building sections.

1.3 SUBMISSION PROCEDURES

- A. Agreement: Submit request for electronic data transfer by signing the Agreement included at the end of this Section and sending copy to ANOVA Architects.
- B. Time: Submit request a minimum of 10 days prior to the date that files are needed.
- C. Response: Architect will email the files or provide files on a diskette, as requested in the transmittal. Files will be in the program used by the Architect's firm; any necessary translations will be the responsibility of the Contractor. Architect is not responsible for any problems encountered as a result of electronic transmission or translation.

PART 2 - PRODUCTS

NOT USED AT THIS TIME.

PART 3 - EXECUTION

NOT USED AT THIS TIME.

END SECTION 01 31 26

ELECTRONIC DATA TRANSFER AGREEMENT

PROJECT NAME:

ARCHITECT'S PROJECT NO.:

ARCHITECT: ARCHITECTURAL NEXUS Architects
1990 Third Street, Suite 500
Sacramento CA 95811

CONTRACTOR MAKING REQUEST:

Firm Name
Address
City, State, Zip

BACK GROUND DRAWINGS FOR PREPARATION OF SHOP DRAWINGS PER SECTION:

Architect will provide background drawings (floor plans, reflected ceiling plans, roof plans, interior and exterior elevations, building sections and site plans) in electronic format to contractor for contractor's use in preparation of shop drawings. No other use is authorized. The drawings will be provided as a courtesy. Any fee charged is to defray the cost of retrieving and handling the files and not to pay for any professional service. Contractor's use of the drawings is optional and will not change the responsibility of any party to any contract related to this project nor alter any provision of the contract documents.

Contractor acknowledges the following: The electronic background drawings are not part of the Contract Documents. They have been extracted from the Architects working CAD files for the project, are incomplete, and differ from the current printed Contract Documents. Shop drawings require more precision and detail than do construction documents as typically prepared by architects. Architect makes no representation that the electronic background drawings are suitable for any particular purpose. Contractor further acknowledges that contractor is solely responsible for the accurate, complete, and timely production and submission of shop drawings and that contractor will modify the electronic background drawings to accurately depict field conditions and the current contract documents to the extent necessary to fulfill those responsibilities.

In consideration for use of the electronic background drawings, contractor agrees to defend, indemnify, and hold harmless the Architect, the Architects Consultants, and the Owner from any claim or liability of any kind, and to waive any claim against the Architect or Owner, arising out of the authorized or unauthorized use of the electronic background drawings by the contractor.

Contractor's Representative's Name (print)

Contractor's Representative's Signature

Date: _____

SECTION 01 32 16 PROGRESS SCHEDULE – DRYOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Within 21 days of commencement date, submit to the Owner estimated construction progress schedules for the Work, with sub-schedules of related activities essential to its progress. Submit revised progress schedules periodically.

1.3 CONSTRUCTION DRY-OUT SEQUENCE

- A. General: In order to reduce mold-supporting latent moisture in construction materials the following sequence of construction shall be followed.
- B. Prior to Construction Dry-Out: Install roofing and at least 1 layer of building paper. Doors and window shall be installed or openings covered weather tight. Temporary heat, ventilation, and dehumidification equipment and related power and fuel supply shall be functioning.
- C. Construction Dry-Out Period: Duration of construction dry-out period shall be until moisture content of wood construction meets the requirements called for in SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS or 1 week, whichever is longer. Do not install insulation or gypsum board until prescribed temperature and humidity duration, and moisture tests results have been documented and authorization to proceed has been granted by Owner.
- D. After Construction Dry-Out: **Moisture content of substrates SHALL be tested.** Do not install interior or exterior finishes until moisture content of substrate meets requirements specified in respective Specification Section. Do not install cement plaster scratch coat on any wall until any nailing of gypsum wallboard has been completed on that wall.

1.4 PREPARATION

- A. Format: Either Gantt chart or network diagram format is acceptable.
 - 1. Bar Chart: Prepare Schedule as a horizontal bar chart with separate bar for each major portion of Work or operation, identifying first work day of each week.
 - 2. CPM Schedule: Prepare network analysis system using the critical path method, as outlined in The Associated General Contractors of America (AGC) publication "The Use of CPM in Construction - A Manual for General Contractors".
 - 3. Sequence of Listings: List each item in chronological order of its start date.
 - 4. Item Identification: Identify each task by specification section number. Coordinate with schedule of values
- B. Content:
 - 1. General: Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

2. Phases: Identify work of separate stages and other logically grouped activities. Provide sub-schedules for each stage of Work identified in SECTION 01 11 00 - SUMMARY OF WORK. Provide sub-schedules to define critical portions of the entire Schedule.
 3. Multiple Buildings: Identify start and finish date of each task for each building.
 4. Percentage of Completion: Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each progress billing cycle.
 5. Scheduled Submittals: Show submittal dates on schedule or provide separate schedule of submittal dates for shop drawings, product data, and samples and dates reviewed submittals will be required from Architect.
 6. Finish and color submittals: Indicate submittal date for all finish and color related submittals. Indicate decision date for selection of finishes and colors. Coordinate with Architect to allow adequate time between submittal and decision dates for presenting colors to Owner for Owners review and approval. Color approval process will not begin until all color related submittals have been approved.
 7. Owner Furnished Products: Indicate delivery dates.
 8. Dry-in Milestone: Show date that roofing, building paper and weather proofing of openings will be complete and temporary heat, ventilation, and dehumidification will be functional.
 9. Construction Dry-out: Show separate line item for construction dry-out period with interim dates for installation of insulation and gypsum board. Refer to SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS for construction dry-out requirements.
 10. Project Closeout: Identify date of inspection for substantial completion. Show 30 day punch list close-out period immediately following this inspection.
- C. Revisions to Schedules:
1. General: Indicate progress of each activity to date of submittal, and projected completion date of each activity.
 2. Revisions: Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
 3. Reports: Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.

1.5 SUBMISSIONS

- A. General: After review of initial Schedule, resubmit required revised data within 10 days.
- B. Revised Schedules: Submit revised Progress Schedules with each Application for Payment. Provide the number of copies required by Contractor, plus 2 copies which will be retained by Owner.
- C. Distribution: Distribute copies of reviewed Schedules to project site file, subcontractors, suppliers, and other concerned parties. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in Schedules.

END SECTION 01 32 16

SECTION 01 33 00 PRODUCT SUBMITTALS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies requirements for preparation, processing, and review of Submittals related to products, materials, and assemblies to be incorporated into the Work.
- B. Product submittals are required to determine conformance with specified requirements, and to promote the planning of the work by the contractor in sufficient detail to allow for proper coordination and execution of the Work. For coordination purposes, submittals typically contain information which is more detailed or specific than that shown in the contract documents. Contractor is solely responsible for reviewing and coordinating that more specific or detailed information.

1.3 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.
- B. Technical Specifications: Specific product submittal and substitution requirements are identified in the individual sections of these specifications.
- C. Non-Product Submittals: Requirements for informational submittals not subject to review and action of the Owner, and requirements for submittals not related to product selection, such as Schedule of Value, Progress Payments, Test Reports, Close-out Submittal, RFI's, etc. are specified in other portions of the Contract Documents.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. General: Make drawings legible and complete in every respect. Show relationship to adjacent structure or material; clearly identify all field dimensions.
 - 2. Variations: If shop drawings show variations from Contract requirements because of standard shop practice or other reason, specifically note such variations in letter of transmittal as well as on drawings.
- B. Product Data:
 - 1. General: Provide manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data. Clearly mark each copy; identify proposed materials, products or models.
 - 2. Required Information: Provide dimensions and clearances required; performance characteristics and capacities; and diagrams of equipment and controls.
 - 3. Manufacturer's Standard Schematic Drawings: Provide standard drawings; delete information not applicable to Project. Supplement standard information as required for Project.

- C. Manufacturer's Instructions:
 - 1. General: Submit most recent applicable printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing of the subject material as provided by the manufacturer for use under conditions similar to those of this Project.
- D. Evidence of Compliance:
 - 1. Provide evidence of compliance with referenced codes and standards such as certification of recognized producer or association, test results, manufacturer's literature indicating compliance.
- E. Samples:
 - 1. Submit samples to illustrate functional and aesthetic characteristics of product with integral parts and attachment devices. Submit color samples in the size and range of colors specified in the individual specification sections.

1.5 CONSIDERATION OF SUBSTITUTIONS

- A. Substitutions: If the Bidder lists a manufacturer in its Proposal that is a substitute (i.e. "or equal"), such listing shall be considered a substitution request by the Bidder. If the Bidder is the apparent low Bidder, the Bidder shall, within two (2) business days following the bid opening, submit data substantiating the request for the substitution with the "or equal" item. Failure to submit such substantiating data within two (2) business days following the bid opening may result in the County deeming the apparent low Bidder non-responsive.
- B. Format: Requests for substitution will not be considered unless a fully executed Substitution Request form has the following information included:
 - 1. Submittal Information: Provide all information required by this specification section and by the specification section of the specified product.
 - 2. Data Comparison: Submit a side-by-side, item-by-item comparison of all characteristics and of the specified product and the proposed product.
 - 3. Construction Time and Sum. Provide statement of the affect of the substitution on Contract Time and Contract Sum.

1.6 ACCEPTANCE OF SUBSTITUTIONS

- A. Proposed substitutions are subject to acceptance by the Owner. Owner may reject any substitution which, in Owner's opinion, in consultation with Architect, is not equal in quality, function, durability, ease of maintenance or aesthetics to that of the specified product. Owner's opinion is final and not subject to appeal or claim procedure.
- B. Owner's acceptance of a product substitution does not relieve Contractor from responsibility for compliance with the Contract Documents. Contractor shall be responsible for any costs, delays or any changes in other parts of the Work which are necessary to accommodate or that result from such substitution.

1.7 SUBMITTAL SCHEDULE

- A. General: Provide submittal schedule per SECTION 01 32 16 - PROGRESS SCHEDULE - DRYOUT. Schedule shall conform to the minimum review times and submittal deadlines described below. Incomplete submittals, submittals that have not been adequately reviewed by Contractor, substitutions, submittals requiring multiple submissions, and unforeseen complications can result in

review times greater than the minimums listed. Contractor shall use its best judgment in scheduling submittals to keep project on schedule and shall provide contingency time for submittals on the critical path.

- B. Review Time: For scheduling purposes, allow for the following minimum review times: Routine submittals, 4 weeks; hardware, casework and other large submittal packages, 5 weeks; substitutions, 6 weeks. Architect will review submittals with reasonable promptness. Shorter review times may be requested on a case by case basis for submittals on the critical path. Include requested review time with submittal. Architect will endeavor to comply with reasonable requests for expedited reviews.
- C. Submittal Deadlines: Make submissions no later than the following number of days after commencement date, unless a later date, acceptable to the Architect, is shown on the Contractor's CPM schedule.
 - 1. Early Start, or Long Lead Items: 45 calendar days.
 - 2. All Other Items: 90 calendar days. No colors will be selected by Architect until all color related submittals have been received.

1.8 SUBMITTAL PROCESS

- A. General: Make submittals as required to cause no delay in the orderly progress of work, layout or fabrication under Contract, due allowance being made for checking by the Architect and for such corrections, resubmission and rechecking as may be necessary. Do not commence work requiring submittals until review by Architect has been completed.
- B. Contractors Review of Subcontractors Submittals:
 - 1. Before Submittal: Contractor shall review submittals for compliance with Contract Documents, stamp and initial or sign submittals. By stamping and initialing submittals, contractor certifies that contractor has performed the following:
 - a. Substitutions: Determine whether submittal meets the specified requirements or a substitution. If it is a substitution, verify that it will have no detrimental affect on project schedule, quality of construction, or coordination with the Work of other trades. Verify that Substitution Request Form is fully executed and that submittal contains side-by-side comparison.
 - b. Complete Submittal: Verify that submittal is complete and contains all submittal items called for in individual specification section.
 - c. Specificity: When product literature contains information on multiple models, options or features, verify that the specific model number, options, and features be proposed are clearly identified and meet specified requirements.
 - 2. Before or After Submittal: By signing and forwarding a submittal to Architect, Contractor certifies that Contractor has verified, or will verify, dimensions and has coordinated, or will coordinate, the information shown on the submittal with field conditions and information shown on other submittals and on the drawings.
- C. Required Information:
 - 1. General: Provide a completed copy of the Submittal Cover Sheet included with each submittal. Complete identified areas of the form as follows:

- a. Submittal Number: Identify submittals sequentially starting from number 1; number re-submissions with same number as original and add letter designation A., B., C., etc., in order submitted.
- b. Specification Section: Identify submitted work with section number shown in the Project Manual. Provide separate submittals for each specification section or Product, as required.
- c. Contractor: Provide company name and mailing address with signature of contact person responsible for work on this project, certifying to review of submittal, verification of field requirements, and compliance with Contract Documents.
- d. Subcontractor: Provide company name, mailing address, telephone number, and name of contact person responsible for work on this project.
- e. Submittal Description: Describe contents of submittal completely; identify if material is a resubmittal, and give previous submittal number.
- f. Submittal Index: List items included in submittal; properly cross-reference to Contract Documents.
- g. Date: Submission date and revision dates.
- h. Project: Project name and number; names of Architect, Contractor, and Subcontractor as shown on Submittal Cover Sheet.
- i. Product or Material: Name of manufacturer, product name and model number, and name of supplier.

D. Number of Copies Required:

- 1. General: Provide electronic PDF's copies of all Product Submittals except as listed below.
- 2. Color charts or brochures: 4 original hardcopies.
- 3. Samples: As required in individual specification section. Additional color samples as requested.

E. Architect's Review:

Architect's review will be for general conformance with the Contract Documents. Review does not relieve Contractor from responsibility for compliance with the Contract Documents or from furnishing materials and work required by contract which may not be indicated on submittals when reviewed. Efforts will be made by Architect to identify errors, but Contractor is solely responsible for accuracy, completeness, dimensions, quantities, coordination with other work, selection of fabrication processes and techniques of construction, or deviations from contract documents not so identified in the submittal. Review does not authorize changes from Contract requirements.

F. Distribution:

- 1. Shop drawings, substitutions and submittals and color selections:
 - a. General: Reviewed submittals will be returned to Contractor for subsequent action, as required. Distributed as follows.
 - b. No Resubmittal Required:
 - i. Architect: 1 electronic PDF copy retained.

- ii. Reviewing Engineer (if any): 1 electronic PDF copy.
 - iii. Owner: 1 electronic PDF copy.
 - iv. Contractor: 1 electronic PDF copy.
- c. Resubmittal Required: Electronic copy retained by Architect; electronic PDF copy forwarded to Contractor. Make corrections to original drawings and send new electronic PDF copy to Architect for review. Secure final review prior to commencing work.
2. Final Color Selections: 1 copy each to Architect, Owner, and Contractor.

END SECTION 01 33 00

SECTION 01 35 16 ALTERATION OF PROJECT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. DESCRIPTION: This Section describes requirements for cutting, patching, protection, and finishing of existing construction, coordination of existing construction to remain with demolition and new construction, and related work and procedures.
- B. REQUIREMENTS INCLUDED:
 - 1. General: Coordinate Work per SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.
 - 2. Demolition Work:
 - a. General: In addition to work as specified in SECTION 02 41 00 - DEMOLITION and that specifically shown; cut, move or remove items as necessary to provide access or to allow alterations and new work to proceed. Include such items as:
 - b. Hazardous and Unsanitary Conditions: Repair and/or removal.
 - c. Abandoned Items: Removal of abandoned items and items serving no useful purpose, such as abandoned piping, conduit and wiring.
 - d. Unusable Materials: Removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals and deteriorated concrete.
 - e. Resurfacing: Cleaning of surfaces, and removal of surface finishes as needed to install new work and finishes.
 - 3. Refinishing: Make transitions consistent with new or existing detailing. Patch, repair and refinish existing items to remain, to the quality specified for new construction of each material, with clean, neat, straight, uniform and unobtrusive transition.
- C. SEQUENCE AND SCHEDULES:
 - 1. General: Schedule Work in the sequences and within times specified in SECTION 01 11 00 - SUMMARY OF WORK.
 - 2. Progress Schedule: Per SECTION 01 32 16 - PROGRESS SCHEDULE - DRYOUT.

1.3 ALTERATIONS, CUTTING AND PROTECTION

- A. GENERAL: Assign work of moving, removal, cutting and patching, to trades qualified to perform the work in manner to cause least damage to each type of work, and provide means of returning surfaces to appearance of new work.
- B. CUTTING AND REMOVAL:
 - 1. General: Perform cutting and patching as specified in SECTION 01 73 29 - CUTTING AND PATCHING. Remove minimum necessary, and in a manner to avoid damage to adjacent work.

2. Lines and Levels: Cut finish surfaces such as masonry, tile, plaster or metals, by methods to terminate surfaces in straight line at natural point of division.
- C. PROTECTION:
1. General: Protect existing finishes, equipment, and adjacent work which is scheduled to remain, from damage.
 2. Weather Protection: Protect existing and new work from weather and extremes of temperature.
 3. Environmental Conditions: Maintain existing interior work above 60 degrees F.
- D. TEMPORARY ENCLOSURE: Provide temporary enclosure as specified in SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS, to separate work areas from existing building and from areas occupied by Owner, and to provide weather protection.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. GENERAL: Refer to Section 01 60 00 - PRODUCT REQUIREMENTS.

2.2 SALVAGED MATERIALS

- A. GENERAL: Salvage sufficient quantities of cut or removed material to replace damaged surfaces in existing construction, when material is not readily obtainable on current market. Do not incorporate salvaged or used material in new construction except with permission of Architect. Identified items not required for use in repair of existing work shall be retained for future use by the Owner.
- B. SALVAGED ITEMS: As identified in SECTION 02 41 00 - DEMOLITION.
- C. STORAGE: Store salvaged items in dry, secure place on site.

2.3 PRODUCTS FOR PATCHING, EXTENDING AND MATCHING

- A. GENERAL: Provide same products or types of construction as that in existing structure, as needed to patch, extend or match existing work.
- B. EXISTING CONSTRUCTION: Generally, Contract Documents will not define products or standards of workmanship present in existing work; the Contractor shall identify products by inspection and testing; and workmanship by use of selected existing work as a sample for comparison.
- C. PRESENCE OF PRODUCT, FINISH OR TYPE OF CONSTRUCTION: Perform patching, extending or matching as necessary to make Work complete and consistent to identical standards of quality.

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. GENERAL: Refer to SECTION 01 73 00 - EXECUTION REQUIREMENTS. Patch and extend existing work using skilled mechanics who are capable of matching existing quality of workmanship. Quality of patched or extended work shall be not less than that specified for new work.

3.2 ADJUSTMENTS

- A. GENERAL: Where partitions are removed, patch floors, walls, and ceilings, with finish materials to match existing.
- B. LINES AND LEVELS: Where removal of partitions results in adjacent spaces becoming one, rework floors and ceilings to provide smooth planes without breaks, steps, or bulkheads.
- C. CHANGES OF PLANE: Where extreme change of plane of two inches or more occurs, request instructions from Architect as to method of making transition.
- D. DOORS: Trim and refinish existing doors as necessary to clear new floors.

3.3 DAMAGED SURFACES

- A. GENERAL: Patch and replace any portion of an existing finished surface which is found to be damaged, lifted, discolored, or shows other imperfections, with matching material.
- B. SUBSTRATE: Provide adequate support of substrate prior to patching finish.
- C. PATCHED SURFACES: Refinish patched portions of painted or coated surfaces in manner to produce uniform color and texture over entire surface.
- D. REFINISHED SURFACES: When existing surface finish cannot be matched, refinish entire surface to nearest intersections of surfaces.

3.4 TRANSITION FROM EXISTING TO NEW WORK

- A. GENERAL: When new work abuts or finishes flush with existing work, make smooth and workmanlike transition. Patched work shall match existing adjacent work in texture and appearance so that patch or transition is invisible at distance of 5'-0".
- B. SURFACE TRANSITIONS: When finished surfaces are cut in such a way that smooth transition with new work is not possible, terminate existing surface in neat manner along straight line at a natural line of division, and provide trim appropriate to finished surface.

3.5 CLEANING

- A. GENERAL: Perform periodic cleaning in accordance with DIVISION 1 – GENERAL REQUIREMENTS and final cleaning as specified in SECTION 01 77 00 - CLOSEOUT PROCEDURES.
- B. OWNER OCCUPIED AREAS:
 - 1. General: Clean daily.
 - 2. Spillage, Overspray, or Heavy Collection of Dust: Clean immediately.
- C. WORK OF TRADES: At completion of work of each trade, clean area and make surfaces ready for work of successive trades.
- D. FINAL CLEANING: At completion of alterations work in each area, provide final cleaning and return space to condition suitable for use by Owner.

END SECTION 01 35 16

SECTION 01 42 00 REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Description:
 - 1. General: Standards, codes, definition of words and terms, are identified in this Section.

1.3 REFERENCES

- A. General: References are made throughout the technical specifications to various standard specifications, codes, practices, and requirements for materials, work quality, installation, inspections and tests, which are published and issued by the organizations, societies and associations listed below by abbreviation and name.
- B. Referenced Standards: Obtain copies direct from publication sources as needed for proper performance and completion of the Work. Addresses for these organizations are available from the Architect.

1.4 STANDARDS

- A. General: All references to established Standards mean and include the latest edition of such Standards, as of the date of issue of this Project Manual.

1.5 CODES AND LAWS

- A. General: Work of this project shall conform to applicable codes, current editions adopted by enforcing agencies.
- B. Applicable Codes:
 - 1. California Building Code (CBC): With amendments.
 - 2. California Code of Regulations (CCR): Title 19, Public Safety; Title 24, Building Standards, Parts 1, 2, 3, 4, 5, 9 and 12.
 - 3. California Mechanical Code (CMC): With amendments.
 - 4. California Plumbing Code (CPC): With amendments.
 - 5. California Electric Code (CEC): With amendments.
 - 6. Americans with Disabilities Act (ADA): Latest edition.
 - 7. Environmental Protection Agency (EPA): National Standards.
 - 8. California Environmental Protection Agency (CalEPA): State and local Standards.

1.6 AUTHORITY HAVING JURISDICTION

- A. The Authority Having Jurisdiction for this Project is the County of El Dorado.

1.7 DEFINITIONS

A. References:

1. Governing Dictionary, Non-technical: The definitions of words and abbreviations used in these Specifications are given in "The American Heritage Dictionary of the English Language, Fourth Edition".
2. Governing Dictionary, Technical: The definitions of words and abbreviations specific to the Architectural/Construction industry are given in the "Means Illustrated Construction Dictionary, Third Edition, Unabridged".

B. Words and Terms:

1. General: The following are used in addition to those defined in the General Conditions, and are defined as follows:
2. Accepted Equal: Reviewed and accepted by the Architect as being equal in quality, utility and appearance.
3. Approved: As accepted by the Architect.
4. As Required: As required by regulatory requirements, referenced standards, existing conditions, or by the Contract Documents.
5. Building Code or Code: Refers to regulations of governmental agencies having jurisdiction.
6. Directed: As instructed by the Architect in writing.
7. Furnish: Supply and deliver to the site.
8. Indicated: As shown, noted, or scheduled on the Drawings.
9. Install: Anchor, fasten, or connect in place and adjust for use; place or apply in proper position and location; establish in place for use or service.
10. Product: Includes materials, systems and equipment.
11. Provide: Furnish and install.
12. Shown: As indicated, noted or scheduled on the Drawings.
13. Site: Area to be occupied by the Project. Use of the word "jobsite" or "site" shall be interpreted to be synonymous with "site of the Work" or "Work Site".

C. Abbreviations:

1. General: Definition of abbreviations and symbols used on the Drawings are identified on the Drawings.
2. Abbreviations of Proper Nouns and Brand Names: Names of manufacturer's names and Brand Names may be assigned abbreviations. The abbreviation will follow the first reference of the manufacturer's name or product in the specification and appear in parenthesis subsequently.
3. Keynote References: Materials or products may be assigned abbreviations for the purpose of distinguishing between different types of similar materials or products. Key note abbreviations will appear in parenthesis following the material or product designation in the specification (e.g. Carpet No. 1 (CPT1), Carpet No. 2 (CPT2)). The same Key Notes will be used on the drawings.

PART 2 - PRODUCTS

2.1 REFERENCE STANDARDS

- A. General: The reference standards applicable to this Project are specifically identified in the technical specification Sections listed in the Table of Contents - DIVISIONS 2 through 33.
- B. Association Names: The following abbreviation or acronym shall be understood to mean the full name of the respective organization or document, as follows:

AA: Aluminum Association
AABC: Associated Air Balance Council
AAC: Aluminum Anodizers Council
AAMA: American Architectural Manufacturers Association
AAN: American Association of Nurserymen
AASHTO: American Association of State Highway and Transportation Officials
AATCC: American Association of Textile Chemists and Colorists
AAU: Amateur Athletic Union
ABMA: American Boiler Manufacturers Association
ACI: American Concrete Institute
ACIL: American Council of Independent Laboratories
ACPA: American Concrete Pipe Association
ADC: Air Diffusion Council
AFPA: American Forest and Paper Association
AGA: American Gas Association
AGC: Associated General Contractors of America
AHA: American Hardboard Association
AHAM: Association of Home Appliance Manufacturers
AI: Asphalt Institute
AIA: American Institute of Architects
AIA: American Insurance Association (successor to NBFU)
AIHA: American Industrial Hygiene Association
AIMA: Acoustical and Insulating Materials Association
AISC: American Institute of Steel Construction
AISI: American Iron and Steel Institute
AITC: American Institute of Timber Construction
ALI: Associated Laboratories, Inc.
ALSC: American Lumber Standards Committee
AMCA: Air Movement and Control Association
ANSI: American National Standards Institute
AOSA: Association of Official Seed Analysts
APA: American Plywood Association
API: American Petroleum Institute
ARI: Air-Conditioning and Refrigeration Institute
ARMA: Asphalt Roofing Manufacturers Association
ASA: Acoustical Society of America
ASC: Adhesive and Sealant Council
ASHRAE: American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME: American Society of Mechanical Engineers
ASPA: American Sod Producers Association

ASPE: American Society of Plumbing Engineers
ASSE: American Society of Sanitary Engineering
ASTM: American Society for Testing and Materials
ATIS: Alliance for Telecommunications Industry Solutions
AWI: Architectural Woodwork Institute
AWPA: American Wood Preservers Association
AWS: American Welding Society
AWWA: American Water Works Association
BHMA: Builder's Hardware Manufacturers Association
BIA: Brick Industry Association
BIFMA: The Business and Institutional Furniture Manufacturer's Association
BSI: Building Stone Institute
CAGI: Compressed Air and Gas Institute
CalOSHA: California Occupational Safety and Health Administration
CalTrans: State of California, Department of Transportation
CARB: California Air Resources Board
CAUS: Color Association of the United States
CBHF: Bureau of Home Furnishings and Thermal Insulation, State of California, Dept. of Consumer Affairs
CBM: Certified Ballast Manufacturers
CCC: Carpet Cushion Council
CDA: Copper Development Association
CFFA: Chemical Fabrics and Film Association, Inc.
CGA: Compressed Gas Association
CISCA: Ceiling and Interior Systems Construction Association
CISPI: Cast Iron Soil Pipe Institute
CLFMI: Chain Link Fence Manufacturing Institute
CRA: California Redwood Association
CRI: Carpet and Rug Institute
CRRC: Cool Roof Rating Council
CRSI: Concrete Reinforcing Steel Institute
CS: Commercial Standard
CSA: Canadian Standards Association
CSDA: Concrete Sawing and Drilling Association
CSI: Construction Specifications Institute
CSIAC: California State Industrial Accident Commission
CPSC: Consumer Product Safety Commission
CSSB: Cedar Shingle and Shake Bureau
CTI: Ceramic Tile Institute of America
DHI: Door Hardware Institute
DIPRA: Ductile Iron Pipe Research Association
DLPA: Decorative Laminate Products Association
DOT: State of California, Department of Transportation
DSA: Division of the State Architect
DTSC: California Environmental Protection Agency Department of Toxic Substances Control
EIA: Electronic Industries Association
EIMAEIFS: Industry Manufacturers Association
EJMA: Expansion Joint Manufacturers Association

ETLETL: Testing Laboratories
FCI: Fluid Controls Institute
FCICA: Floor Covering Installation Contractors Association
FGMA: Flat Glass Marketing Association
FM: Factory Mutual Research and Engineering Corporation
FMRC: Factory Mutual Research Corporation
FTI: Facing Tile Institute
FS: Federal Specification General Services Administration
GA: Gypsum Association
GANA: Glass Association of North America
GIS: Germany Institute for Standardization
HEI: Heat Exchange Institute
HI: Hydronics Institute
HI: Hydraulic Institute
HMA: Hardwood Manufacturers Association
HMMA: Hollow Metal Manufacturers Association
HPVA: Hardwood Plywood and Veneer Association
HUD: U.S. Department of Housing and Urban Development
IAPMO: International Association of Plumbing and Mechanical Officials
IBD: Institute of Business Designers
ICC-ES: International Code Council – Evaluation Services
ICEA: Insulated Cable Engineers Association
IEC: International Electrotechnical Commission
IEEE: Institute of Electrical and Electronics Engineers
IESNA: Illuminating Engineering Society of North America
IFAI: Industrial Fabrics Association International
IGCC: Insulating Glass Certification Council
ILI: Indiana Limestone Institute of America
IMSA: International Municipal Signal Association
IRI: Industrial Risk Insurers
ISA: Instrument Society for Measurement and Control
ISO: International Standards Organization
KCMA: Kitchen Cabinet Manufacturers Association
LIA: Lead Industries Association, Inc.
LPI: Lightning Protection Institute
LSGA: Laminators Safety Glass Association
MBMA: Metal Building Manufacturers Association
MCAA: Mechanical Contractors Association of America
MFMA: Maple Flooring Manufacturers Association
MIA: Marble Institute of America
ML/SFA: Metal Lath/Steel Framing Association Division of NAAMM
MSSVFI: Manufacturers Standardization Society of the Valve and Fittings Industry
NAA: National Arborist Association
NAAMM: National Association of Architectural Metal Manufacturers
NAIMA: North American Insulation Manufacturers Association
NAPA: National Asphalt Pavement Association
NCAA: National Collegiate Athletic Association
NCMA: National Concrete Masonry Association

NCPI: National Clay Pipe Institute
NCRPM: National Council on Radiation Protection and Measurements
NCSPA: National Corrugated Steel Pipe Association
NECA: National Electrical Contractors Association
NEI: National Elevator Industry, Inc.
NEMA: National Electrical Manufacturers Association
NETA: International Electrical Testing Association
NFPA: National Fire Protection Association
NHLA: National Hardwood Lumber Association
NIST: National Institute of Standards and Technology
NLGA: National Lumber Grades Authority
NOFMA: National Oak Flooring Manufacturers Association
NPA: National Particleboard Association
NPCA: National Paint and Coatings Association
NRCA: National Roofing Contractors Association
NRMCA: National Ready-Mix Concrete Association
NSF: National Sanitation Foundation
NSSEA: National School Supply and Equipment Association
NSWMA: National Sanitation and Waste Management Association
NTMA: National Terrazzo and Mosaic Association
OSHA: Occupational Safety and Health Administration
OSHPD: Office of Statewide Health Planning and Development
PATMI: Power Actuated Tool Manufacturers' Institute, Inc.
PCA: Portland Cement Association
PCI: Precast Prestressed Concrete Institute
PDCA: Painting and Decorating Contractors of America
PDI: Plumbing and Drainage Institute
PEI: Porcelain Enamel Institute
PS: Product Standard of National Bureau of Standards
RFCI: Resilient Floor Covering Institute
RIS: Redwood Inspection Service
RMA: Rubber Manufacturers Association
SAMA: Scientific Apparatus Makers Association
SDI: Steel Deck Institute
SDI: Steel Door Institute
SIGMA: Sealed Insulating Glass Manufacturers Association
SFM: State Fire Marshal
SGCC: Safety Glazing Certification Council
SJI: Steel Joist Institute
SMA: Screen Manufacturers Association
SMA: Stucco Manufacturers Association
SMACNA: Sheet Metal and Air Conditioning Contractors National Association
SPIB: Southern Pine Inspection Bureau
SPR: Simplified Practice Recommendation
SPRI: Single-Ply Roofing Institute
SSMA: Steel Stud Manufacturers Association
SSPC: Steel Structures Painting Council
SSPMA: Sump and Sewage Pump Manufacturers Association

STI: Steel Tank Institute
SWI: Steel Window Institute
SWPA: Submersible Wastewater Pump Association
SWRI: Sealant, Waterproofing and Restoration Institute
TCA: Tile Council of America
TIMA: Thermal Insulation Manufacturers Association
TPI: Truss Plate Institute
UL: Underwriters' Laboratories, Inc.
UNI: Uni-Bel PVC Pipe Association
USP: United States Pharmacopoeial Convention
USDA: United States Department of Agriculture
USTC&TBA: United States Tennis Court and Track Builders Association
VWDI: Vinyl Window and Door Institute
WA: Wallcoverings Association
WCLIB: West Coast Lumber Inspection Bureau
WCMA: Window Covering Manufacturers Association
WCRSI: Western Concrete Reinforcing Steel Institute
WDMA: Window & Door Manufacturers Association
WH: Warnock Hersey International, Inc.
WI: Woodwork Institute
WLPDIA: Western Lath, Plaster, Drywall Industries Association
WRI: Wire Reinforcement Institute
WSC: Water Systems Council
WSFI: Wood and Synthetic Flooring Institute
WWPA: Western Wood Products Association
WWPA: Woven Wire Products Association

PART 3 - EXECUTION

NOT USED AT THIS TIME.

END SECTION 01 42 00

SECTION 01 43 00 QUALITY ASSURANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Description: This section includes administrative and procedural requirements for quality assurance.

1.3 REFERENCES:

- A. General: Refer to SECTION 01 42 00 - REFERENCES. Products or workmanship specified in the Project Manual by association, trade, or other consensus standards shall conform to the requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Contractual Relationship: The contractual duties and responsibilities of the parties of the Contract and those of the Architect shall not be altered from the requirements of the Contract Documents by any statement or inference in any reference document.

1.4 TESTING

- A. General: Refer to SECTION 01 45 29 - TESTING LABORATORY SERVICES.
- B. Quality Control: Provide facilities for storage and field curing of test samples.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Refer to SECTION 01 60 00 - PRODUCT REQUIREMENTS; assure a consistent quality of products furnished by suppliers and manufacturers as indicated throughout the Project Manual.

PART 3 - EXECUTION

3.1 PERFORMANCE

- A. Workmanship: Perform shop and field work with mechanics, craftspersons, artisans, and workers skilled and experienced in the fabrication and installation of work specified. Install and erect work plumb, level, square, and true, or true to indicated angle, and in proper alignment and relationship to other work. Finished work shall be free from defects and damage. Quality of work shall conform to the highest established standards and practices of the various trades required. The Architect upon Owner's approval reserves the right to reject materials and work quality which does not meet accepted standards. Repair or replace substandard material or work as directed, at no additional cost to the Owner.
- B. Inspection of the Work: Do not cover up work that requires inspection, testing and approval by Architect or Project Inspector until such approval is received. Give timely notice of readiness for such inspections. Any such work covered up without approval shall, if required by Architect, be uncovered and replaced at Contractor's expense, including the expense of testing, if required.

3.2 INSTALLATION

- A. General: Conduct quality control in concert with suppliers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Manufacturer's Instructions:
 - 1. General: Follow manufacturer's instructions, including each step in progression of installation. If manufacturer's instructions conflict with Contract Documents, request clarification from Architect before commencing Work.
 - 2. Installer: Manufacturer approved, as required in the technical sections of the Project Manual.
 - 3. Field Services: Coordinate with manufacturer of a product, system, or assembly which requires special knowledge and skill for proper application/installation of the product, system, or assembly to obtain field service, consultation and inspection as required for the application/installation work at no additional cost to the Owner.
- C. Reference Standards: Conform to specified standards as minimum quality for the Work except where more stringent codes or specified requirements indicate higher standards or more precise workmanship.
- D. Anchorage: Secure products in place with positive anchorage devices designed and sized to withstand stress, vibration, physical distortion, or disfigurement.
- E. Tolerances:
 - 1. General: Adjust products to appropriate dimensions; position before securing in place. Monitor and control tolerances of installed products to produce acceptable Work.
 - 2. Finished Wall Surfaces: Plumb; maximum variation of 1/8 inch in 8'-0" when a straightedge is laid on the surface in any direction, and no measurable variation in any 2'-0" direction.
 - 3. Finished Ceiling Surfaces: True and level; maximum variation of 1/8 inch in 8'-0" when a straightedge and water level are laid on the surface in any direction, and no measurable variation in any 2'-0" direction.
 - 4. Floor Surfaces:
 - a. Concrete Floors: Tolerances for concrete floors and pavement are specified in SECTION 03 30 00 - CONCRETE.
 - b. Wood and Plywood Subfloors: Level; maximum variation of plus or minus 1/8 inch in 10'-0". An additional tolerance of plus 1/4 inch per 12'-0" of unsupported span will be allowed for camber.
 - c. Finished Floors: Level to within plus or minus 1/8 inch in 10'-0" for hardwood and resilient floor coverings.
- F. Protection of Material:
 - 1. General: Provide protection of materials and products, whether or not installed, including erected and installed wood framing and sheathing, from water and moisture damage until completion and acceptance of the Project. Keep informed of weather conditions and forecasts and, when there is a likelihood of rain, protect installed and exposed construction and stored materials and lumber to the elements with suitable water-repellent coverings, such as canvas/tarpaulins or polyethylene sheeting.

2. **Finish Materials:** Keep millwork and trim, paneling, cabinets, shelving, and other products susceptible to water damage under cover and dry at shop until time of delivery. Do not deliver fabricated finish materials to the site until the building is roofed, and exterior walls are sheathed and protected with building paper as a minimum, the doors and windows are installed and glazed, and there is ample interior storage space for such materials and products. Do not deliver during periods of rain or heavy fog.
 3. **Moisture Damage:** Interior finishes and materials or products which are susceptible to water damage, that become wet from rain, dew, fog, or other source will be considered to have moisture damage and will be rejected, requiring replacement by the Contractor with new, dry materials or products at no additional cost.
- G. **Protection of Installed Work:** Provide barriers, covers or other temporary construction as required to protect work from damage or accident from any source, including vandalism or contractor's own forces.

END SECTION 01 43 00

SECTION 01 45 29 TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes administrative and procedural requirements for testing laboratory services, for inspections, tests, and related actions, including reports prepared by Contractor, by independent agencies, and by governing authorities. Contract enforcement activities performed by Architect are not included.

1.3 REQUIREMENTS INCLUDED

- A. General: Owner will employ and pay for services of an independent testing laboratory to perform specified testing. Costs of retesting after failed test will be paid by Owner and deducted from contract amount.
- B. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.
- C. Cooperation: Cooperate with laboratory to facilitate required services.
- D. Performance of Work: Employment of laboratory shall not relieve Contractor's obligations to perform work of Contract.

1.4 RELATED REQUIREMENTS

- A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.
- B. Respective Sections of the Specifications: Certification of products.
- C. Listed Specification Sections: Laboratory tests required and standards for testing.
- D. Testing Laboratory Inspection, Sampling and Testing is Required for:
 - 1. Concrete and Reinforcement: SECTION 03 30 00 - CONCRETE.
 - 2. Disinfecting: SECTION 33 13 00 - DISINFECTING.

PART 2 - PRODUCTS

NOT USED AT THIS TIME.

PART 3 - EXECUTION

3.1 LABORATORY DUTIES

- A. General: Comply with ASTM E329 "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction".

- B. Cooperation: Cooperate with Architect, Engineer and Contractor; provide qualified personnel after due notice.
- C. Services:
 - 1. General: Perform specified inspections, sampling and testing of materials and methods of construction.
 - 2. Specified Standards: Verify compliance.
 - 3. Specified Materials: Ascertain compliance with requirements of Contract Documents.
- D. Notification: Promptly inform Architect and Engineer of observed irregularities or deficiencies of work or products.
- E. Distribution of Reports: Distribute 1 copy of certified written report, of each inspection, test, or similar services to each of the following: Owner, Architect, Contractor, Civil Engineer, Structural Engineer, County of El Dorado Building Department.
- F. Additional Testing: Perform additional tests as required by Architect or Owner.

3.2 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

- A. Laboratory is Not Authorized to release, revoke, alter or enlarge on requirements of Contract Documents or perform any duties of Contractor.

3.3 CONTRACTOR'S RESPONSIBILITIES

- A. Coordination:
 - 1. Scheduling: Notify laboratory sufficiently in advance of operations to allow laboratory to schedule tests and assign personnel. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred.
 - 2. Laboratory Personnel: Cooperate with, provide access to Work, and to manufacturer's operations.
 - 3. Inspector: Cooperate with Inspector to secure and deliver to laboratory adequate quantities of representative samples of materials proposed for use and that require testing.
 - 4. Report Distribution: Provide contact name and addresses to laboratory for test report distribution.
- B. Statement of Responsibility: The contractor's statement of responsibility shall contain the following for each system or component requiring special inspection:
 - 1. Acknowledgment of awareness of the special requirements contained in the statement of special inspections.
 - 2. Acknowledgement that control will be exercised to obtain conformance with the construction documents approved by the building official;
 - 3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports; and
 - 4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.
- C. Manufacturer's Test Reports: Furnish copies of products test reports as required.

- D. Incidental Labor and Facilities: Provide access to Work to be tested; facilitate inspections and tests.
- E. Additional Testing: Paid for by Owner and backcharged to Contractor as specified in the individual sections.
- F. Repair and Protection: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Refer to SECTION 01 73 29 - CUTTING AND PATCHING.

END SECTION 01 45 29

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Furnish and install temporary facilities and controls as specified, plus other unspecified temporary facilities, including labor, materials, services, utilities, and equipment, as may be required for proper performance of the contract, except as otherwise provided.

1.3 SUBMITTALS

- A. Temporary Sign: Submit layout; see page 5 of this section for additional information.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

- A. General: Temporary facilities and controls shall be approved by appropriate authorities and regulatory agencies, including insurance companies, for safety precautions, operation and fire hazard.
- B. California Code of Regulations (CCR): Title 8 - (Cal-OSHA) Construction Safety Orders.
- C. Associated General Contractors of America (AGC): "Manual of Accident Prevention in Construction".

1.5 PRODUCT HANDLING

- A. Protection: Protect and maintain temporary facilities and controls in proper and safe condition throughout progress of work.
- B. Replacements: Immediately repair or replace lost or damaged temporary facilities or controls.

PART 2 - PRODUCTS AND EXECUTION

2.1 TEMPORARY UTILITIES

- A. General: Provide and pay for water, electricity, gas and other specified utility services required during construction and extend service lines to construction areas; allow use by all trades.
- B. Utility Loss: Owner will pay for construction power service, contractor to pay for and manage temporary distribution as required by project sequencing.
- C. Temporary Water:
 - 1. General: Owner will pay for construction water use.
 - 2. Temporary Connections: Provide connections to source and sufficient hose or pipe to carry water to all required locations.
- D. Temporary Electrical Facilities:
 - 1. General: Owner will pay for power, contractor to provide temp power distribution and temp lighting.

2. Construction Requirements:
 - a. General: Provide and install temporary fencing at the throat of the back entrance for staging and storage of materials.
 - b. No trailer is required.
 3. Interior Lighting: Provide and maintain at a minimum level of 2 watts per square foot, as required.
- E. Telephone:
1. General: Provide telephone for the use of the Contractor, provide for a cellular telephone and/or pager for use of Contractor's Superintendent.
 2. Availability: Provide access to telephone service for subcontractors and suppliers for duration of construction.
 3. Provide copier with scanning capability on site during construction.

2.2 TEMPORARY HEAT, VENTILATION AND DEHUMIDIFICATION:

- A. General: Provide heat, ventilation, and dehumidification as required to protect work and materials and reduce humidity to extent required to prevent corrosion of metal, dampness or mildew that may damage materials and finishes; fuel, equipment and method of heating and ventilating shall be acceptable to Architect. No direct-fired space heaters or propane, salamander type, heaters permitted.
- B. Equipment: Use either or a combination of the following:
 1. Installed building HVAC equipment: Complete installation of building HVAC system and assure that it is operational prior to the scheduled dry-out period. Cover all air intake grilles with temporary filters. Tape edges to prevent leaks. Operate building HVAC system 24 hours a day to heat, ventilate, and dehumidify building interiors. Replace all permanent filters, and extend manufacturer's warranty at final acceptance.
- C. Finishing and Closeout: Unless more restrictive requirements are specified for specific finishes, maintain dry bulb temperature between 60 and 80 degrees F with maximum relative humidity of 50% continuously, 24 hours a day after taping and texturing and until final acceptance or occupancy by Owner.

2.3 SANITARY FACILITIES

- A. Toilet Facilities: Provide enclosed chemical toilets with urinal for use of personnel engaged on Project.
- B. Drinking Water Facilities: Provide adequate clean and sanitary drinking water.

2.4 CONSTRUCTION EQUIPMENT

- A. General: Erect, equip, operate, and maintain construction equipment per applicable statutes, laws, ordinances, rules, and regulations of jurisdictional authorities and insurance companies regarding safety, operation and fire hazard.
- B. Construction Access Equipment:
 1. General: Provide and maintain scaffolding, staging, runways, and similar equipment, as required. Coordinate furnishing and use with subcontractors.

2.5 ENCLOSURES, FENCING AND BARRICADES

- A. General: Provide and maintain barricades, fencing, shoring, pedestrian walkways including lights and other safety precautions to guard against personal injury and property damage as prescribed by jurisdictional authorities, including insurance companies.
- B. Safety Orders: Obtain copies and conduct work under the requirements of applicable Safety Orders issued by State of California, Division of Industrial Safety. Inform subcontractors and material suppliers as to the requirements of applicable Safety Orders.
- C. Contractor's Storage Area: Locate where shown; enclose with fences and gates as required for security.

2.6 TEMPORARY SIGNS

- A. Project Sign:
 - 1. General: Provide 8'-0" by 4'-0" project sign in location as directed; construct per detail at the end of this section. Electronic file of sign is available from the Architect. Sign printing is available at Brownies, Rancho Cordova, CA, (916) 635-2679. Brace to withstand site and weather conditions.
 - 2. Painting: Paint entire assembly with two coats exterior house paint; provide white background with exhibit lettering by a professional sign painter.
 - 3. Lettering: Include the following:
 - a. Name of Project.
 - b. Name of County.
 - c. Name of architects and engineers.
 - d. Name of general contractor.
 - e. The following statement in 3 inch high, upper and lower case letters:
Removal: Upon contract completion, remove sign and restore area to match surrounding condition.

2.7 SITE CONTROLS AND PARKING

- A. Entrance to Work Site: Use identified entrances and access roads, as shown, or as directed. Maintain roads in satisfactory condition during Contract; repair damage resulting from work of this Project, as required, to leave in condition equal to that existing at start of Work.
- B. Site Storage and Work Areas: On-site storage and work areas will be identified by the Architect, for the Contractor's use, subject to change as necessary as job progresses.
- C. Regulations: Observe and comply with rules and regulations in effect at occupied facilities, including parking and traffic regulations, security restrictions, hours of access, and the like.
- D. Use of Public Sidewalks and Streets: Make arrangements with civic authorities for temporary use of streets and sidewalks for offices, shops, storage, etc.; abide by rules, regulations and ordinances; obtain and pay fees for permits.
- E. Debris Control: Keep work and storage areas clean and free of debris. Dispose of debris off site as it accumulates; pay required fees for use of dumps. Burning or burying on site is prohibited.

- F. Dust Controls:
 - 1. Indoor Operations: Control dust by using temporary partitions, curtains, or other means to prevent its spread beyond immediate work area. Use temporary means of closure for ducts and other openings communicating with other parts of building.
- G. Noise Control: Minimize noise caused by work operations. To extent possible, schedule accomplishment of noisy construction operations to hours during which adjacent building occupants will be least inconvenienced.
- H. Security: Contractor is responsible for security of areas of Work during entire time of Contract. Repair damage to Work and replace materials lost due to vandalism or theft.

2.8 MAINTENANCE AND REMOVAL

- A. Maintain temporary facilities and controls as long as required for safe and proper completion of Work; remove temporary facilities and controls as rapidly as progress of Work will permit.

END SECTION 01 50 00

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. Definitions:
 - 1. Products:
 - a. General: Items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - b. Named Products: Items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - 2. Materials: Components shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
 - 3. Equipment: Product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.3 SUBMITTALS

- A. Products List: Within 21 days after date of commencement, submit complete list of products intended for use on this Project. Provide list tabulated by Section Number, giving the trade name, name of the manufacturer, and model number or catalog designation of each product. Indicate which products will have submittals, which are being proposed as substitutions (Substitution Request Form) and which do not require submittals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Nameplates:
 - 1. General: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
 - 2. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.

3. Equipment: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.

2.2 PRODUCT OPTIONS

- A. General: For purposes of this Project, and in satisfaction of the requirements of the California Public Contract Code products have been specified with the following options:
- B. Products Specified By Reference Standards: Contractor may select any product which meets the standards, by any manufacturer.
- C. Specified Products and Alternate Manufacturers: Wherever catalog numbers and specific brand or trade names are used in conjunction with a designated material, product, thing or service mentioned in these specifications, they are used to establish the standards of quality, utility and appearance required. The "specified product" shall be understood to be the basis for the project design. Comparable products of named "alternate manufacturers" shall be considered equal in quality, utility and appearance. Contractor has the option of selecting from products and manufacturers named, with recognition of submittal requirements specified in SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- D. Accepted Equal: Where specification includes the designation "or accepted equal", Contractor may request acceptance as "equal" any material, process, or product of unnamed manufacturer through use of the Substitution Request specified in SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS. Requirements of that Section must be satisfied. Acceptance as "equal" will be the decision of the Owner; if the material, process or product is not, in the opinion of the Owner in consultation with the Architect, equal in quality, utility and appearance to that specified, Contractor must furnish material, process or product specified.
- E. Required Products: Where use of one named product and manufacturer is required to match others in use or because only one brand or trade name is known, there is no option, and no substitution will be allowed.

PART 3 - EXECUTION

- A. Product Handling: Assure that Work is manufactured and/or fabricated in ample time so as to not delay construction progress.

END SECTION 01 60 00

SECTION 01 64 00 OWNER FURNISHED PRODUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The Owner shall procure and provide certain products for installation as shown and specified per Contract Documents.
- B. Related Work Specified Elsewhere:
1. Products furnished and paid for by the Owner are described in the following technical sections:
 - Washer / Dryer – Owner supplied and contractor installed. Contractor to supply misc. accessories necessary for installation of all owner furnished appliances - dryer exhaust duct, etc.
 - Dishwasher – Owner supplied and contractor installed. Provide all connections for operation.
 - Refrigerator – Owner supplied and contractor installed. Provide all connections for operation.
 - Toilet paper and Paper Towel Dispensers – Owner supplied and contractor installed.

1.3 DEFINITIONS

- A. General: The following are used to identify products as noted on the Drawings.
- B. Owner Furnished Contractor Installed (O.F.C.I.): Products or equipment furnished by the Owner for installation under this contract.
- C. Owner Furnished Owner Installed (O.F.O.I.): Products or equipment to be provided and installed by the Owner, but requiring surfacing, backing, utility connections or other preparation under this contract, for proper installation.
- D. Not In Contract (N.I.C.): Products or equipment to be provided and installed by Owner, not requiring surfacing, backing, utility connections or other preparation under this contract.

PART 2 - PRODUCTS

NOT USED AT THIS TIME.

PART 3 - EXECUTION

3.1 OWNER'S RESPONSIBILITIES

- A. Submittals: Arrange for and deliver necessary shop drawings, product data and samples to Contractor.

- B. Delivery:
 - 1. General: Arrange and pay for product delivery to site, in accordance with construction schedule.
 - 2. Bill of Materials: Deliver supplier's documentation to Contractor.
 - 3. Inspection: Inspect jointly with Contractor.
 - 4. Claims: Submit for transportation damage and replacement of otherwise damaged, defective, or missing items.
- C. Guarantees: Arrange for manufacturer's warranties, bonds, service, inspections, as required.

3.2 CONTRACTOR'S RESPONSIBILITIES

- A. Submittals: Review shop drawings, product data and samples and submit to Architect with notification of any discrepancies or problems anticipated in use of product.
- B. Delivery:
 - 1. General: Designate delivery date for each product in Progress Schedule.
 - 2. Receiving: Receive and unload products at site. Handle products at site, including uncrating and storage.
 - 3. Inspection: Promptly inspect products jointly with Owner; record shortages, damaged or defective items.
 - 4. Storage: Protect products from damage or exposure to elements.
- C. Installation:
 - 1. General: Assemble, install, connect, adjust and finish products, as stipulated in the respective section of Specifications.
 - 2. Repair and Replacement: Items damaged during handling and installation.

END SECTION 01 64 00

SECTION 01 73 00 EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Description: This Section includes administrative and procedural requirements governing the Contractor's installation of products specified for use in the Project.

1.3 QUALITY ASSURANCE

- A. Qualifications: Use installers specialized in the work required, as specified in the individual sections of the Project Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Product Handling:
 1. Delivery: Schedule delivery of materials to the site at such time as required for proper coordination of the work. Receive materials in manufacturer's unopened packages and bearing manufacturer's label.
 2. Storage: Store materials in a dry, adequately protected from damage and exposure to the elements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Construction Layout:
 1. General: Engage a land surveyor or civil engineer to lay out the work using accepted surveying practices.
 2. Verification: Before beginning to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. Verify that existing improvements are correctly located on drawings. If deviations are observed, promptly notify Architect.
 3. Layout All Work: Lay out location and elevation of all work as shown. Notify Architect of any work whose location or elevations are not clearly dimensioned. Do not scale drawings to establish location.
 4. Templates: Obtain templates, patterns, and setting instructions as required; verify dimensions.
 5. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name

and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

- B. Examination of Conditions: Carefully examine subsurfaces before beginning work; report to Architect any defects. Starting of work constitutes acceptance of conditions as they exist.
- C. Environmental Requirements: Verify that ambient temperature and moisture content are within specified limits and limits of material and equipment manufacturers' instructions.

3.2 INSTALLATION

- A. General: Install products in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Embedded Items: Coordinate delivery and placement of items embedded in work.
- C. Operating Equipment: Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate Work of various contractors having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Mechanical and Electrical:
 - 1. General: Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
 - 2. Pipes, Ducts, Conduit, Fixtures and Outlets: In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. COMPLETION:
 - 1. General: Coordinate completion and clean up of Work of various subcontractors in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy.
 - 2. Correction of Defective Work: After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

END SECTION 01 73 00

SECTION 01 73 29 CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Provide all cutting, fitting and patching, including excavation and backfill as required per SECTION 31 00 00 - EARTHWORK AND TRENCHING, and SECTION 02 41 00 - DEMOLITION; to complete the Work and to accomplish the applicable listed items.
- B. Listed Items:
 - 1. Fitting: Make parts fit together properly.
 - 2. Untimely Work: Uncover portions of the Work to provide for installation of work not installed in the proper sequence of construction.
 - 3. Defective Work: Remove and replace defective and non-conforming work.
 - 4. Samples for Testing: Remove samples of installed work for testing per SECTION 01 45 29 - TESTING LABORATORY SERVICES and as identified in individual sections of the specifications.
 - 5. Mechanical and Electrical Penetrations: Provide penetrations of non-structural surfaces for installation of piping and conduit; refer to DIVISION 22 – PLUMBING, DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) and DIVISION 26 – ELECTRICAL.
 - 6. Existing Construction: Install specified work in existing Construction.

1.3 SUBMITTALS

- A. Cutting and/or Alteration Request:
 - 1. General: Submit written request to the Architect in advance of executing any cutting or alteration affecting any of the following: work process of the Owner or any separate contractor; structural value or integrity of any element of the Project; integrity or effectiveness of weather-exposed or moisture-resistant elements or systems; efficiency, life, maintenance or safety of operational elements; visual qualities of sight-exposed elements.
 - 2. Request Requirements: Project name and location; description of all affected work; explanation of necessity for cutting, alteration or excavation; impact on the work of the Owner or any separate contractor, or on the structural or weatherproof integrity of the building; description of proposed work, including scope of cutting, patching, alteration, or excavation, products proposed to be used, trades who will complete the work, and extent of refinishing to be done; alternatives to cutting and patching; cost proposal, when applicable; written permission from any separate contractor whose work will be affected.
 - 3. Product Substitutions: Should conditions of Work or schedule indicate change of products from original installation, submit request for substitution as specified in SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 - 4. Field Observation: Submit written notice to Architect designating date and time work will be uncovered.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements of individual sections of these Specifications for replacement of Work removed and type of work to be done.

PART 3 - EXECUTION

3.1 INSPECTION

- A. General: Inspect existing conditions; include elements subject to damage or movement during cutting and patching.
- B. After Uncovering Work: Inspect conditions affecting the installation of products, or performance of Work.
- C. Unsatisfactory Conditions: Report unsatisfactory or questionable conditions to the Architect in writing; do not proceed with work until Architect has provided further instructions.

3.2 PREPARATION

- A. Temporary Support: Provide as necessary to assure structural value or integrity of affected portion of Work.
- B. Protection:
 - 1. General: Provide devices and methods to protect other portions of the Project from damage.
 - 2. Environmental Protection: Provide protection from the elements for that portion of the Project which may be exposed by cutting and patching, and maintain excavations free from water.

3.3 PERFORMANCE

- A. Excavation and Backfill: Execute excavating and backfilling by methods which will prevent settlement or damage to other work per SECTION 31 00 00 - EARTHWORK AND TRENCHING.
- B. Surface Preparation: Provide proper surfaces to receive installation of repairs.
- C. Patching: Perform work with workers skilled in the trades involved. Make patches, seams and joints durable and inconspicuous.
- D. Adjustment: Execute fitting and adjustment of products to provide a finished installation complying with specified products, functions, tolerances and finishes.
- E. Fitting: Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- F. Restoration: Restore work which has been cut or removed; install new products to provide completed Work as shown and specified.
- G. Refinishing: Refinish entire surfaces as necessary to provide even finish to match adjacent finishes; refinish continuous surfaces to nearest intersection; entire unit of any assembly.

END SECTION 01 73 29

SECTION 01 77 00 CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Perform operations necessary for and incidental to closing out the Contract and assisting in obtaining Project acceptance by the Owner.

1.3 FINAL CLEANING

- A. General: Remove marks, stains, fingerprints, dust, dirt, and paint drippings resulting from work of this Project. Wash tile, plumbing and other fixtures clean; polish hardware and other unpainted metals. Remove temporary labels, tags and paper covering.
- B. Finish Surfaces: Perform specified cleaning, polishing, sealing, waxing, and other finish operations required for acceptance of work by the Owner.
- C. Glass: Employ professional window cleaners to clean glass, mirrors and plastic surfaces of putty, paint materials, stains and dirt, as specified. Leave work bright, clean and polished.

1.4 CLOSEOUT SCHEDULE AND PROCEDURE

- A. Requirements Prior to Inspection For Substantial Completion: Work required to be completed prior to inspection for substantial completion include but are not limited to the following:
 - 1. All products and materials shown and/or specified shall be installed and finished.
 - 2. All equipment and systems shall be installed and operational as shown and specified.
 - 3. All testing shall be completed, include balancing of HVAC system and testing of fire alarm system. Provide all required test reports.
 - 4. Instruction of Owner in use and operation of equipment and systems as specified.
 - 5. Thorough site and building cleaning as specified.
- B. Requirements Prior to Final Completion and Final Payment:
 - 1. Temporary Facilities: Remove from site per SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
 - 2. Adjustments:
 - a. General: As required in the various technical sections of this Project Manual.
 - b. Plumbing and Mechanical Equipment: Assure that equipment operates quietly and free from vibration. Properly adjust, repair, balance, or replace equipment producing objectionable noise or vibration in occupied areas of building; provide additional brackets, bracing, etc., to prevent such objectionable noise or vibration.
 - c. Systems: Assure that all operate without humming, surging, or rapid cycling.

3. Extra Stock: Deliver 1% or a minimum of 1 full container of each kind and type of interior or unit finish material installed, unless otherwise specified. Package materials with protective covering and identify with labels describing contents.
4. Affidavits: Submit affidavits of release of stop notices or liens, payment of debts and claims and all applicable taxes.
5. Submittals: Collect closeout submittals and deliver with itemized list of submittals. Provide all items listed under PART 2 – PRODUCTS of this section.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. General: Refer to GENERAL CONDITIONS, Paragraph 3.11.1. Record drawings shall be kept up-to-date at all times Drawings:
 1. General: Designate sets of prints at job site for record drawing documentation.
 2. Progress: At time of installation, record installed locations of underground, drainage, plumbing and electrical work, including storm drain grate and invert elevations on prints, and review with Inspector.
 3. Documentation:
 - a. General: Transfer installed locations to reproducible, scan and provide electronic file to Owner and Architect.
 - b. Identification of Changes: Information entered on reproducible prints shall be neat, legible and emphasized by drawing "clouds" around changed items.
 - c. Dimensions: Locate work, including stubs for future connections, with reference to permanent landmarks or buildings and indicate depth below finish grade.
 - d. Symbols and Designations: Use same as shown on Contract Drawings.
- B. Certification: Completed Record Drawings shall be signed by Contractor as complete and accurate records of the Project, as built prior to scanning and providing electronic file to owner and Architect.

2.2 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. General: Incorporate in Maintenance/Operating Manual(s), as specified below, brochures, manufacturer's catalogs and written instructions for equipment and materials needing regular care or maintenance; i.e., carpets, resilient flooring, architectural finishes, mechanical and electrical equipment, etc. Provide 2 complete copy of each manual required.
- B. Manual:
 1. General: Prepare manuals using durable plastic loose leaf binders approximately 8-1/2 x 11 inches in size with following minimum data:
 - a. Identification: On, or readable through, a front cover stating general nature of manual.
 - b. Index: Neatly typewritten at front of manual; clearly identify location of emergency data.
 - c. Operation and Maintenance Data: Complete instructions for products and equipment required.

- d. Repair/Replacement Parts: Provide name and address of nearest vendor for replacement of parts or repair services.
 - e. Additional Data: Where contents of manuals include manufacturer's catalog pages, clearly indicate precise items included in this installation and delete, or otherwise clearly indicate, manufacturer's data which is not in this installation.
- C. Operating Instructions: Mount and post instructions for equipment, as required.
 - D. Service and Maintenance Contracts: As specified, executed by each subcontractor, manufacturer, and supplier as applicable.

2.3 GUARANTEES

- A. General: Provide in conformance with the requirements of DIVISION 1 – GENERAL REQUIREMENTS and as required in the individual sections of this Project Manual. Submit: **Reports and Affidavits required by the Authority Having Jurisdiction.**
- B. Guarantee Period: Duration of the guarantees shall be as stated in the individual sections of this Project Manual. Guarantee periods shall commence on the official date of acceptance by the Owner of the Project.
- C. Submittal: Submit required Guarantees on copies of Guarantee Form and deliver in a complete package to the Architect. Required Guarantee Forms must be reviewed and accepted by the Architect prior to final acceptance by Owner.

2.4 BUILDING MATERIAL COMPLIANCE

- A. Certification: Certify that no materials containing asbestos have been installed in the Work, and that materials used in construction operations and installed in the Work comply with the volatile organic compound (VOC) requirements of the environmental protection agency having jurisdiction at the project site.

PART 3 - EXECUTION

3.1 PROJECT ACCEPTANCE

- A. Substantial Completion:
 1. Scheduling Inspection: Complete “requirements prior to inspection for substantial completion” listed in PART 1 and any item of work identified in project progress meetings as requiring completion prior to substantial completion Attach punch list of any known items of work remaining to be completed or corrected.
 2. Inspection: Architect accompanied by Owner, and engineering consultants as appropriate, will inspect work to determine if project is substantially complete in accordance with DIVISION 1 – GENERAL REQUIREMENTS. If project is determined to be substantially complete Architect upon Owner’s approval will prepare Certificate of Substantial completion and attach a punch list of work to be corrected or completed prior to final inspection. If project is determined not to be substantially complete, Architect will notify contractor in writing. Additional inspections at contractor’s expense may be required. If contractor desires a detailed list of work remaining to be completed or corrected prior to substantial completion, the Owner may hire the Architect to prepare such a list and deduct the cost of the service from the amount owed to the Contractor.

B. Final Completion:

1. Scheduling Inspection: Complete “requirements prior to final completion and final payment” listed in PART 1 and every item of work identified on the punch list. submit request for final payment and written request for inspection for final completion, stating that all punch list items have been performed.
2. Inspection: Architect accompanied by Owner, and engineering consultants as appropriate, will inspect work to determine if project is complete. If project is determined to be complete Architect upon Owner’s approval will begin processing of the final certificate of payment and owner will file the Notice of Completion. If project is determined not to be complete, owner may exercise, at owner’s sole discretion, any provisions of the GENERAL CONDITIONS, including the following 2 options: Owner may require contractor to complete the work and deduct from the contract amount any costs incurred by the Owner related to failure of the contractor to complete the work as previously scheduled; or Owner may take possession of the work in its incomplete state and deduct from the contract amount the estimated cost of having the work completed by a different contractor.

END SECTION 01 77 00

END DIVISION 1 – GENERAL REQUIREMENTS

DIVISION 2 – EXISTING CONDITIONS

SECTION 02 41 00 DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes demolition and related work as shown and specified.
- B. Retained Items: Carefully remove items to remain property of Owner and be reinstalled in the work.

1.3 SUBMITTALS

- A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.
- B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.
- C. Project Record Documents:
 - 1. General: Submit under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.
 - 2. Capped Utilities and Subsurface Obstructions: Accurately record actual locations.

1.4 QUALITY ASSURANCE

- A. Refer to standards listed in SECTION 01 42 00 - References.

1.5 PROJECT CONDITIONS

- A. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

PART 2 - PRODUCTS

NOT USED AT THIS TIME.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Report existence of hazardous materials or unsafe structural conditions.
- C. Verify that utilities have been disconnected and capped before starting demolition operations.

3.2 PREPARATION

- A. Scheduling:
 - 1. General: Coordinate and schedule demolition work as required by the Owner and as necessary to facilitate construction progress.
- B. Existing Utilities:
 - 1. Coordinate shutting off, disconnection and capping of existing gas, water, sewer, electrical, telephone, cable and security system utilities; verify work is complete before starting demolition work affecting these utilities. Refer to DIVISION 22 – PLUMBING for disconnecting, removing and capping existing gas, water, and sewer utilities.
 - 2. Refer to DIVISION 26 – ELECTRICAL for disconnecting, removing, and capping existing electrical utilities. Owner will make arrangements with telephone company concerning their equipment and lines.
- C. Hazardous Materials:
 - 1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
 - 2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact the Owner. Do not proceed with demolition until directed by Owner.

3.3 PROTECTION

- A. Site: Protect existing adjacent installations not scheduled for demolition from damage. Take measures to prevent damage to existing turf, trees, streets, curbs, walks, piping, sewers, etc., during demolition and construction.
- B. Safety Precautions: Prevent damage to existing elements identified to remain or to be salvaged, and prevent injury to the public and workmen engaged on site. Demolish roofs, walls and other building elements in such manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate on site. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends.
- C. Dust: Contain and control dust produced by operations as required by jurisdictional agencies.
- D. Selective Demolition:
 - 1. General: Prevent movement of structure; provide required bracing and shoring.
 - 2. Watertight Barriers: Provide and maintain as required to prevent water intrusion and damage.
 - 3. Temporary Partitions: Erect and maintain to prevent spread of dust, odors and noise to permit continued Owner occupancy.
 - 4. Egress: Do not close or obstruct route or required width to exits.

3.4 DEMOLITION

- A. General: Perform demolition as shown and remove from the site. Use methods required to complete Work within limitations of governing regulations.
- B. Explosives: Use not permitted.
- C. Utilities: Disconnect, remove, cap and identify designated utilities within demolition areas
- D. Selective Demolition:
 - 1. General: Protect existing supporting structural members and materials.
 - 2. Cutting And Removal: Remove existing work as shown; cut in neat straight lines, parallel to adjacent elements or plumb to vertical surfaces; grind smooth saw cut edges of concrete slabs or walks. Neatly remove existing finish materials back to clean straight line on nearest support to facilitate installation of new materials, patches or repairs. Use methods that prevent damage to other work, and provide proper surfaces for installation of repairs and new work. Upon completion of work, leave areas in clean condition. Saw cut wall panels to minimize over-cuts.
 - 3. Roof Demolition: Refer to SECTION 07 51 00 - COATED TPO ROOFING.
- E. Construction Waste Management and Disposal:
 - 1. Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.
 - 2. Burning and Burying of Materials: NOT ALLOWED.
 - 3. Haul Routes:
 - a. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance; post flagmen for the safety of the public and workmen.
 - b. Keep streets free of mud, rubbish, etc.; assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.

END SECTION 02 41 00

END DIVISION 2 – EXISTING CONDITIONS

DIVISION 3 – CONCRETE

SECTION 03 30 00 CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes concrete, formwork, reinforcement, and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's data, installation instructions and evidence of compliance with requirements of this section for the following:
 - 1. Cement: Submit certification from cement manufacturer that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C150 for Portland cement and ASTM C595 for blended hydraulic cement, whichever is applicable.
 - 2. Reinforcement: Submit mill test and chemical analysis certificates for all reinforcing steel delivered to the site.
- B. Shop Drawings: Reinforcement shop drawings in accordance with ACI 315. Show all fabrication and installation details and dimensions, including embedded items.
- C. Mix Designs: Include record of test data per CBC 1905A.3. Identify mixes by design strength, intended use, and placement restrictions, such as “pump mix” or “hot weather mix”.
- D. Materials List: Within 35 days after award of Contract, and before any concrete is delivered to the jobsite, submit to Architect a complete list of all materials proposed to be used in this portion of the work, showing manufacturer’s name and catalog number of all items such as admixture, membrane, concrete mix design and the name and address of supplier of transit-mix concrete.
- E. Placement Records: Keep on job site until completion, and open to inspection, record showing time and date of placing concrete in each portion of structure together with transit-mix delivery slip certifying contents of each placement. Delivery placement record and delivery slips to the architect upon completion of the work.
- F. Closeout Submittals: Provide completed Guarantee form.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this

specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.

B. Reference Standards:

1. American Society of Testing Materials (ASTM): Materials and testing standards as identified throughout this Section.
2. American Concrete Institute (ACI):
 - a. ACI 301: Specifications for Structural Concrete for Buildings.
 - b. ACI 302.1R: Guide for Floor and Slab Construction.
 - c. ACI 304R: Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - d. ACI 305R: Hot Weather Concreting.
 - e. ACI 306R: Cold Weather Concreting.
 - f. ACI 308: Standard Practice for Curing Concrete.
 - g. ACI 315: Details and Detailing of Concrete Reinforcement
 - h. ACI 318: Building Code Requirements for Reinforced Concrete.
 - i. ACI 347R: Recommended Practice for Concrete Formwork.
 - j. ACI SP-66: Detailing Manual.
3. American Welding Society (AWS): AWS D1.4 - Structural Welding Code - Reinforcing Steel.
4. California Building Code (CBC) 2010, Chapter 19A, for concrete requirements.
5. Concrete Reinforcing Steel Institute (CRSI): Manual of Standard Practice.
6. National Ready Mixed Concrete Association (NRMCA): Check List for Certification of Ready Mix Concrete Production Facilities.

C. Testing: Refer to SECTION 01 45 29 - TESTING LABORATORY SERVICES.

1.5 GUARANTEE

- A. Provide in required form for a period of **1 year** from date of acceptance by Owner.

1.6 DELIVERY

- A. Deliver undamaged products to job in manufacturer's sealed containers and original bundles with tags and labels intact.

PART 2 - PRODUCTS

2.1 FORMWORK

- A. Forms:
 1. Lumber: Construction grade Douglas Fir. Hand select at exposed finishes to produce smooth, true surfaces.

2. Plywood: APA B-B Plyform, Class 1 or better, mill oiled and edge sealed; thickness as required to achieve true plane surfaces with forming system used, minimum 5/8 inch thickness.
- B. Fasteners: As required; of sufficient strength and character to maintain formwork in place while placing concrete.
- C. Form Release Agent: Colorless mineral oil which will not stain the concrete or impair natural bonding characteristics of coating intended for use on concrete.

2.2 VAPOR BARRIER

- A. General: 10 mil polyethylene sheeting. Provide and install only if existing barrier found during excavation. Install to match existing and tie into existing to form a vapor tight seal.
- B. Joint Tape: As recommended by manufacturer.

2.3 REINFORCEMENT

- A. Reinforcement Bars: ASTM A615, deformed; Grade 60 unless noted otherwise. ASTM A706 for all bars to be welded and where shown.
- B. Reinforcing Supports:
1. General: Metal chairs, bolsters, bar supports, or spacers, sized and shaped for strength and support during concrete placement.
 2. Footings: Bottom bars supported with concrete blocks.
- C. Tie Wire: 16 gage annealed type.

2.4 ANCHOR BOLTS

- A. ASTM A307; rolled body bolts with upset threads not permitted.

2.5 TIE WIRE

- A. 16 gage annealed type.

2.6 CONCRETE

- A. Cement: Portland cement; ASTM C150, Type I or II, per ACI 318 Section 3.2
- B. Aggregates:
1. General: ASTM C33, except as modified by this Section and per CBC Section 1903A.3.
 2. Lightweight: ASTM C330.
- C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials; CBC Section 1903A.4.
- D. Admixtures:
1. Water Reducing and Retarding Admixture: ASTM C494, type D.
 2. Water Reducing Admixture (cool weather): ASTM C494, type A.
 3. Mid-range Water Reducing Admixture: Master Builders "Polyheed" or approved equal.
 4. Air Entrainment Admixture: ASTM C260.
 5. Fly Ash: ASTM C618, Class N or F. Class C not permitted.

6. Vapor Control Admixture: Moxie 1800 Super-Admix by Moxie International, no known equal. Confirm final specification with finish flooring manufacturer's requirements and acceptability and compatibility with the finish flooring product installation requirements.

2.7 WATER VAPOR EMISSION CONTROL: REFER TO SECTION 09 61 00 - VAPOR CONTROL FOR FLOORING

2.8 MEMBRANE CURING COMPOUND

- A. Per ASTM C309, compatible with specified finishes and proposed adhesives. Use only products in compliance with VOC content limits required by state and local regulations and compatible with vapor control system.
- B. If vapor emission control product is intended to provide concrete curing membrane, use curing compound specified above only on concrete that will not receive vapor emission control. Refer to SECTION 09 61 00 - VAPOR CONTROL FOR FLOORING.

2.9 BONDING AGENT FOR PATCHING

- A. Acceptable Products: Acryl 60, as manufactured by Master Builders Technologies, Inc.

2.10 NON-SHRINK GROUT

- A. Per ASTM C-1107, consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.

2.11 EXPANSION JOINT MATERIALS

- A. Expansion Joint in Concrete (EJ-C): ASTM D 1751, preformed; ½ inch thick, unless otherwise shown.
- B. Removable Expansion Joint Cap:
 1. Acceptable Products:
 - a. Sandell's Removable Expansion Joint Cap, as manufactured by Sandell Construction Solutions.
 - b. Snap-Cap, as manufactured by W. R. Meadows, Inc.
 - c. Model No. EXPJ-006, as manufactured by Right/Pointe Company.
 2. Alternate Products: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 3. Use at expansion joints in pavement and other horizontal surfaces.
 4. Size: 1/2 inch wide, 1 inch deep.

2.12 SEALANT FOR JOINTS AND CRACKS

- A. Acceptable Products: Sikaflex-2c NS, as manufactured by Sika Corp; two component polyurethane, or per vapor control manufacturer's recommendation.

2.13 DESIGN AND MIXING

- A. Mix Designs:
 1. Mix designs shall be prepared at contractor's expense by a registered civil engineer experienced in concrete mix design in accordance with CBC Section Chapter 19A. Identify mixes by design strength, intended use, and placement restrictions, such as "pump mix" or "hot weather mix".

2. Concrete at Buildings: Design strength, aggregate size and water/cement ratio as shown on structural drawings.
3. Concrete slabs which will receive adhered finish flooring shall have a maximum water cement ratio of 0.45.
4. Site Concrete (concrete not shown on structural drawings): 3000 psi at 28 days; 1 inch maximum aggregate size; 0.50 maximum water to cement ratio. Exposed concrete to have 6% air entrainment.
5. Slump:
 - a. Footings and Retaining Walls: 3 inches plus or minus 1 inch.
 - b. Flatwork: 3 inches plus or minus 1 inch. Exception: mixes using mid-range water reducing admixture shall have a 2 inch maximum slump before dosing and 6 inches maximum slump after dosing.
6. Water Reducing Admixture: Water reducing and retarding admixture (type D) is required for all concrete to be placed on days when the daily high temperature is expected to exceed 80 degrees Fahrenheit. Water reducing admixture (type A) may be substituted in mixes to be placed on cooler days.
7. Water Vapor Emission Control Admixture or Topping: As required for in floor slabs on grade. Refer to SECTION 09 61 00 - VAPOR CONTROL FOR FLOORING.

B. Mixing of Concrete:

1. General: Concrete shall be transit mixed per CBC Chapter 19A and ASTM C94. Mix until there is uniform distribution of material and mass is uniform and homogeneous; mixer must be discharged completely before the mixer is recharged.
2. Ready-Mix Concrete: Mix and deliver in accordance with the requirements set forth in CBC Section 1905A.8. Batch Plant Inspection may be waived in accordance with CBC Section 1704A.4.4 when approved by Structural Engineer El Dorado County Building Department.
 - a. Approved inspector of the testing laboratory shall check the first batching at the start of the work and furnish mix proportions to the licensed Weighmaster.
 - b. Licensed Weighmaster to positively identify materials as to quantity and to certify to each load by ticket.
 - c. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Inspector will not accept load without load ticket identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit 2 copies of record to authority having jurisdiction.
 - d. A minimum of 1 set of 2 cylinders shall be taken and tested for each 50 cubic yards of concrete or fraction thereof.
3. Admixtures: Verify compatibility of concrete admixtures when multiple admixtures are used in a specific mix. Proportion and mix in accordance with manufacturers written instructions.
4. Job Mixed Concrete:
 - a. General: Not allowed without prior approval of Architect. Use batch mixer of approved type, with capacity to handle one or more full sack batches, no split sack batches

permitted. Operate as recommended by manufacturer, mixing at least 1-1/2 minutes after all materials are in drum.

- b. Handling and Mixing of Concrete: Subject to approval of inspector and Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Notify Architect and Structural Engineer at least 48 hours prior to placing of concrete.
- B. Environmental Requirements: Per ACI 305R and ACI 306R.
- C. Take field measurements; report variance between plan and field dimensions.
- D. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness; lumpy or stale cement will be rejected.
- E. Protect finish surfaces adjacent to locations scheduled for placement of concrete. Inspect forming placed against existing work and establish a tight, leak-proof seal before concrete is poured. Replace finish work defaced by concrete placement operations.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Install to allow application of subsequent finish materials within specified tolerances.
- C. Formwork:
 - 1. General:
 - a. Workmanship: Provide formwork required to produce smooth concrete; straight, plumb and true to plane. Concrete out of line, level or plumb will be rejected.
 - b. Material: Provide straight, true and sound form material, able to withstand deformation due to loading and the effects of moist curing. Do not reuse warped or delaminated materials that require patching of contact surfaces.
 - c. Construction: Construct forms to shapes, lines, grades and dimensions indicated; tight to prevent leakage, properly braced and tied together to maintain position and shape. Form bevels, grooves and recesses to neat, straight lines; chamfer corners where indicated. Provide for easy removal without hammering, wedging or prying against concrete.
 - d. Adjustment: Tighten forms, posts and shores during and immediately after concrete placement; readjust as required to maintain grades, levels and camber.
 - e. Exposed Finish: At vertical surfaces exposed to view and other conditions where formed surface will be visible, formwork shall be crafted to produce finished concrete without further work such as sacking or patching. Finish shall be is smooth, true to plane, uniform in appearance, and free irregularities and defects at time of stripping.

Small air pockets less than ¼ inch in diameter will not be considered defective. Vertical Surfaces: Provide formwork required to produce finished concrete that is smooth, true to plane, uniform appearance, and free irregularities and defects at time of stripping. Small air pockets less than ¼" in diameter will not be considered a defect.

2. Embedded Components:
 - a. General: Install straight, level and plumb prior to concrete placement; brace, anchor and support items to prevent displacement or distortion.
 - b. Inserts: Coordinate work of other Sections in setting bolts, anchors, and other components, as required.
 - c. Formed Openings: Provide slots, recesses, chases and sleeves where required for work to be imbedded in or pass through concrete.
 3. Anchor Bolts: Install as shown.
 4. Form Coating:
 - a. General: Before placement of reinforcing steel, coat exposed face of forms to prevent moisture absorption from concrete and facilitate removal of forms; seal all cut edges.
 - b. Re-use: Thoroughly clean and recoat form material acceptable for re-use.
- D. Reinforcement:
1. Fabrication: Do not bend or straighten reinforcement in manner that will injure material. Bars with kinks or bends not shown, and heating of bars for bending is not permitted.
 2. Placement:
 - a. Reinforcement shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with CBC Section 1907A.7.
 - b. Provide minimum center to center distance between parallel bars 2-1/2 times diameter, 1-1/2 inches or 2-1/2 times maximum size coarse aggregate. Wire bar lap together; splice reinforcing steel with lap of 69 diameters, unless otherwise shown.
 3. Welding:
 - a. All welding shall be observed by an AWS certified welding inspector, approved for this purpose by El Dorado County Building Department.
 - b. Welding of reinforcing bars shall be performed only where indicated on plans and in compliance with AWS D1.4 and CBC Section 1903A.4.
- E. Expansion Joints:
- a. Location: As shown. If not shown at exterior locations, place at 24 feet on center.
 - b. Flush Sealant: Unless noted otherwise, hold expansion joint material 1 inch back from finish surface. Provide sealant flush with finish surface.
 - c. Depressed Sealant: Where shown as drainage channel, depress expansion joint to provide ½ inch deep recess after sealant is applied.

F. Cast-In-Place Concrete:

1. General: Placement of forms, inserts and reinforcements are subject to approval of Architect. Notify Architect and Structural Engineer at least 48 hours prior to placement of concrete.
2. Cleaning:
 - a. General: Remove dirt, wood chips, sawdust and other debris before concrete pour; use compressed air at inaccessible areas. Remove all water from excavations.
 - b. Reinforcing: Clean reinforcement and other embedded items of substances that might impair bonding, prior to placement of concrete.
 - c. Previously Placed Concrete: Roughen to 1/4 inch amplitude; clean with steel brush prior to applying bonding agent.
3. Vapor Barrier:
 - a. General: Install under interior slabs on grade. Lap joints minimum 6 inches and seal watertight.
 - b. Penetrations: Seal watertight; repair penetrations and damage with vapor barrier material and lapped minimum 6 inches over area and sealed with joint tape.
4. Placing of Concrete:
 - a. General: Maintain records for placement of all concrete. Place concrete in dry conditions; keep excavations free of water, ice, loose soil or debris.
 - b. Weather Requirements: Per ACI 305R (Hot) and ACI 306R (Cold). Hot weather is defined as any period in which temperature exceeds 85 degrees F.
 - c. Transportation: Handle concrete from mixer to place of deposit as rapidly as possible; using methods to prevent separation or loss of ingredients. Deposit in final position; avoid rehandling or flowing. Do not place partially hardened concrete in work. Do not wheel placement containers directly on top of reinforcing steel.
 - d. Placement:
 - i. General: Place concrete continuously between predetermined expansion, control and construction joints. Do not break or interrupt placement of concrete in manner that cause cold joints to occur.
 - ii. Footings: Place footings in one continuous pour.
 - iii. Concrete Slabs: Lay slabs to required lines and grades, in pattern shown. Water subgrade at exterior concrete the night before placement; dampen again immediately before placement; standing water not allowed.
5. Compacting:
 - a. General: Thoroughly work concrete around reinforcement, embedded components and into corners of forms. Consolidate concrete by internal vibration, only. Do not puddle, tamp or vibrate concrete which has already taken initial set or continue long enough cause segregation of material.
 - b. Slabs: Consolidate concrete on grade by spading and puddling and internal vibration.
 - c. Formwork: Consolidate concrete in forms with high speed internal vibrators.

6. Flatness:
 - a. Typical Interior Slabs: True to 1/8 inch in 10 feet when measured with a 10 foot straight edge. Slabs to receive finish flooring may be patched with approved hydraulic cement to required flatness. Polished concrete floors and other exposed concrete floors shall be removed and replaced if they do not meet the flatness requirements per ASTM E1155.
 - b. Exterior Slabs: as required to avoid "bird baths" and meet accessibility maximum slopes; true to maximum 1/8 inch in 10 feet.
7. Concrete Finishes:
 - a. Sacked Formed Finish (SFF): Exposed concrete surface (not including top surface of slabs); immediately after removal of forms from concrete to be left exposed, remove fins and rough spots; damaged and irregular surfaces and holes left by form clamps and sleeves shall be patched with grout; tie wires are to be withdrawn and holes pointed up with neat cement paste. Care shall be taken to approach as nearly as possible texture of exposed adjacent concrete surface. Where not exposed, ends of wire shall be cut off flush. After grouting and pointing, all concrete that is to remain exposed shall be grout cleaned with mixture of 1 part cement and 1 ½ parts fine sand with sufficient water to produce consistency of thick paint. Apply to concrete surfacing with brush after first wetting concrete. Immediately after applying, float surface with wood float, scouring vigorously. Keep damp during this period in hot weather. When set, grout shall be scraped from wall with edge of steel trowel, allowed to dry, then wiped or rubbed with dry burlap. Entire cleaning operation of any area shall be completed on the day started. This treatment shall be carried 4 inches below grade, and all patching and grout cleaning done immediately upon removal of forms.
 - b. Slab Finish:
 - i. General: Uniformly spread, screed and float concrete.
 - ii. Float: Apply at tile setting beds, where shown.
 - iii. Trowel: Apply 2 steel troweling operations at surfaces to receive carpet, resilient materials, thinset tile and where left exposed. Finish interior exposed concrete to achieve burnished surface.
 - iv. Broom (BRF): Apply medium broom finish at exterior exposed surfaces, perpendicular to direction of traffic flow. Apply medium broom finish at slopes less than 5% at the designated path of travel; apply heavy broom finish at slopes greater than 5%.
 - c. Vertical Surfaces:
 - i. Vertical Formed (VF): Vertical surfaces and other formed surfaces permanently exposed to view after stripping shall be smooth, uniform and free of defects without additional finish work after stripping. Minor sacking and repair work will be allowed only if it blends with the adjacent finish and is not visually distinguishable.
 - d. Vertical Troweled (VT): Curbs adjacent to pavement and vertical surfaces requiring troweled finish shall be stripped at the appropriate time and troweled to a burnished

finish to match adjacent or nearest slab finish and shall be true to line with a maximum tolerance of 1/8 in 10 feet.

8. Joints:
 - a. Exterior Joints: Mark off exposed joints, where indicated, with 1/2 inch radius by 1 1/2 inch deep joint tool. Markings to be clean cut, straight and square with respect to border. Tool edges of exposed expansion and control joints, border edges, and wherever concrete adjoins other material or vertical surfaces.
 - b. Interior Joints: Joints in concrete to be left exposed shall be made with a 1/4 inch radius by 1 1/2 inch deep joint tool. Saw cut joints at interior slabs to receive flooring only. Saw cut joints as soon as slab will support foot traffic. Complete all saw cutting as part of finishing operation.
 - c. Horizontal Construction Joints: Keep exposed concrete face of construction joints continuously moist after initial set until placement of concrete; thoroughly clean contact surface by exposing solidly embedded aggregate, or by other method that will assure proper bonding.
9. Curing:
 - a. General: Refer to ACI 308. Protect concrete from premature drying for minimum 5 days following pour.
 - b. Exterior Slabs: Cover and cure with membrane curing compound as soon as slab can take foot traffic, or approved method; upon completion wash clean.
 - c. Interior Slabs: Cure with sealing and curing compound as soon as slab can take foot traffic (after any saw cutting).
 - d. Concrete in Forms: Keep wet until forms are stripped.
10. Removal of Forms: Remove without damage to concrete surfaces.
 - a. Sequence and timing of form removal shall insure complete safety of concrete structure.
 - b. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
 - i. Vertical Forms of Foundations, Walls and All Other Forms Not Covered Below: 7 days.
 - ii. Slab Edge Screens or Forms: 5 days.
 - iii. Concrete Columns and Beams: 14 days.
11. Sealant: Fill all interior slab joints with sealant. Fill all expansion joints with sealant. Fill all cracks in areas to receive adhered flooring with sealant.
12. Defective Concrete:
 - a. General: Remove or cut out defective concrete and repair before concrete is completely cured, as directed by Architect.

- b. Defective concrete is:
 - i. General: Concrete not meeting specified 28-day strength.
 - ii. Finish: Concrete not matching the specified finish.
 - iii. Durability and Appearance: Concrete containing rock pockets, voids, spalls, cracks, exposed reinforcing, or other defects.
 - iv. Construction: Concrete out of line, level, flatness, plumb, or location.
 - v. Deleterious Materials: Concrete containing embedded wood or other debris.
 - vi. Unsatisfactory Patching: Concrete that was not patched under Architect's direction or patching that does not meet the specification for new concrete.
 - vii. Embedded Items: Concrete not containing required embedded items.
- c. Patching:
 - i. General: Repair minor defective work with approved patching material.
 - ii. Patching of serious defects affecting the strength or appearance of the concrete are unsatisfactory, will not be accepted and shall be completely removed and replaced.
 - iii. Preparation: Chip out minor defective areas to a minimum depth of 1 inch, with edges perpendicular to surface. Wet area at least 6 inches around surface to be patched to prevent absorption of water from patching mortar.
 - iv. Repair: Coat with cement wash mix consisting of neat cement and solution of specified bonding agent. Immediately apply patching mortar consisting of 1 part cement to 3 parts fine aggregate mixed with solution with minimum water required for placement.
 - v. Finishing: Match adjoining surfaces; provide protective covering; keep wet for at least 7 days.
 - vi. Structural Repairs: Any repairs to concrete involving structural strength or integrity are subject to the approval of the Architect and El Dorado Building Department.

3.4 FIELD QUALITY CONTROL

- A. General: Per CBC, Section 1704A.4; agency selected and paid for by Owner.
- B. Field Testing:
 - 1. General: The following testing will be performed by the Owner's testing lab in accordance with ASTM procedures. Test cylinders are to be provided by the contractor.
 - 2. Cylinders: Make, cure, and store 1 set of 3 cylinders, for each 50 cubic yards (or not less than once for each 2,000 square feet of surface area for slabs or walls) of each concrete mix being placed not less than once per day per ASTM C31. Test cylinders per ASTM C39. Test first cylinder at the age of 7 days and the other at 28 days; cylinder for 28-day test will not be broken if cylinder for 7-day test meets 28-day strength. Hold third cylinder for 56 day test, if required. Additional samples for 7-day compressive strength tests shall be taken for each

class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

3. Slump: Perform one slump test, per ASTM C143, for each 15 cubic yards of concrete placed and for each cylinder taken.
 4. Reinforcement: Make 1 tensile test and 1 bend test of specimen taken from each 10 tons of steel delivered to the site.
- C. Retesting: Cost of retests or coring because of low strength, or defective concrete will be paid for by Owner and deducted from the contract cost. Concrete that does not meet flatness and levelness criteria shall be removed and replaced.

3.5 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.

END SECTION 03 30 00

END DIVISION 3 – CONCRETE

DIVISION 4 – MASONRY

NOT USED AT THIS TIME

DIVISION 5 – METALS

SECTION 05 31 00 STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division Specification Sections, apply to this Section.

1.2 SCOPE OF WORK

- A. Description: Provide Metal Deck, complete, as shown and specified per Contract Documents.
- B. Related Work Specified Elsewhere:
 - 1. SECTION 05 50 00 - METAL FABRICATIONS.
 - 2. SECTION 06 10 00 - ROUGH CARPENTRY.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. General: All welding shall be in compliance with and applicable provisions of CBC Chapter 22A.
 - 2. Welders: Qualified for each light gauge welding process to be used in fabrication.
- B. Testing:
 - 1. General: Refer to SECTION 01 45 29 - TESTING LABORATORY SERVICES.
 - 2. Retesting: Laboratory selected and paid for by the Owner and backcharged to the Contractor.
- C. Reference Standards:
 - 1. American Society of Testing Materials (ASTM) Standards as Referenced in the 2006 IBC: Material and testing standards as identified throughout this Section.
 - 2. American Iron and Steel Institute (AISI): North American Specification for the Design of Cold-formed Steel Structural Members (NAS-01), including 2004 Supplement.
 - 3. American Welding Society (AWS): Structural Welding Code – Sheet Steel; AWS D1.3-98.
 - 4. Steel Deck Institute (SDI): Design Manual for Composite Decks, Form Decks, and Roof Decks, Publication No. 30.
 - 5. 2007 California Building Code (CBC): Chapter 22A.

1.4 SUBMITTALS

- A. General: Refer to SECTION 01 33 00 – PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- B. Shop drawings:
 - 1. General: Provide shop and location drawings. Show gages and types, locations and dimensions of openings, location of welds, reinforcing, metal flashings and closure angles, and other

pertinent data. Clearly mark or code units and location drawings in manner to permit ease of identification during erection and efficient sequence of erection.

- C. Samples: If specifically requested.
- D. Product Data: Submit manufacturer's specification, data, and installation instructions for review prior to fabrication of work.
- E. Test Reports: Refer to SECTION 01 45 29 - TESTING LABORATORY SERVICES.

1.5 PRODUCT HANDLING

- A. General: Refer to SECTION 01 60 00 - PRODUCT REQUIREMENTS.
- B. Storage: Store all materials in a dry and well ventilated place adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Sheet: ASTM A553 with galvanized coating ($F_y = 40$ ksi min.). Deck is being used as diaphragm to resist lateral loads and materials will not be approved as equals unless suitable test data has been established.
- B. Deck: As manufactured by ASC Steel Deck, Verco Manufacturing, or accepted equal. Deck designations used on Drawings refer to Verco Manufacturing steel deck designations; other decks offered under provisions of this specification shall conform to general configuration and dimensions and shall have geometrical properties equaling or exceeding those shown.
- C. Primer: Zinc dust - zinc oxide primer.

2.2 FABRICATION

- A. General: Fabricate units in single lengths for at least 3 spans where practicable.
- B. Metal Closures: Fabricate from same gauge steel sheet as deck; manufacturer's standard profiles or as required.

PART 3 - EXECUTION

3.1 EXAMINATION OF CONDITIONS

- A. Substrate Conditions: Examine substrate and report any defects to Architect. Start of work is acceptance of conditions as they exist.
- B. Job Measurements: The Contractor shall take field measurements for this work and be responsible for same. Report any discrepancy between plan and field dimensions to the Architect.

3.2 INSTALLATION

- A. General: Place and adjust units into final position prior to permanent fastening. Bring each unit to proper bearing on supporting structure with 2" minimum bearing. Place units in straight alignment for entire length of cell runs, close alignment of adjoining units, and with minimum space between ends of abutting units. Defective or damaged units are not permitted.
- B. Attachments: All welding shall be by qualified welders; use materials and methods recommended by decking manufacturer and AWS; comply with CBC.

1. General: $\frac{3}{4}$ " diameter puddle welds at each flute over supporting structure, unless otherwise shown. Where parallel to supporting structure use $\frac{3}{4}$ " diameter puddle welds at 12"oc.
 2. Side Joint: Weld side joints at 12"oc; crimp male-female side joint prior to welding.
- C. Welded Studs:
1. General: Welded to top flanges of beams through deck.
- D. Angle Closures: Secure into position by welding at not over 18"oc, unless otherwise shown. Provide angle closures at perimeter of building, openings, and where otherwise required to make decking complete.
- E. Patching, Drilling, Cutting and Reinforcing: When required on site by other trades; by Contractor and cost borne by respective trades.
- F. Clean-Up: After erection, remove metal cuttings and construction debris. Leave decking in a condition acceptable to other trades.

3.3 FIELD QUALITY CONTROL

- A. Field Testing: See drawings.
- B. Retesting: Make necessary corrections to work that is not in conformance with specified requirements. Retests paid by Owner and backcharged to Contractor.

END SECTION 05 31 00

SECTION 05 41 00 STRUCTURAL METAL STUD FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes metal stud system and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.
- B. Samples: If specifically requested for specified products; required for alternate products.
- C. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
- D. Closeout Submittals: Provide completed Guarantee form.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.
- B. Reference Standards:
 - 1. American National Standards Institute (ANSI): Standard No. A97.2.
 - 2. Factory Mutual Research Corporation (FM): Fire resistance standards.
 - 3. Steel Stud Manufacturers Association (SSMA): Product Technical Information.
 - 4. Underwriters Laboratories, Inc. (UL): Fire resistance standards.

1.5 GUARANTEE

- A. Provide in required form for a period of 1 year from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 METAL STUD SYSTEM (MET)

- A. Acceptable Manufacturers:
 - 1. Unimast, Inc.
 - 2. Gold Bond Building Products, Division of the National Gypsum Corp.
 - 3. Or equivalent.
- B. Stud Types:
 - 1. General: Provide types designed for screw application of gypsum wallboard.

2. Metal Studs: ASTM C645, non-load bearing type with punched webs; roll-formed electro-galvanized steel sheet; 20 gage, unless otherwise shown.
 3. Top Track: Flex-type track for movement.
- C. Channels:
1. Furring: 25 gage electro-galvanized steel sheet, roll-formed, 2-3/4 inch x 7/8 inch deep with 1/2 inch wide flanges.
 2. Runners: 1/2 inch cold rolled steel weighing not less than 475 lbs. per 1000 lineal feet; rust-inhibitive coated.
 3. Stiffeners: 3/4 inch cold rolled steel weighing not less than 300 lbs. per 1000 lineal feet; rust-inhibitive coated.
 4. Prepunched Top Track:
 - a. General: "Eliminator Track" as manufactured by COC Drywall Systems Division of COC Industries, Inc.; size as shown.
 - b. Alternate Manufacturers: Comparable products manufactured by USG Interiors. Proposed equals are subject to substitution process per SECTION 01 33 00 – PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- D. Fasteners:
1. Expansion Bolts: FS FF-S-325, Group III, expansion shield (self-drilling tubular expansion shell anchor bolts); Type 1 or 2, unless otherwise shown.
 2. Powder Driven Fasteners:
 - a. General: Shot pins type DS 42 P10, as manufactured by Hilti, Inc.; 0.177 diameter, embed fastener 1 7/16".
 - b. Alternate Manufacturers: Comparable products with current ICC-ES approval and equal or greater rated load capacity, manufactured by the ITW Ramset/Red Head. Proposed equals are subject to substitution process per SECTION 01 33 00 – PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 3. Screws: Type S bugle head; sizes recommended by gypsum board manufacturer.
- E. Wire Hangers: 8 gage galvanized soft steel wire.
- F. Neoprene Tape: ASTM D1056, Grade SCE41, soft sponge neoprene with adhesive one side; black; 1/4 inch x 1/2 inch, unless otherwise shown.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.

3.2 PREPARATION

- A. Take field measurements; report variance between plan and field dimensions.
- B. Environmental Requirements: Where partitions and sprayed fireproofing are scheduled in same area, install clips for attachment of metal framing before application of sprayed-on fireproofing.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Metal Framing:
 - 1. General: ANSI A97.2.
 - 2. Structural Studs: MLSFA.
- C. Assemblies:
 - 1. Fire Rated: Per UL and code requirements. Use one manufacturer for each assembly, unless otherwise permitted by governing authorities.
 - 2. Sound Controlled: Use one manufacturer for each assembly, unless otherwise permitted by manufacturer.
- D. Metal Stud Partitions:
 - 1. General: Install complete with matching runner tracks and accessories. Align runner tracks accurately to partition layouts.
 - 2. Floor Runners: Secure with 1/4 inch diameter expansion bolts or powder driven fasteners at least 1 inch long, where permitted by code. Space fasteners 4 inches from ends of each piece; maximum 24 inches on center intermediately; minimum of 2 fasteners per piece of runner.
 - 3. Ceiling Runners:
 - a. To Concrete: Fasten as specified for floor runners.
 - b. To Wood Framing: Fasten with screw anchors directly to joists, purlins, blocking.
 - c. To Structural Steel: As specified for metal decking; secure with welds or other appropriate means in lieu of powder driven fasteners.
 - 4. Studs: Gages, depths, and spacing shown
 - 5. Chase Wall Partitions: Cross brace at quarter points with 5/8 inch thick gypsum wallboard; braces 12 inches by width of partition. Fasten to studs with 3 fasteners per edge.
- E. Furred Partitions:
 - 1. General: Install furring channels at 24 inches on center; level and plumb with steel shims.
 - 2. To Concrete: Fasten with powder driven fasteners at 24 inches on center.
 - 3. To Concrete Block: As specified for concrete.
 - 4. To Structural Steel: As specified for metal stud partitions.
- F. Backing Plates: Install for built-in items; attach to metal studs by welds or sheet metal screws as applicable.
- G. Hard Lid Gypsum Board Ceilings: Metal joists per plans
 - 1. Openings: Reinforce as required for support of mechanical and electrical fixtures.

3.4 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.

END SECTION 05 41 00

SECTION 05 50 00 METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes metal fabrications and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and data for review.
- B. Shop Drawings: Submit manufacture installation details, including fastenings, for review.
- C. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
- D. Closeout Submittals: Provide completed Guarantee form.

1.4 QUALITY ASSURANCE

- A. Welding: Performed by certified welders per AWS and CBC.
- B. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.

1.5 GUARANTEE

- A. Provide in required form for a period of 2 year from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Steel Pipe: ASTM A 53, Type E or S, Grade B.
- C. Steel Tube: Cold-formed per ASTM 500 or hot-formed per ASTM A501

2.2 FASTENERS

- A. General: Hexagon head bolts, hex nuts, screws, washers, and other fastenings necessary for proper erection of work. Hot dipped galvanized steel fastenings for exterior steel work.
- B. Exposed in Finished Surfaces: Tamperproof countersunk Phillips flat head screws, unless shown otherwise; match adjacent surface finish.

2.3 NON-SHRINK GROUT

- A. Per ASTM C-1107, consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.

- B. Alternate Products: No known equals; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.

2.4 PLASTIC CEMENT

- A. FS SS-C-153, Type 1, bituminous asphalt base.

2.5 PRIMER

- A. General: Fast-curing, lead- and chromate-free, corrosion inhibitive, modified-alkyd primer.
- B. Primer: Certified to pass 200 hours salt spray test per ASTM D2247 and 500 hour humidity test per ASTM B117.
- C. Paint Top Coats: Verify compatibility. Refer to SECTION 09 90 00 - PAINTING AND COATING.

2.6 FINISHES

- A. Galvanizing:
 - 1. General: Hot-dip process per ASTM A123. Minimum 2 ounces coating per square foot (G85).
 - 2. Repair Compound: Zinc-based solder per ASTM A780 (zinc-based alloy rod).
- B. Shop Painting: Per SSPC standards.

2.7 FABRICATION

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible.
- B. General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- C. Miter corners and edges unless otherwise shown. Make members true to length so assembling may be done without fillers. Bends, twists, open joints in finished members, or projecting edges or corners at connections will not be permitted. Miter, cope, and block carefully to produce tight hairline joints. Provide lugs, clips, connections, bolts, and fastenings necessary to complete fabrication.
- D. Exposed Steel: Comply with ASIC Architecturally Exposed Structural Steel fabrication requirements.
- E. Fabricating with Galvanized Material: Fabrications to be painted or concealed may be fabricated from galvanized materials. Treat all welds, cut ends, and any surfaces where galvanizing has been removed or damage with specified repair compound to the specified thickness.
- F. Galvanized Final Finish: Fabrications for galvanized final finish shall be fabricated out of ungalvanized material per ASTM A385 – “Providing High Quality Zinc Coatings” and hot-dip galvanized in one finished piece after fabrication. Fabrications to have galvanized final finish shall not be field welded.
- G. Welding: Use sequence welding to minimize distortion and heat stresses. Weld by shielded electric arc process per AWS. Use continuous welding along entire area of contact, unless detailed otherwise. Grind all welds smooth on exposed surfaces. Spot welding not permitted on exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Take field measurements; report variance between plan and field dimensions.

3.2 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required carefully for installing metal fabrications. Fit work at job before finishing. No burning in field permitted.
- C. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- D. Drill holes for fasteners to exact diameter as recommended by fastener manufacturer. Oversized holes or holes not properly located that produce misalignment of fastener will be rejected.
- E. Fit exposed connections accurately together to form hairline joints. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Replace, or repair parts damaged or injured during erection in an acceptable manner.
- G. Galvanizing: Treat areas damaged during fabrication or erection with specified repair compound to restore zinc coating to a minimum of 2 ounces per square foot.

3.3 ADJUSTING AND CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.
- C. Field Touch-up: Touch-up damaged surfaces and field welds of steel, scheduled to be painted, per SSPC standards.
- D. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in SECTION 09 90 00 - PAINTING AND COATING.

END SECTION 05 50 00

END DIVISION 5 – METALS

DIVISION 6 – WOOD, PLASTICS AND COMPOSITES

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes rough carpentry and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's specifications, data, and installation instructions for review.
- B. Samples: If specifically requested.
- C. Certificates:
 - 1. Pressure Treatment: Submit mill certificate verifying compliance as specified, for each shipment received, in addition to a stamp on each piece of lumber, from an approved independent inspecting agency operating under the overview of the ALSC.
 - 2. Lumber Grades: Where lumber and plywood is exposed to view and clear finished, provide Certificates in lieu of grade stamping and trademarks.
- D. Closeout Submittals:

1.4 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Forest and Paper Association (AFPA): National Design Specification for Wood Construction.
 - 2. American Lumber Standards Committee (ALSC): Grading Standards.
 - 3. American National Standards Institute (ANSI):
 - a. Mat-Formed Wood Particleboard: ANSI A208.
 - b. Basic Hardboard: ANSI/AHA A135.4.
 - 4. American Plywood Association (APA): Standard Grading Rules.
 - 5. American Wood Preservers Association (AWPA): Standard U1, preservative and fire retardant treatments.
 - 6. National Institute of Standards and Technology (NIST): PS-20.
 - 7. Redwood Inspection Service (RIS): Standard Specifications for Grades of California Redwood Lumber.
 - 8. West Coast Lumber Inspection Bureau (WCLIB): Standard Grading Rules No. 17.
 - 9. Western Wood Products Association (WWPA): Western Lumber Grading Rules.

PART 2 - PRODUCTS

2.1 GRADING

- A. General: NIST PS-20 and applicable lumberman's association rules, as approved by authority having jurisdiction, under which each lumber species is produced.
- B. Grade Marking:
 - 1. Lumber: CBC Standard 23-1; each piece of lumber, factory marked with official grade mark of grading agency or independent agency operating under the overview of ALSA.
 - 2. Plywood: CBC Standard 23-2 and PS 1; each panel legibly identified for type, grade and species by APA grade mark.

2.2 LUMBER

- A. General: Sizes dressed as shown, surfaced 4 sides; 19% maximum moisture content; air or kiln dried. Lumber 3 inches nominal and thicker shall be free of Heart Center.
- B. Lumber Grades:
 - 1. General: Douglas Fir-Larch; up to 4 inch nominal thickness - No. 2; over 4 inch nominal thickness - No. 1.
 - 2. Sills:
 - a. General: Pressure treated Douglas Fir-Larch – No. 1 or better; AWPB marked.
 - b. Non-bearing Stud Walls: Redwood, where specifically shown.
 - 3. Posts, Beams and Stringers: Douglas Fir-Larch – No. 1.
 - 4. Tongue and Groove Decking: Douglas Fir or Hemlock; kiln dried, maximum moisture content 15%; size as shown. Select for appearance when installed in exposed locations.
 - 5. Miscellaneous Framing: Framing for skylight openings and misc. framing.
 - a. Douglas Fir-Larch: Blocking, nailers, furring, bridging and stripping; No. 2 grade.
 - b. Redwood: Where specifically shown; Foundation Grade, unless otherwise noted.
- C. Plywood: U.S. Product Standard PS 1
- D. Wood Treatment:
 - 1. General: Factory applied treatment, unless noted otherwise.
 - 2. Acceptable Manufacturers:
 - a. California Cascade-Woodland, Inc.
 - b. J. H. Baxter Company.
 - 3. Alternate Manufacturers: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 - 4. Fire Retardant: AWPB Standard U1, Exterior Type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25.

5. Wood Preservative
 - a. Pressure Treatment: AWWA Standard U1 using water borne preservative.
 - b. Surface Application: Clear type.

2.3 ROUGH HARDWARE

- A. Hangers, Clamps, Straps and Anchors:
 1. General: Types as shown.
 2. Acceptable Manufacturers:
 - a. Simpson Strong Tie Co., Inc.
 - b. USP Structural Connectors, a Gibraltar Industries Company.
 3. Alternate Manufacturers: Comparable products with current ICC-ES approval and equal or greater rated load capacity, manufactured by USP Lumber Connectors. Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS. Submit ICC-ES Report approval for review for all alternate products.
- B. Special Fabrications: Refer to SECTION 05 50 00 - METAL FABRICATIONS.
- C. Fasteners:
 1. Nails: ASTM F1667, common wire; hot dip galvanized for pressure preservative treated work, exterior work, and as shown. Gun nails shall be full size with full heads and are subject to approval of Architect. Box or sinker nails are not permitted.
 2. Bolts and Nuts: ASTM A307, Grade A, including supplementary requirement S1; galvanized for exterior work.
 3. Wood Screws: ANSI/ASME Standard B18.6.1; galvanized for exterior work.
 4. Lag Screws: ANSI/ASME Standard B18.2.1; galvanized for exterior work.
 5. Washers: Malleable iron or standard cut steel with steel lock washer; galvanized at exterior work.
 6. Specialty Fasteners: Galvanized.
 - a. Acceptable Manufacturers:
 - i. Hilti, Inc.
 - ii. ITW Ramset/Readhead.
 7. Alternate Manufacturers: Comparable products with current ICC-ES approval and equal or greater rated load capacity; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 8. Expansion Bolts: Kwik Bolt III at masonry; Kwik Bolt TZ at concrete.
 9. Concrete Screws: Kwik Con II.
 10. Powder Actuated Fasteners: Hilti shot pin XU; 2 7/8 inch length.

2.4 ADHESIVE

- A. General: Per APA-AFG-01 for plywood floor sheathing.
- B. Acceptable Products: EnerBond SF, as manufactured by Wind-lock.
- C. Alternate Products: No known equals; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.

2.5 BUILDING PAPER

- A. General: ASTM D226, 15 pound asphalt saturated felt.

2.6 CAULKING

- A. Refer to SECTION 07 92 00 - JOINT SEALANTS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate work specified elsewhere that affects the work of this Section.
- B. Take field measurements; report variance between plan and field dimensions.
- C. Protection:
 - 1. Security and Safety: Provide temporary protection and enclosures as required.
 - 2. Temporary Bracing: Provide bracing adequate to keep structure stable, plumb and in line; keep in place until permanent framing is completed. Provide bracing capable of supporting loads imposed by stockpiled material, erection equipment and other loads, during construction.

3.3 GENERAL ERECTION

- A. Coordinate placement of anchors, inserts, etc., in concrete and masonry. Establish locations, lines, levels and provide cutting, patching and fitting as required to accommodate built-in Work specified in other Sections.
- B. Use new lumber; re-use not permitted unless authorized in writing by the Architect. Select lumber in a manner that allowable knots and obvious minor defects do not interfere with placement of bolts, nailing or structural connections.
- C. Layout as shown; set plates, nailing blocks, anchors, grounds, etc., as required.
- D. Brush apply 2 coats of preservative treatment on site-sawn cuts in pressure treated lumber. Allow preservative to dry prior to erecting members.
- E. Fasteners:
 - 1. Nails: Per CBC Table 2304.9.1 unless otherwise noted. Space groups of nails no closer together than required penetration and not closer than one half of the required penetration from cut ends or edges of lumber. Prevent splitting due to nailing drill holes for nails no more

than 0.75 diameter of nail. Where nails of normal length may penetrate through exposed work, use nail of specified diameter and shorter length. Use of nailing gun is subject to visual approval of the engineer, Architect and inspector. Gun nail heads shall not penetrate the face ply of structural panels. Gun nails shall not cause wood members to split or otherwise compromise the integrity of connections.

2. Bolts and Nuts: Use steel pieces as template for location of holes; drill holes 1/16-inch larger than diameter of bolts; tighten nuts or rods and bolts at time of installation. Re-tighten before covering up and just before final inspection and acceptance of the work; at exposed work, cut protruding bolt ends off to within 1/8-inch of nut and file off burrs.
3. Washers: Install at bolts, nuts or lag screws bearing on wood; not required under heads of carriage bolts.
4. Screws:
 - a. General: Hammering or driving in place not permitted. Use soap to lubricate screw threads, if required.
 - b. Lag Screws: Drill holes of same diameter and depth as shank; drill holes for threaded portion of screw no larger than 3/4 shank diameter.
 - c. Wood Screws: Drill lead holes for shank and threaded portions, hole diameter 7/8 of shank or thread root diameter.
5. Powder Actuated Fasteners:
 - a. General: Install where shown or required; **DO NOT** install in structural connections required to carry computed stresses.
 - b. Application: Per Article 28, Powder-Actuated Tools, Paragraph 1685, of Title 8, CCR.

3.4 INSTALLATION

A. General:

1. Structural Members:
 - a. General: Set level and plumb, in correct position; place horizontal members level, with crown side up.
2. Framing Members: Construct full length without splices; notching permitted only with approval of the Architect.
3. Blocking:
 - a. General: Provide as shown and where necessary to obtain required lines and levels in finished surface and to provide solid nailing. Secure blocking plumb and rigid; use wood shims wherever necessary to form true and even plane for finish materials.
 - b. Firestopping: Provide per CBC at interior and exterior walls at intersection with floor, ceiling and roof, and at all hollow concealed spaces. Install minimum 2-inch nominal material by width of enclosed spaces within partition in continuous row to prevent vertical and horizontal draft. Maximum concealed air space of 10'-0" in any direction.
 - c. Backing: Provide blocking within walls where anchorage is required for equipment and accessories shown.

4. Recessed Fixtures: Frame openings for panel boxes and other equipment, as required for fixtures provided.
- B. Floor Framing:
1. Sills: Pressure treated when in contact with concrete; secure with anchor bolts, or nails, as shown. Join solid sill at corners and with halved joints where member is not continuous. Minimum length 4'-0", unless otherwise shown.
 2. Joist Framing: Support ends of each member with minimum of 1-1/2 inches bearing on structure below. Anchor joists and provide solid blocking for plywood joints, and as shown.
- C. Wall Framing:
1. General: Wood studs as shown; frame openings with multiple studs at sides and headers as shown.
 2. Plates: Provide continuous sole plates, pressure treated when in contact with concrete, and double top plates. Lap top plate splices 4'-0" minimum; lap at wall corners and intersections.
 3. Studs: Continuous lengths without splices; provide solid blocking at plywood joints.
 4. Framing for Piping: Provide proper clearances; furr partitions as required. At pipe 1-1/2 inches diameter, or less, set pipe in center of plate using neat holes; no notching allowed. Holes in plates less than 5-1/2 inches in width, not allowed.
 5. Headers: Continuous members as shown.
 6. Corner Bracing: Continuous members as shown.
 7. Sheathing:
 - a. Orientation: Secure with long dimension parallel to studs, with joints located over studs or solid blocking and end joints staggered; nailing as shown.
 - b. Joints: Minimum 1/16-inch space at end joints and 1/8-inch at edge joints.
 - c. Penetrations: Penetration of structurally required sheathing to accommodate electrical or mechanical requirements must be approved in writing by the Architect.
- D. Roof Framing:
1. General: Provide minimum bearing as shown at both ends of each member and anchor as shown. Provide solid blocking at plywood joints.
 2. Beams and Girders: As shown; splices not permitted except where centered over columns.
 3. Joist Framing: As shown.
 4. Rafter Framing: Place rafters directly opposite each other at ridge; notch to fit exterior wall plates; bevel ends at ridge and hip. Provide double rafters at openings in roof.
 5. Sheathing: Secure with long dimension perpendicular to joists with joints located over joists or solid blocking and end joints staggered; nailing as shown. Minimum 1/16-inch space at end joints and 1/8-inch at edge joints.

- E. Miscellaneous Framing:
 - 1. General: Provide nailers, backing, and stripping as necessary to obtain required lines and levels in finished surface. Secure plumb and rigid; use wood shims where required. Provide backing required for wall or ceiling hung fixtures and equipment.
 - 2. Building Paper:
 - a. General: Apply where shown, with 2-inch horizontal laps and 6-inch vertical laps at joints and corners. Repair damaged paper before installation of finish material.
 - b. Paper: Use 3/8-inch head galvanized nails spaced adequately to hold paper in place, without buckling.
 - 3. Caulking:
 - a. Energy Compliance: Apply during framing operations as required by CBC.
 - b. Sound-Rated Partitions: Install sole plates on double bead of acoustical sealant.
 - c. Thresholds: Set in full bed.
 - 4. Ventilating Holes: Provide in indicated sizes where shown.
 - 5. Mechanical and Electrical: Provide curbs, backing and blocking, as required for mechanical and electrical fixtures and equipment.
- F. During inclement weather, protect exposed roof sheathing and wood decking with protective waterproof covering until roofing has been installed.

3.5 TOLERANCES

- A. Install to allow application of subsequent finish materials within specified tolerances.

3.6 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 06 10 00

SECTION 06 41 16 PLASTIC LAMINATE-CLAD CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes plastic laminate casework and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Shop Drawings: Submit manufacture and installation details, including fastenings, for review. Provide WI Certified Compliance Label.
- C. Samples: Submit 2 minimum 2 x 3-inch plastic laminate samples for each color specified. Provide full range of available colors for manufacturer's standard plastic laminate colors; other products if specifically requested.
- D. Certificates:
 - 1. Provide WI Certified Compliance Certificate for fabrication and installation of all casework in grade specified.
- E. Closeout: Provide completed Guarantee form.

1.4 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. Woodwork Institute (WI): Eleventh Edition 2003 Manual of Millwork.
 - 2. National Electric Manufacturers Association (NEMA): Plastic laminate standards.
- B. Qualifications:
 - 1. Fabrication shall be performed by manufacturer with minimum 5 years documented experience in producing WI compliant casework.
 - 2. Installation shall be performed by the fabricator provided fabricator has minimum 5 years documented experience installing casework. Alternatively installation may be performed by a W.I. certified installer.

1.5 GUARANTEE

- A. Provide in required form for a period of 2 years from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Conform to WI Custom Grade, except where more stringent requirements are specified herein.
- B. Plastic Laminate: High-pressure decorative laminate plastic; Class A flame spread.

1. Acceptable Manufacturers:
 - a. Wilsonart International.
 - b. Formica Corp.
 - c. Or equivalent.
 2. Plastic Veneer: NEMA Standard for vertical and horizontal surfaces grade; satin finish.
 3. Backing Sheets: Per NEMA Standard.
 4. Colors and Patterns: **As selected by Architect from manufacturer's full range;** more than one per cabinet may be required. **Provide full range of available colors for each material submitted.**
 5. Low Pressure Melamine: Thermoset decorative laminate panel conforming to WI minimum acceptable standards when tested per NEMA "LD-3" test method.
- C. Polyvinyl Chloride (PVC) Banding: Resilient, minimum 3 millimeters thick by appropriate width. Install at all edges of drawers and doors only. Color to match laminate.
- D. Lumber:
1. WI Custom Grade standards; particle board with 40 to 50 pound density.
 2. Scribe Moulds: Smallest possible size lumber; finish all exposed edges with plastic laminate to match casework.
- E. Casework Hardware:
1. Per WI Standards, and as follows.
 2. Finish: Match door hardware finish; refer to SECTION 08 71 00 - DOOR HARDWARE.
 3. Hinges:
 - a. General: Grade 1; do not let in hinge to edge of door.
 - b. Acceptable Products:
 - i. Model No. RPC 376-US26D, as manufactured by Rockford Process Control, Inc.
 - ii. Comparable Grade 1 hinge, as manufactured by the Stanley Hardware Division of the Stanley Works.
 - c. Gate Hinge: Model No. 7112 Spring Pivot, as manufactured by Lock and Hinge.
 - d. Alternate Products: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 4. Door and Drawer Pulls:
 - a. Acceptable Products: Model No. MC-402 U-shaped, 4-inch wire pull, as manufactured by Engineered Products Company.
 - b. Alternate Products: No known equals; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.

5. Magnetic Catches:
 - a. Acceptable Products: Model No. 323, as manufactured by the H.B. Ives Division of Ives, Horrow Company.
 - b. Alternate Products: No known equals; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 6. Silencers:
 - a. Acceptable Manufacturers: Ceco Building Systems Division of Robertson-Ceco.
 - b. Alternate Manufacturers: No known equals; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 7. Locks:
 - a. Acceptable Products: National Cabinet Lock Model No. NCL C-8183 cabinet lock; 5-pin tumbler, modified cam on backside.
 - b. Alternate Products: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 8. Drawer Guides:
 - a. Acceptable Manufacturers: Accuride International, Inc.
 - b. Alternate Manufacturers: No known equals; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 - c. Small Drawer 16 inches Wide or Less: Model No. 3832; 75 pounds.
 - d. Medium Drawer 24 inches Wide or Less: Model No. 3832; 100 pounds.
 - e. Large Drawer 27 inches or Less: Model No. 3832; 150 pounds.
 - f. Large Drawers 27 inches or More: Model No. 4034.
 - g. Drawers 42 inches or More with Face Height 7 inches or More: Model No. 3640.
 9. Adjustable Shelf Hardware:
 - a. Acceptable Products: Universal Model No. 1, as manufactured by Hettich America, L.P.
 - b. Alternate Products: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 10. Wire Management Grommets:
 - a. Acceptable Products: Model No. SAG60-BK, as manufactured by Outwater Plastic Industries, Inc.
 - b. Alternate Products: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- F. Cantilevered Countertop Supports:
1. Acceptable Products: Countertop Brace One (CB1): 1/8-inch thick steel "L" bracket as manufactured by A & M Hardware, Inc.

2. Countertop Brace Two (CB2): As shown; as manufactured by Hafele America Company.
 3. Countertop Brace Three (CB3): Model No. EH-1824, 2 x 3 inches, with aluminum faceplates, as manufactured by Rakks, Rangine Corp.
 4. Alternate Products: No known equals; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 5. Size: As shown.
 6. Color: Primed grey; **as selected by Architect from manufacturer's full range.**
 7. Delete option if glass is not used.
- G. Fasteners and Adhesives: Per WI requirements.

2.2 FABRICATION

- A. General: Manufacture to Custom Grade standards, except where specifically noted otherwise, per Section 10 of AWS Manual. Provide WI Certified Compliance Label for grade specified, to each elevation of casework.
- B. Construction:
1. General: Type A (frameless); Style 1 (Overlay). Inside corner cabinets shall be accessible.
 2. Open Shelving: Semi-exposed surfaces on casework without doors or with glass doors shall be faced with vertical grade plastic laminate in color to match exposed surfaces.
 3. Door and Drawer Fronts: Reveal overlay. Surface mount door hinges.
 4. Backs: ¼ inch thick, ½ inch thick where back is exposed; rabbeted or dadoed into top and sides; ½ inch nailer at top.
 5. Shelves: Shall be constructed of plywood or particle board in thicknesses and lengths per WI Table 15-1, "Maximum Adjustable Shelf Lengths" for 50 pounds per square foot load.
 6. Filler Panels: Thickness as required; to match cabinets.
 7. Edge Banding: 3 millimeters PVC at visible edges. Color to match cabinet.
 8. End Panels: 2 layers of 3/4-inch plywood at countertop end locations with no cabinets below.
- C. Countertops:
1. Plastic Laminate: Should be compliant to Section 11 of the AWS Manual. Fabricate to waterfall profile, in longest practicable length; minimize number of joints. Make joints neat and watertight; abutting ends splined and adjoining surfaces flush. Ease exposed edges and provide a minimum 1-inch radius at outside corners. Provide backing sheet on bottom side of countertops where plumbing fixtures are to be installed or where exposed to moisture.
- D. Casework Hardware:
1. General: Prefit; remove for application of finish. Keep hardware with casework to which it has been prefit; reinstall after casework is anchored in place, as shown.
 2. Hinges: 4 - No. 8 screws into end panel and door panel; 1-1/2 pair on 7'-0" high cabinet doors; tall cabinet doors must swing 180 degrees when adjacent to low cabinets without interference from counter top.

3. Magnetic Catches: One catch on cabinet doors up to 48 inches high; 2 catches (top and bottom) on cabinet doors over 48 inches high.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Environmental Requirements: Relative humidity 50% or less; temperature 65 degrees F minimum.
- B. Measurements: Take field measurements prior to fabrication; report variance between plan and field dimensions.
- C. Delivery: Use clean, nonstaining materials for blocking and packing. Carefully load and cover for shipment; do not transport during inclement weather.

3.3 INSTALLATION

- A. Install in conformance with CSIP referenced standards, manufacturer's written directions, as shown, and as specified. Provide WI Certified Compliance Certificate for Installation.
- B. Casework:
 1. General: Install level, with tight joints between units; scribe edges to fit adjacent finishes. Secure to backing or plates in wall or to casework carriers with lag bolts with washers to permit removal; screw penetration of not less than 1 inch into 2 inches nominal backing or framing is required.
 2. Anchorage should be #14x3" with washer head, reference the CSIP.
 3. Filler Panels: Scribe to cabinets and abutting finishes.
- C. Countertops:
 1. General: Install level, using concealed fasteners, with tight joints; scribe to fit wall finishes.
 2. Cantilevered Countertop Supports: Install brackets as shown. Paint fastener heads to match bracket color. Install Countertop Brace Three to wall stud before gypsum board installation.
- D. Hardware:
 1. General: Check hardware upon delivery to site; store in an orderly manner. Fit and install in place without marring or injuring either hardware or casework.
 2. Seismic Restraint: At all shelf supports.

3.4 CLEANING

- A. General: Immediately following installation, clean casework to remove dirt, stains, scratches, and abrasions. Protect casework against damage by other trades; repair or replace damaged and defaced material at no cost to Owner.

3.5 JOBBING

- A. General: 6 months after final acceptance of the building, and at any time within 1 year after acceptance when so directed, examine casework doors, drawers, fittings, etc., and perform such fitting and adjustment as necessary to put items in good condition and working order.

END SECTION 06 41 16

END DIVISION 6 – WOOD, PLASTICS AND COMPOSITES

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07 21 00 THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes building insulation and related work as shown and specified:
- B. Replace missing insulation at roof framing and match existing. See plans for quantity.

1.3 SUBMITTALS

- A. Product data and installation instructions for each type of product indicated and each installation condition. Include flame spread and smoke developed.

1.4 QUALITY ASSURANCE

- A. Insulation Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products in original packaging with labeling identifying compliance with requirements of this section. Protect from moisture or damage. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing and protecting during installation.

1.6 GUARANTEE

- A. Provide in required form for a period of 2 years from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 INSULATION

- A. General: Provide insulating materials that comply with requirements and with referenced standards. Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, width, and lengths.

- B. Thermal and Sound Insulation: Unfaced Batts Full depth of framing members: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass; passing ASTM E 136 for combustion characteristics.
 - 1. Use in concealed cavities and open cavities exposed to uninhabitable spaces.
 - 2. At Vertical Cavities: Thickness at interior walls to be full depth of wall cavity 6", width as required for friction fit. R value shown is minimum requirement.
 - 3. At Horizontal or Sloping Cavities: Thickness as required for R value shown; width as required for friction fit.
- C. Repair any insulation damaged during construction both on roof deck and at roof framing locations. Match existing faced insulation. Match thickness.

2.2 AUXILIARY INSULATING MATERIALS

- A. Fasteners and Support System: As recommended by manufacturer for installation shown.
- B. Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings and for attaching facing to metal studs.
- C. Insulating Foam Sealant: Great Stuff Pro Gaps & Cracks, Great Stuff Pro Window & Door, manufactured by the Dow Chemical Corporation. Apply per manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substance harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 BATT INSTALLATION

- A. General: Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions.
- B. Complete Envelope: Extend insulation in required thickness to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Provide sizes to produce snug fit.
- C. Water-Piping: Install insulation on exterior side of water pipes. Do not place insulation between water pipe and substrate on interior side of wall cavity.
- D. Largest Practical Sizes: Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness. Fill Cavities with minimum number of pieces practical.
- E. Unfaced-Batts in Cavities Use in concealed cavities and open cavities exposed to uninhabitable spaces.

1. Use blanket thicknesses, widths, and lengths that fill the entire cavity formed by framing members and finish substrates.
 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. In fully enclosed roof cavities, maintain continuous air space above insulation as shown.
 4. In vertical cavity heights exceeding 96 inches, support batts temporarily until finish substrate is installed.
 5. In open cavities (vertical, horizontal, or sloping cavities which will not have finish substrate to contain insulation), attach 18 gage wire to face of studs, horizontally at 2 feet on center, or provide other means mechanical support per manufacturer's written recommendations.
- F. Kraft-Faced Batt:
1. At metal stud construction, tape stapling flanges to face of steel studs.
- G. At metal-framing, support with 18 gage wire at 2 feet on center attached to each framing member to provide other means or mechanical support per manufacturer's written instructions.

3.4 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.5 CLEAN UP

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.

END OF SECTION 07 21 00

SECTION 07 41 13 METAL ROOF AND WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes metal roof system and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, data, and installation instructions.
- B. Certificates: Cool Roofing certified by Cool Roof Rating Council.
- C. Shop Drawings: Submit manufacture and installation details. Include dimensions, penetrations, joints, flashings, closure and fastenings, for review.
- D. Samples: Submit samples in selected color manufacturer's standard colors (minimum 25 colors).
- E. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
- F. Closeout Submittals:
 - 1. Maintenance Data: Manufacturer's instructions.
 - 2. Guarantee: Provide completed form.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.
- B. Source Limitations: Obtain each metal roof system from a single manufacturer.

1.5 GUARANTEE

- A. Provide in required form for a period of 2 years from date of acceptance by Owner.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within 20 years of acceptance by Owner.

PART 2 - PRODUCTS

2.1 METAL ROOF SYSTEM (MRS)

- A. Alternate Products: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- B. Fire Rating: UL Class "A" fire retardant.
- C. Panels: 24 gage steel; 16 or 17 inches width; longest practical length; corrugated panels.

- D. Accessories: Manufacturer's standard for system shown. All exposed parts to be prefinished to match roof panels.
- E. Finish: Factory applied "Dura Tech 5000" paint system.
- F. Color: See Color Schedule in plans.
- G. Fasteners: Corrosion resistant per CBC Chapter 15; exposed fasteners finished to match panel finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from contact with lime, cement or chemicals.
- B. Do not allow traffic or material storage on completed roof surface.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Panels:
 - 1. Install plumb, straight, square and level; at proper elevations, locations and in alignment with adjacent work. Attach panels with fully concealed galvanized steel anchor clips. No perforation of panels by anchoring fasteners is allowed, except as shown or necessary for flashing and trim members. Tightly close interlocking seam between panels. Finish panels clean, securely fastened to structure, and weather tight. Work showing dents, creases, deformations, weathering or other defects affecting use or appearance will not be accepted.

3.4 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 07 41 13

SECTION 07 51 00 COATED TPO ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes coated built-up roofing and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.
- B. Samples: If specifically requested.
- C. Certificates:
 - 1. General: Submit manufacturer's certificate for type asphalt provided, Equiviscous Temperature (EVT), Final Blowby Temperature (FBT) and Flashpoints (FP) per NRCA requirements.
 - 2. Asbestos: Submit certificate stating that no material installed under this Section contains asbestos.
 - 3. Cool Roofing: Certified by Cool Roof Rating Council.
- D. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
- E. Closeout Submittals:
 - 1. O & M Manuals: Maintenance instructions.
 - 2. Guarantee: Provide completed form.

1.4 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society of Testing Materials (ASTM): Materials and testing standards as identified throughout this Section.
 - 2. Factory Mutual (FM): Roof Assembly Classifications.
 - 3. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
 - 4. Underwriters Laboratory (UL):
 - a. UL 580: Tests for Wind Uplift Resistance for Roof Assemblies.
 - b. UL 790: Tests for Fire Resistance of Roof Covering Materials.
 - 5. California Building Code (CBC): Chapter 15.
- B. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this

specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.

- C. Fire Characteristics: UL Class "A" fire retardant, minimum.
- D. Applicator-Manufacturer Review: Verify that selected system is proper, compatible and adequate for application shown.
- E. Preinstallation Conference: Scheduled by applicator with one week advance notice; to be attended by applicator, his working foreman, Architect, and roofing material manufacturer's agent at job site. Discuss requirements of related work surface preparation, storage and handling, protection measures, materials and application specifications.

1.5 GUARANTEE

- A. Provide Mfg. Certificate of Installation approval to maintain existing warranty.

PART 2 - PRODUCTS

2.1 TPO 45 MIL

- A. Acceptable Manufacturers:
- B. Tremco 45 mil. TPO to match existing; maintain warranty and provide mfg. rep. certificate for all repairs.
- C. Bill Burke 916-990-5859 "Certification"

2.2 ROOFING MATERIALS

- A. Match Existing

2.3 UNDERLAYMENT – MATCH EXISTING

2.4 ROOF WALKWAY PROTECTION

- A. Provide plywood, marlite or other similar protection material at all areas of work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Take field measurements; report variance between plan and field dimensions.
- B. Environmental Requirements:
 - 1. General: Do not apply roofing during wet or freezing weather or when roofing material is wet or damp.
 - 2. Temperature: Do not apply roofing when surface temperature of deck is less than 50 degrees F or when application temperature of bitumen cannot be maintained.

- C. Protection:
1. General: Protect adjoining surfaces from bitumen stains, especially at perimeter of building. Enveloping of felts at eaves and projections will be required. Prevent bitumen and debris from entering and clogging roof drains and gutters.
 2. Temporary Waterproofing: Remove only that portion of existing roofing that can be protected against water infiltration before completion of new roofing and flashings. At the end of each workday provide watertight seals at edges of flashings and penetrations through roofing work; remove such seals before continuing roofing work. Roofing contractor is fully liable for water entry and resulting damage to the building, its contents, or roofing work.
- D. Surface Preparation:
1. General: Deck surface dry and free of rough spots, ridges, projections, pockets or depressions. Sweep roof deck clean; keep free of loose and foreign materials.
 2. Roof Loading: Distribute materials in a manner that will avoid overloading roof structure.
 3. Nailable Deck:
 - a. General: Permanently fill or cover cracks and knot holes; provide a level and smooth surface. Provide clean and dry roof deck, free of rough spots, ridges, or projections.
 - b. Existing Deck: Correct warped, buckled or deformed plywood; cover knot holes larger than 1/2-inch and cracks wider than 1/4-inch with 6-inch wide strip of elastomeric flashing material. Reset nails as required; replace missing or loose fasteners with deformed shank fasteners of the same shank diameter.
- E. Storage: Store materials on end, under vapor permeable waterproof coverings, on raised platforms until installed. Return unused materials to platforms and replace coverings for overnight storage or during inclement weather.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Underlayment: Install where shown, per manufacturer's instructions for specified substrate and roofing system.
- C. Cants: Install as shown, at angle of intersections of roof deck and vertical surfaces; miter corners evenly. Prime wall when required; when dry, apply cants on deck in plastic cement or mechanically fasten to wall and deck at 12 inches on center.
- D. Metal Flashings: Coordinate installation with SECTION 07 62 00 - SHEET METAL FLASHING TRIM and flashings installed under DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) and DIVISION 26 – ELECTRICAL to insure watertight installation. Prime coat all metal in contact with roofing materials as recommended by the roofing manufacturer.
- E. Roof Penetrations: Reinforce roofing at plumbing/electrical jacks, flanges, roof drains, scuppers, curbs, etc. with minimum 6 inch wide strip of elastomeric flashing material. Fit roofing neatly to all penetrations; seal with plastic cement.

3.4 FIELD QUALITY CONTROL

- A. Inspector shall be present at all times when roofing materials are being applied.

3.5 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.

END SECTION 07 51 00

SECTION 07 62 00 SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes flashing and sheet metal and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.
- B. Shop Drawings: Submit manufacture and installation details, including fastenings, for review.
- C. Samples: If specifically requested.
- D. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
- E. Closeout Submittals: Provide completed Guarantee form.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings. If a specific detail is not shown, use a detail from the SMACNA Manual appropriate to that condition.

1.5 GUARANTEE

- A. Provide in required form for a period of **1 year** from date of acceptance by Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack preformed material to prevent twisting, bending or abrasion; slope to ensure drainage.

PART 2 - PRODUCTS

2.1 GALVANIZED SHEET METAL

- A. Per ASTM A653, Grade A, G90 zinc coating; 24 gage minimum, core steel.

2.2 PRE-FINISHED SHEET METAL

- A. Underlayment: ASTM D226, 15 pound asphalt saturated roofing felt, unperforated.

2.3 SELF-ADHERED FLASHING (SAF) AT SKYLIGHT INSTALLTION AS NEEDED

- A. General (at wall locations): Grace Vycor Plus, Grace Vycor Butyl, as manufactured by Grace Construction Products.

- B. Roof locations: Grace Roof Detail Membrane, confirm product with geographic location.
- C. Alternate Manufacturers: Comparable products manufactured by the Pecora Corporation; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.

2.4 FASTENERS

- A. General: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- B. Nails:
 - 1. General: FS FF-N-105
 - 2. Steel: Hot-dipped galvanized, annular thread, size as required.
 - 3. Concrete: Flat head, size as required.
- C. Rivets: 1/8 inch diameter; solid type.
- D. Washers: Lead or neoprene, where required.

2.5 SOLDER

- A. General: ASTM B32; 50/50 type; lead free.
- B. Flux: FS A-A-51145D.

2.6 GALVANIZING REPAIR TREATMENT

- A. Zinc Alloy Rod: Zinc-based solder Per ASTM A780.

2.7 PROTECTIVE COATINGS

- A. Asphaltic Primer: ASTM D41
- B. Bituminous Paint: FS TT-C-494, Type II; bituminous.
- C. Backing Paint: Galvanized steel primer as specified in SECTION 09 90 00 - PAINTING AND COATING.

2.8 PLASTIC CEMENT

- A. Per FS SS-C-153, Type I; asphaltic.

2.9 SEALING TAPE

- A. General: No. 606 Architectural Sealant Tape, as manufactured by Protective Treatments, Inc.
- B. Alternate Manufacturers: No known equals; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.

2.10 SEALANTS

- A. Per FS TT-S-230, non-hardening, non-sagging.

2.11 REGLETS

- A. General: Type STX, unless shown otherwise, manufactured by the Fry Reglet Corp.; galvanized with butyl rubber sealer and removable snap-in base flashing. Alternate Manufacturers: No known equal.
- B. Corners: One piece pre-fabricated with minimum 18 inch long legs.

2.12 FABRICATION

- A. General: Form sections from galvanized sheet metal, per referenced standards, true to shape, accurate in size, square, and free from distortion or defects. Form pieces in single length sheets, not to exceed 10'-0" in length. Hem exposed edges on underside 1/2 inch; miter and factory solder inside and outside corners. If a specific detail is not shown, use a detail from the SMACNA "Architectural Sheet Metal Manual" appropriate to that condition.
- B. Seams: Drive cleat or lock.
- C. Cleats: Minimum 2 inches wide, interlockable with sheet.
- D. Vertical Faces: Bottom edge formed outward 1/4 inch and hemmed to form drip.
- E. Flashing Toe: Extend toe 2 inches over roofing; return and brake edges.
- F. Soldering: Solder shop formed metal joints. Spot weld for permanent alignment. Solder joints water-tight. After soldering, remove flux; wipe and wash solder joints clean.
- G. Assemblies:
 - 1. Exterior Hollow Metal Frame Flashing: 24 gage, as shown.
 - 2. Countertops:
 - a. General: One piece construction, front to back; 20 gage; size as shown.
 - b. Stainless Steel: Gage and size as shown.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Take field measurements; report variance between plan and field dimensions.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Underlayment:
 - 1. General: Apply 1 layer of felt underlayment over surfaces as shown; lap all edges 6 inches minimum, in direction of slope.
 - 2. Self-Adhered Flashing: Install as shown.
- C. Application:
 - 1. General: Make corners square, surfaces true and straight in planes, and lines accurate to profiles. Fit sheet metal tight in place; secure using concealed fasteners. Apply plastic cement compound between metal flashings and felt flashings. Spot weld and solder metal joints watertight.

2. Expansion and Contraction: Allow for expansion and contraction over an ambient temperature range up to 150 degrees F; distortions resulting from fastening or expansion and contraction stresses not acceptable
 3. Dissimilar Metals: Isolate with heavy coat of bituminous paint. Coat all sheet metal in contact with roofing felts.
- D. Components:
1. Reglets: Install as shown; set flashing; spot weld and solder joints watertight.
- E. Assemblies:
1. Flashing:
 - a. General: Miter joints at corners; spot weld and solder joints watertight. Lap flashings to drain; spot weld and solder joints watertight. Install flashing in longest lengths practical. Lap end joints not less than 6 inches and seal with 2 strips of sealing tape. Extend counterflashing down not less than 6 inches.
 - b. Exterior Hollow Metal Frame Flashing: Provide at frame heads, as shown.
 2. Site Fabricated Seams: Install drive cleat seams per SMACNA.
 3. Countertops:
 - a. Stainless Steel: As shown.
- F. Sealants: As shown; per manufacturer's directions.
- G. Galvanizing Repair Treatment: Repair damaged zinc coating with specified repair compound, as required.

3.4 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.

END SECTION 07 62 00

SECTION 07 84 00 FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes firestopping and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.
- B. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
- C. Certificates: Manufacturer certifies that products meet or exceed specified requirements for fire rating for assembly penetrated.
- D. Closeout Submittals:
 - 1. Guarantee: Provide completed form.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.
- B. Volatile Organic Compounds (VOC): Use only products in compliance with VOC content limits required by state and local regulations.

1.5 GUARANTEE

- A. Provide in required form for a period of **1 year** from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 FIRESTOPPING

- A. Acceptable Manufacturers:
 - 1. Dow Corning Corp.
 - 2. Specified Technologies Inc.
 - 3. Fibrex insulation Inc.
 - 4. Thermafiber Division of USG Interiors, Inc.
 - 5. Or equivalent.

- B. Dam Material:
 - 1. General: Permanent or removable as recommended by sealant manufacturer.
 - 2. Safing Insulation: Mineral fiber, unfaced; thickness as shown.
 - 3. Mineral Fiberboard: Mineral fiber fireproofing, unfaced; thickness as shown.
- C. Primer: Model No. 1200 RTV.
- D. Foam: Firestop Foam. Putty:
 - 1. Acceptable Products: FSP, as manufactured by Hevi-Duty/Nelson Firestop Products.
 - 2. Alternate Products: Comparable product manufactured by 3M Fire Protection Products. Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- E. Fasteners:
 - 1. Retainers: Manufacturers standard clips to support mineral fiber matting.
 - 2. Masking Tape: Pressure sensitive adhesive tape recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sequence Work to permit firestopping materials to be installed after adjacent and surrounding work is complete.
- B. Do not apply materials when temperature is below 60 degrees F; maintain minimum temperature before, during, and for 3 days after installation.
- C. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Dam Materials: Install as backing to arrest liquid material leakage; remove after firestopping material has cured.
- C. Primer: Where required; per manufacturer's instructions.
- D. Firestopping: Install material at walls of partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items requiring firestopping to thickness required for fire rating.
- E. Fire Rating: As shown.

3.4 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.

END SECTION 07 84 00

SECTION 07 92 00 JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealers and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, data, and installation instructions for review. Select first option if color is selected during design. Select second option if color is to be selected during construction administration.
- B. Samples: Submit 2 minimum 2-inch samples for each color specified. Provide full range of available colors for each material submitted.
- C. Certificates: Submit certification that sealants proposed for use, comply with the Contract Documents.
- D. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
- E. Closeout Submittals:
 - 1. Provide completed Guarantee form.

1.4 QUALITY ASSURANCE

- A. General: The manufacturer of the sealant used shall have been in the business of manufacturing the specified types of such sealants for not less than 10 years.
- B. Installer Qualifications: Minimum of 5 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.
- C. Volatile Organic Compounds (VOC): Use only products in compliance with VOC content limits required by Federal and State EPA regulations.
- D. Compatibility with Substrate: Verify that caulking and sealants used are compatible with joint materials.
- E. Joint Tolerances: Comply with manufacturer's joint width to depth ratio limitations.

1.5 GUARANTEE

- A. Provide in required form for a period of 2 years from date of final acceptance by Owner.
- B. Provide material in manufacturer's standard form for a period of 5 years from date of acceptance by owner.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS

- A. Acceptable Manufacturers:
 - 1. Tremco, Inc.
 - 2. Sika
 - 3. Pecora Corp.
 - 4. Or equivalent.
- B. Exterior Joints:
 - 1. Vertical Surfaces: Non-sag polyurethane; Dymeric 240 FC.
 - 2. Horizontal Paving Joints: Self-leveling polyurethane; THC 900 or Sikaflex 2cSL; interior and exterior.
- C. Interior Joints:
 - 1. General: Acrylic latex.
 - a. Tremflex 834, as manufactured by Tremco.
 - b. AC-20, as manufactured by Pecora Corporation.
 - c. Sonolac, as manufactured by Sonneborn, BASF Building Systems.
 - 2. Ceramic Tile and Plumbing Fixture Joints: Silicone rubber; Tremsil 200.
 - 3. Firestop Caulking:
 - a. Acceptable Products: Metacaulk, as manufactured by the Rectorseal Corp.
 - b. Alternate Products: Comparable products manufactured by the Dow Corning Corp. Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- D. Joint Cleaner: Provide cleaner recommended by sealant manufacturer for specific joint surface and condition.
- E. Joint Primer and Sealer: As recommended by sealant manufacturer for each condition.
- F. Bond Breaker Tape: Pressure sensitive polyethylene tape.
- G. Other Materials: Manufacturer's standard for items required or type best suited for intended use.
- H. Colors:
 - 1. Concealed Joints: Manufacturer's standard color having best overall performance characteristics for indicated application.
 - 2. Exposed Joints: Match adjacent surface. Provide full range of available colors for each material submitted.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Environmental Requirements: Do not apply materials when temperature is below 40 degrees F, or under extreme temperature conditions when joint width is expanded or contracted beyond normal conditions.
- B. Surfaces: Prepare joints in accordance with manufacturer's recommended instruction to ensure maximum adhesion. Prime as required, protecting adjacent exposed surfaces.
- C. Sealants: Prepare sealant as required, including proper mixing of multicomponent sealants.
- D. Protect surfaces adjacent to joints to receive sealant. Cover joints in walking surfaces with heavy duty, non-staining tape, until material has dried.

3.2 EXAMINATION

- A. General: Carefully examine before beginning work; report defects.
- B. Substrate: Inspect surfaces to insure that no bond-breaker materials contaminate the surface to which the sealant is to adhere and to ensure that unsound substrates are repaired.
- C. Storage: Per manufacturer's recommendations for proper precautions for shelf life, temperature, humidity and similar storage factors to ensure the fitness of the material when installed.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Prevent three-sided adhesion. Provide sealant depth of 1/2 joint width; minimum depth of 1/4 inch; maximum of 1/2 inch, unless otherwise required by the manufacturer.
- C. Backer Rod: Install using blunt or rounded tools to insure uniform (plus or minus 1/8 inch) depth without puncturing material. Oversize backer rod minimum of 33% for closed cell type, minimum of 50% for open cell type, unless otherwise required by the manufacturer.

3.4 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 07 92 00

END DIVISION 7 – THERMAL AND MOISTURE PROTECTION

DIVISION 8 – OPENINGS

SECTION 08 11 03 HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes hollow metal doors and frames and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Include installation instructions, construction details, material descriptions, fastenings, core descriptions, label compliance, fire-resistance and temperature-rise ratings, and finishes for each type of hollow metal door and frame indicated.
- B. Samples: If specifically requested for specified products; required for alternate products.
- C. Shop Drawings: Provide a schedule of hollow metal doors and frames using same reference numbers for details and openings as those on Drawings. Submit manufacturer and installation details, including fastenings, for review. Show details of each condition at 3-inch scale.
- D. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of door and frame.
- E. Closeout Submittals: Provide completed Guarantee form.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single y metal doors and frames shall comply with the following:
 - 1. Manufacturing of Hollow Metal Doors and Frames: Per HMMA 802.
 - 2. Hollow Metal Doors: Per HMMA 810 and HMMA 861.
 - 3. Hollow Metal Frames: Per HMMA 820 and HMMA 861.
 - 4. Hardware Selection for Hollow Metal Doors and Frames: Per HMMA 830.
 - 5. Hardware Locations for Custom Hollow Metal Doors and Frames: Per HMMA 831 and 861.
 - 6. Installation and Storage of Hollow Metal Doors and Frames: Per HMMA 840.
 - 7. Fire Rated Hollow Metal Doors and Frames: Per HMMA 850.
 - 8. Custom Hollow Metal Work: Per HMMA 861.
 - 9. Door Hardware Institute (DHI): Installation Guide for Doors and Hardware.

1.5 GUARANTEE

- A. Provide in required form for a period of **1 year** from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

- A. Subject to compliance with this specification the following manufacturers are acceptable:
 - 1. NADCOR North American Door Corp.
 - 2. Curries
 - 3. Timely
 - 4. Or equivalent.
- B. Alternate Manufacturers: No known equals. Other custom hollow metal manufacturers who are members of HMMA and who routinely manufacture doors and frames that meet all requirements of this specification may submit for approval.

2.2 MATERIALS

- A. Cold-Rolled or Hot-Rolled Steel Sheet: ASTM A 1008, ASTM A 1011, Commercial Steel (CS); free of scale, pitting, or defects; pickled and oiled.
- B. Galvanized Steel Sheet: Hot-dip galvanized according to ASTM A 653, Commercial Steel (CS); with A60 or G60, zinc-coated carbon steel coating designation, mill phosphatized.
- C. Reinforcement: ASTM A36.
- D. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153.
- E. Inserts, Bolts, and Fasteners: Galvanized or cadmium plated.
 - 1. Bolts and Nuts: ASTM A307, Grade A.
 - 2. Machine Screws: FS FF-S-92, Type III cross-recessed, Design I or II recess, Style 2c flat head; carbon steel.
- F. Silencers: Provide per SECTION 08 71 00 - DOOR HARDWARE; drill holes.
- G. Sealant: Refer to SECTION 07 92 00 - JOINT SEALANTS.
- H. Primer: Fast-curing, lead- and chromate-free, corrosion inhibitive, modified-alkyd primer. Primer must be certified to pass 200 hours salt spray test per ASTM D2247 and 500-hour humidity test per ASTM B117. Verify compatibility with paint top coats. Refer to SECTION 09 90 00 - PAINTING AND COATING.
- I. Concrete Grout: Refer to SECTION 03 30 00 - CONCRETE.

2.3 DOORS

- A. General: Fabricate to size, type and design shown, fabricated with smooth surfaces and seamless, vertical edges. Welds shall be ground and filled. Weld marks visible after finish paint are not acceptable.
- B. Design: As indicated.
- C. Door Construction: 16 gage steel sheet faces with steel-stiffened core.
 - 1. Non-Rated Core: Commercial hollow metal doors, Type A per HMMA 810 and HMMA 861. Fill doors with fiberglass batts to eliminate metallic ring.

2. Fire Core: Commercial hollow metal doors per HMMA 850 and HMMA 861. Fill doors with mineral wool or equivalent fire retardant material to provide indicated ratings and to eliminate metallic ring.
 3. Reinforcing: Steel stiffeners per HMMA 861; at 6 inches on center.
 4. Vertical Edges for Double-Acting Doors: Round vertical edges, each with 1/8-inch radius.
 5. Top Edge: Closed with minimum 16 gage inverted channel and continuous 16 gage flush channel per HMMA 861.
 6. Bottom Edge: Closed with standard inverted minimum 16 gage channel per HMMA 861.
- D. Hardware Reinforcement:
1. Hinges and pivots: 7 gage (minimum 0.167 inch thick), by 1-1/2 inches wide by 6 inches longer than hinge, securely welded in place. Alternatively, provide continuous 12 gage channel punched for thread depth equivalent to 7 gage.
 2. Lock Face, Flush Bolts, Closers, and Concealed Holders: 12 gage (minimum 0.093 inch thick).
 3. All Other Surface-Mounted Hardware: 16 gage (minimum 0.067 inch thick).
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Visible Light Frames:
1. Acceptable Manufacturers:
 - a. Anemostat Door Products Division of the Dynamics Corporation of America.
 - b. Air Louvers, Inc.
 2. Alternate Manufacturers: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
 3. Louvers: Model No. AFDL.
 4. Visible Light Frames: Model No. LoPro; glass and glazing per SECTION 08 80 00 - GLAZING and as shown.
 5. Fasteners: Manufacturer's standard; countersunk Phillip screws.
- G. Astragals: 1/8 inch x 2 inch steel, specifically for double doors. Secure with flat head screws at 6 inches on center and 1 inch from each end.

2.4 FRAMES - KNOCK DOWN

- A. General: Commercial hollow metal frames per HMMA 820 and HMMA 861.
- B. Fire Rated: Commercial hollow metal frames per HMMA 850 and HMMA 861.
- C. Exterior Frames: 16 gage galvanized steel sheet.
- D. Interior Frames: 16 gage.
- E. Hardware Reinforcement: Per HMMA 820.
 1. Hinges: Minimum 0.167 inch (7 gage) thick by 1-1/2 inches wide by 10 inches long, securely welded in place.

2. Pivots: Minimum 0.167 inch (7 gage) thick by 1-1/2 inches wide by 10 inches long, securely welded in place.
3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.093 inch (12 gage) thick.
4. All Other Surface-Mounted Hardware: Minimum 0.093 inch (12 gage) thick.

2.5 FABRICATION

- A. General: Fabricate hollow metal doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow Metal Doors:
 1. Exterior Doors: Provide filler channel and seal watertight per HMMA 861. Seal joints in top edge of doors against water penetration. Provide closure channel with openings in bottom edge to permit moisture escape.
 2. Fire Rated Doors: Permanently attach fire-rating label identifying UBC Standard 7-2 compliance to each door unit. Apply label to top of door to prevent concealment under continuous hinges.
 3. Flush Panels: Fabricate as specified for flush doors. Prepare panels for concealed support and anchorage.
 4. Glazed and Louvered Openings: As shown.
 5. Electrical Requirements: Make provisions for installation of electrical items specified under SECTION 08 71 00 - DOOR HARDWARE and other applicable Sections.
- C. Hollow Metal Frames: Knock Down (no welded frames).
 1. Applied Stops: Rolled steel shape, mitered corners, continuous to floor, prepared for countersunk or flat head exposed tamper resistant screws and bolts for exposed fasteners, unless otherwise indicated.
 2. Sanitary Stops: Where sanitary stops are shown for on drawings, terminate door stops 6 inches above finished floor and close at 45 degree angle.
 3. **Removable** Mullions at Double Doors: If scheduled. Same profile as jamb.
 4. Fire Rated Frames: Permanently attach metal fire-rating label identifying UBC Standard 7-2 compliance. Apply label to frame head to prevent concealment by continuous hinges.
 5. Jamb Anchors: Fabricate 16 gage x 2 inch wide anchors of same material used for door frames. Weld all anchors to frame.
 6. Provide number and spacing of anchors per as shown.
 - a. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
 - b. Single-Door Frames and Mullions of Double Doors: Drill stop in strike jamb to receive three door silencers equally spaced on strike side.
 - c. Double-Door Frames: Drill stop in head jamb to receive 2 door silencers equally spaced.

- D. Hardware Preparation: Fabricate doors and frames with hardware reinforcement welded in place. Provide mortar guard boxes, where required.
- E. Stops: Refer to SECTION 08 80 00 - GLAZING.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify locations of slab block-outs for compliance with requirements for installation tolerances exterior frames and examine conditions of work in place before beginning work; report defects. Do not begin work in affected areas until defects are corrected.

3.2 PREPARATION

- A. Take field measurements; report variance between plan and field dimensions.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Fire Rated Openings: As shown; make manufacturer's installation instructions available to inspecting authorities.
- C. Frames: Set frames accurately in position; plumbed, aligned.
 - 1. At fire-protection-rated openings, install frames according to NFPA 80.
 - 2. Glazed Frames: Attach frames to structure to withstand 24 lbs. per square foot wind load normal to glass surface. Install per SECTION 08 80 00 - GLAZING.
 - 3. Anchors: Securely fasten to structure per mfg. installation instructions.
 - 4. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- D. Hollow Metal Doors: Match doors into their respective frames; install plumb, straight and square. Shim as necessary.
 - 1. Clearances: Threshold clearances as specified under SECTION 08 71 00 - DOOR HARDWARE.
 - 2. Non-Fire-Rated Hollow Metal Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.

- c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
- d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
- 3. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- 4. Smoke-Control Doors: Install doors according to UBC Standard 7-2.
- 5. Glazing: Coordinate installation of glazing per SECTION 08 80 00 - GLAZING. Mount frame with exposed fasteners on inside face of door.
- 6. Door Louvers: Per louver manufacturer's recommendation with tamper resistant fasteners.
- 7. Hardware: Refer to SECTION 08 71 00 - DOOR HARDWARE.
- E. Finish: Touch-up factory applied baked primer; refer to SECTION 09 90 00 - PAINTING AND COATING.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection.
- B. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- C. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 08 11 03

SECTION 08 14 00 WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes wood doors and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data and installation instructions.
- B. Samples: If specifically requested for specified products; required for alternate products.
- C. Certificates:
 - 1. General: Submit WI Certified Compliance Certificate for Installation.
- D. Closeout Submittals:
 - 1. Guarantee: Provide completed form.

1.4 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. California State Fire Marshal (CSFM): Standard 12-7-4.
 - 2. American Woodworking Institute: Architectural Woodwork Quality Standards
 - 3. Underwriters Laboratories (UL): UL 10B - Fire Tests of Door Assemblies.
 - 4. Warnock-Hersey (WH): Certification listings for fire doors.
 - 5. Woodwork Institute (WI): Manual of Millwork; Section 20.
- B. Labeled Doors: Conform to UBC Standard 7-2 and Underwriters Laboratory for labeled wood doors in fire-rated openings. Verify requirements for "S" label.
- C. Testing: 1 or more doors, of each type, may be selected at random from those delivered for testing. Those tested or cut apart will be used to determine compliance with specified requirements; noncompliance is basis for rejection of all of that kind and type of door delivered to the site. Acceptable doors used for testing will be replaced at Owner's expense.

1.5 GUARANTEE

- A. Provide manufacturer's warranty that products are to be free from defects in materials and workmanship for 2 years beginning at date of acceptance by Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Individually wrap or bag doors to protect finish during shipping and installation. Do not use packing materials that will stain or discolor door surface.

- B. Storage: Per WI Technical Bulletin No. 420-R for flush doors and No. 416-R for fire rated doors. Store materials under cover, in heated rooms and protected from damage, including exposure to excess humidity.

PART 2 - PRODUCTS

2.1 WOOD DOORS

- A. General: Conform to WI Custom Grade Standards.
- B. Acceptable Manufacturers:
 - 1. Architectural Series, as manufactured by Mohawk Flush Doors, Inc.
 - 2. Marshfield Door Systems, Inc.
 - 3. Algoma Hardwoods Inc.
 - 4. Western Oregon Door
 - 5. Or equivalent.
- C. Flush Type:
 - 1. Construction: 5-ply, solid core, hardwood edge-bands.
 - 2. Unrated and 20 Minute Core: Particleboard core.
 - 3. 45 minute and longer rating: Mineral core.
 - 4. Facing: Birch; white rotary cut.
 - 5. Adhesive: PS 51 Type I and II.

2.2 ACCESSORIES

- A. Acceptable Manufacturers:
 - 1. Air Louvers, Inc.
 - 2. Anemostat Door Products, a Mestek Company.
 - 3. L & L Louver.
 - 4. Or equivalent.
- B. Louvers:
 - 1. Model 1500A, as manufactured by Air Louvers, Inc.
 - 2. Model PLSL, as manufactured by Anemostat Door Products.
 - 3. Model SZ-70A, as manufactured by L & L Louver.
- C. Vision Light Frames:
 - 1. Slimline Model, as manufactured by Air Louvers, Inc.
 - 2. LoPro Model, as manufactured by Anemostat Door Products.
 - 3. Model STF-B1-LP, as manufactured by L & L Louver.
 - 4. Glass and Glazing: Per SECTION 08 80 00 - GLAZING; as shown.

- D. Fasteners: Manufacturer's standard; tamperproof.
- E. Transom Panels: Same construction as flush type doors.
- F. Flush Full or Half Glazed Doors: Same construction as flush type doors; stile and rail glued block core with edge bands all sides.
- G. Stile and Rail Doors:
 - 1. Construction: 1-3/4 inch thick Douglas Fir; solid lumber construction.
 - 2. Top Rail: Minimum 5 inches wide.
 - 3. Adhesive: PS 51 Type I and II.
- H. Fire Rated Doors: Permanently attach "S" label identifying UBC Standard 7-2 compliance. To avoid concealment, attach label to top of doors with continuous hinges.
- I. Finish: Factory Finish
- J. Colors: Refer to SECTION 09 90 00 - PAINTING AND COATING.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify that door frames are the type required for door and are properly installed. Install fire rated doors only in corresponding fire rated frames.

3.2 PREPARATION

- A. Take field measurements; report variance between plan and field dimensions.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified. Make manufacturer's instructions available to the inspecting authorities.
- B. Tolerances:
 - 1. Maximum distortion measured with straight edge or taught string, corner to corner, over an imaginary 36-inch x 84-inch surface area.
 - 2. Diagonal (Warp), Vertical (Bow) and Width (Cup): 1/8 inch.
 - 3. Fit doors to specified clearances; do not trim job fitted doors more than 1/4 inch from any edge.
- C. Fire Rated Doors: Securely attach UL certified installation instructions to each door.
- D. Hardware: Per SECTION 08 71 00 - DOOR HARDWARE.
- E. Glazing: Per SECTION 08 80 00 - GLAZING.
- F. Protection: To the extent possible, maintain integrity of factory protective wrapping until final inspection.

3.4 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 08 214 00

SECTION 08 16 13 FIBERGLASS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes fiberglass reinforced polyester (FRP) flush doors and related work as shown and specified.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.
- B. Thermal Transmission for Exterior Doors: U-Value per AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections. Maximum of 0.29 BTU/hr x sf x degrees F. Minimum CRF value of 55.
- C. Impact Strength: FRP Doors and Panels, Nominal Value, ASTM D256: 15.0 foot-pounds per inch of notch.
- D. Tensile Strength: FRP doors and panels, nominal value, ASTM D638: 14,000 psi.
- E. Flexural Strength: FRP doors and panels, nominal value, ASTM D790: 21,000 psi.
- F. Water Absorption: FRP doors and panels, nominal value, ASTM D570: 0.20% after 24 hours.
- G. Indentation Hardness: FRP doors and panels, nominal value, ASTM D2583: 55.
- H. Abrasion Resistance: Face sheet, taber abrasion test, 25 cycles at 1,000 gram weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.
- I. Stain Resistance: ASTM D1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Superficial change (stain removed easily with mild abrasive or FRP cleaner) when exposed to Sharpie, ink pen and white spray paint.
- J. Chemical Resistance: ASTM D543; excellent rating
 - 1. Acetic acid, 5%.
 - 2. Chlorine bleach, 10% solution.
 - 3. Sodium hypochlorite, 4 to 6% solution.
 - 4. Citric acid, 10% solution.
 - 5. Sodium Carbonate Solution, 20%.
 - 6. Turpentine.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.

- B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, finish, options, and accessories.
- C. Samples: Submit manufacturer's sample of door showing face sheets, core, framing, finish, options, and accessories. Provide full range of available colors for each material submitted.
- D. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.
- E. Closeout Submittals:
 - 1. O & M Manuals: Operation, adjustment, maintenance and cleaning instructions.
 - 2. Guarantee: Provide completed form.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain door and frame components from a single manufacturer.
- B. Fire-Test-Response Characteristics: Per ASTM E84; Class A on interior faces of FRP exterior panels and both faces of FRP interior panels.
 - 1. Flame Spread: Maximum of 25.
 - 2. Smoke Developed: Maximum of 450.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening, door mark, and manufacturer.
- B. Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening, door mark, and manufacturer.

1.7 GUARANTEE

- A. Provide warranty on manufacturer's form that products are to be free from defects in materials and workmanship for 10 years beginning at date of acceptance by Owner. Warrant door, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

PART 2 - PRODUCTS

2.1 FRP FLUSH DOORS

- A. Acceptable Products:
 - 1. Model No. SL-17 Flush Doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets, as manufactured by Special-Lite, Inc.
 - 2. Or equivalent.
- B. Construction:
 - 1. Stiles and Rails: Aluminum Alloy 6063-T5, minimum of 2-5/16-inch depth.

2. Corners: Mitered.
 3. Joinery: Provide 3/8-inch diameter full-width tie rods through extruded splines top and bottom as standard tubular shaped stiles and rails reinforced to accept hardware as specified.
 4. Securing Internal Door Extrusions: 3/16 inch angle blocks and hex-type aircraft nuts for joinery. Welds, glue, or other methods are not acceptable.
 5. Stiles and Rails: Furnish 0.125-inch tubular extruded stiles and rails with integral reglets to accept face sheet and lock it into place to permit flush appearance.
 6. Rail caps or other face sheet capture methods: Not acceptable.
 7. Rail Legs: Extrude top and bottom rail legs for interlocking continuous weather bar. Lock face sheet in place with extruded interlocking edges flush with rails and stiles.
 8. Meeting Stiles: Nylon brush weatherstripping. Extrude meeting stile to include integral pocket to accept nylon brush.
 9. Bottom of Door: Install bottom weather bar, with nylon brush weatherstripping, into extruded interlocking edge of bottom rail.
- C. Face Sheet:
1. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface.
 2. Texture: Pebble.
 3. Color: **See Color Schedule on Plans.**
- D. Core:
1. Material: Poured-in-place polyurethane foam.
 2. Density: Minimum of 5 pounds per cubic foot.
 3. R-Value: Minimum of 11.
- E. Cutouts: Manufacture doors with cutouts for required visible lites, louvers, and panels. Factory install visible lites, louvers, and panels.
- F. Hardware: Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule. Factory install hardware and provide Owner with all adjustment tools.

2.2 MATERIALS

- A. Aluminum Members:
1. Extrusions: ASTM B221.
 2. Sheet and Plate: ASTM B209.
 3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.
- B. Fasteners:
1. Material: Aluminum, nonmagnetic stainless steel, or other non-corrosive metal.
 2. Compatibility: Compatible with items to be fastened.

3. Exposed Fasteners: Screws with finish matching items to be fastened.

2.3 FABRICATION

- A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements as shown.
- B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.
- C. Assembly: Complete cutting, fitting, forming, drilling, and grinding of metal before assembly. Remove burrs from cut edges.
- D. Welding: Welding of doors or frames is not acceptable.
- E. Fit:
 1. Maintain continuity of line and accurate relation of planes and angles.
 2. Secure attachments and support at mechanical joints with hairline fit at contacting members.

2.4 VISIBLE LITES

- A. Glazing: 1/4-inch glass; factory installed.
- B. Lites in Exterior Doors: Allow for thermal expansion.
- C. Rectangular Lites:
 1. Size: As shown.
 2. Glazed with screw-applied aluminum stops anodized to match perimeter door rails.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Install doors plumb, level, square, true to line, and without warp or rack.
- C. Anchor frames securely in place.
- D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.
- E. Set thresholds in bed of mastic and backseal.
- F. Install exterior doors to be weathertight in closed position.
- G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

- H. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.
- B. Upon completion, demonstrate testing in the presence of the Owner and provide a staff training session.

3.5 ADJUSTING

- A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.6 CLEANING

- A. Clean doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that would damage finish.

3.7 PROTECTION

- A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END SECTION 08 16 13

SECTION 08 17 43 FIBERGLASS REINFORCED POLYESTER (FRP) DOOR FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass reinforced polyester (FRP) frames.

1.2 RELATED SECTIONS

- A. SECTION 08 71 00 - DOOR HARDWARE.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

1.4 SUBMITTALS

- A. Comply with SECTION 01 33 00 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.
- C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, and finish.
- D. Samples:
 - 1. Frame: Submit manufacturer's sample of door frame.
 - 2. Color: Submit manufacturer's samples of standard colors of frames.
- E. Warranty: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Continuously engaged in manufacturing of frames of similar type to that specified, with a minimum of 25 years successful experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finish from damage during handling and installation.

1.7 WARRANTY

- A. Warrant frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
- B. Warranty Period: Ten years starting on date of shipment. In addition, a limited lifetime (while the frame is in its specified application in its original installation) warranty covering: failure due to corrosion

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Universal Pultrusions, LLC, (870) 448-4406. Fax (870) 448-5120. www.universalpultrusions.com
- B. Or equivalent.

2.2 FRP FRAMING SYSTEMS

- A. Framing:
 - 1. Size and Type: As indicated on the Drawings.
 - 2. Materials: ¼" thick solid pultruded FRP profiles having no corrosive components or reinforcement.
 - 3. Width: 2" face.
 - 4. Depth: 5 ¾".
 - 5. Assembly: One piece chemically welded at factory.
 - 6. Door Stop: 5/8" x 2 ¼".
 - 7. Corner Construction: Mitered with 4" x 4" x 3/8" pultruded FRP angle reinforcement with interlocking pultruded FRP brackets.
 - 8. Reinforcing: ¼" pultruded FRP chemically welded at all hinge, strike and closer locations.
 - 9. Transom and Sidelites: Shall be same material as perimeter frame with removable stop for glass by others.
 - 10. Anchors: Furnished with type as specified on drawings.
 - 11. Fasteners for reinforcing: 18-8 Stainless Steel.

2.3 HARDWARE

- A. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
- B. Hardware Schedule: As specified in SECTION 08 71 00 - DOOR HARDWARE.

2.4 VISION LITES

- A. Factory Applied Stop for Glazing: 1/4-inch tempered glass]
- B. Lite Size:
 - 1. Size: As indicated on the Drawings.

2.5 FINISH

- A. Finish for Doors and Frames: Primer with a finished color coat.
 - 1. Painted Finish: Two-part aliphatic polyurethane, low VOC, Industrial Coating.
 - 2. Thickness: 5 mils
 - 3. Sheen: Gloss

4. Impact Resistance per ASTM D 2794: 140 in lbs.
5. Gel-Coat not allowed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION

- A. Anchor frames securely in place.
- B. Set thresholds in bed of mastic and backseal.
- C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- D. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.5 ADJUSTING

- A. Adjust frames, hinges, and locksets for smooth operation without binding.

3.6 CLEANING

- A. Clean frames promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that would damage finish.

3.7 PROTECTION

- A. Protect installed frames to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END SECTION 08 17 43

SECTION 08 31 00 ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.
- B. Refer to DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) and DIVISION 26 – ELECTRICAL for access doors and panels required for access to concealed mechanical and electrical equipment.

1.2 SUMMARY

- A. This Section includes access doors and panels and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: For each product listed. Include installation details, instructions, and fastenings.
- B. Closeout Submittals:
 - 1. Manuals: Maintenance instructions.
 - 2. Guarantee: Provide completed form.

1.4 GUARANTEE

- A. Provide in required form for a period of **2 years** from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 ACCESS DOORS IN FRAMED WALLS AND CEILINGS

- A. General:
 - 1. Basis-of-Design: Details shown are based on the basis-of-design products identified below. The alternative products listed may require changes in the work or additional work to fit or accommodate adjacent work or to comply with alternate manufacturer's installation instructions. By submitting alternative products Contractor assumes responsible for any costs, delays, additional work, or design changes necessary to properly provide and install alternatives.
 - 2. Locks: All doors shall have key operated cylinder locks. Coordinate keying of electrical and mechanical access doors so that all access doors are keyed alike. Furnish two keys per lock.
 - 3. Door size: As shown
- B. Access Door in Gypsum Board
 - 1. Locations: Use at painted gypsum board walls and ceilings
 - 2. Basis of Design: Model No. DW, as manufactured by Milcor LP.
 - 3. Acceptable Alternative Products:
 - a. Model WB, as manufactured by J.L. Industries.
 - b. Model L-DWR, as manufactured by Larsen's Manufacturing Company.

- C. Access Door, Stainless Steel:
 - 1. Locations: Use at walls and ceilings with vinyl wall covering or other pre-finished materials such as ceramic tile or acoustical tile.
 - 2. Basis of Design: Model No. MS, as manufactured by Milcor LP, surface mounted.
 - 3. Acceptable Alternative Products
 - a. Model TMS manufactured by J.L. Industries.
 - b. Model L-MPSS manufactured by Larsen's Manufacturing Company.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects. Do not begin related work until defects are corrected.
- B. Verify that door locations shown will provide access intended.

3.2 PREPARATION

- A. Take field measurements; report variance between plan and field dimensions.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Coordinate with framing and finish trades for proper door location and sequence of construction.

3.4 ADJUSTMENT

- A. Prior to acceptance, adjust moveable parts to assure smooth operation.

3.5 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 08 31 00

SECTION 08 41 13 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes aluminum entrance and storefront and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Aluminum Entrance and Storefront: None required for specified products; required for alternate products.
- B. Shop Drawings: Submit manufacture and installation details, including fastenings, for review.
- C. Samples:
 - 1. Aluminum Entrance and Storefront: If specifically requested for specified products; required for alternate products. Submit manufacturer's standard colors.
- D. Certificates: Storefront shall bear a permanently installed "AAMA Prime and Replacement Label" bearing the manufacturers name, product series number, grade and class designations. Do not install label in exposed location.
- E. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
- F. Closeout Submittals:
 - 1. O & M Manuals: Maintenance instructions.
 - 2. Guarantee: Provide completed form.

1.4 QUALITY ASSURANCE

- A. Design Requirements: Aluminum frame members must span vertically to withstand 25 pounds per square foot wind load, minimum, per CBC; provide internal reinforcing as required; maximum deflection of L/175 of clear span or maximum of 3/4 inch.
- B. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.

1.5 GUARANTEE

- A. Aluminum Entrance and Storefront: Provide manufacturer's warranty that products are to be free from defects in materials and workmanship for 3 years beginning at date of acceptance by Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect prefinished components with wrapping or stripable coating; adhesive papers and sprayed coatings are not acceptable.

1.7 PROJECT CONDITIONS

- A. Do not install sealants when temperature is less than 40 degrees F.

PART 2 - PRODUCTS

2.1 ALUMINUM ENTRANCE AND STOREFRONT (ALST)

- A. Acceptable Products:
 - 1. 4" Window Wall with Center Glazing, as manufactured by:
 - 2. U.S. Aluminum Systems.
 - 3. Traco Co., Inc.
 - 4. Vistawall Architectural Products.
 - 5. Kawneer.
 - 6. Or equivalent.
- B. Alternate Products: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- C. Doors:
 - 1. Manufacturer's monumental wide style, wide rail, with 12-inch bottom rail style.
 - 2. Hardware: Per SECTION 08 71 00 - DOOR HARDWARE; mohair pile weatherstripping where required.
 - 3. Finish: Match Existing; Confirm Color in Field
- D. Glass: As shown; refer to SECTION 08 80 00 - GLAZING.
- E. Fasteners: As recommended by manufacturer to meet wind pressures shown.
- F. Protective Coatings:
 - 1. General: Bituminous, FS TT-C-494, Type II.
 - 2. Gasketing: Chromate type.
- G. Sealant: Refer to SECTION 07 92 00 - JOINT SEALANTS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Take field measurements; report variance between plan and field dimensions.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

- B. Storefront:
1. Install level, plumb, straight and aligned with adjacent surfaces, with hairline watertight joints; free of dents, buckles, twists, or other imperfections, as shown. Install flashings where shown.
 2. Anchor to adjacent structure; permit sufficient adjustment to accommodate construction tolerances and other irregularities. Use No. 12 sheet metal screws or wood screws at 18 inches on center with a minimum of 2 inches penetration into structure.
 3. Tolerances: Maximum variation from plumb of 0.06 inch every 3'-0" non-cumulative or 1/16 inch per 10'-0", whichever is less. Maximum misalignment of 2 adjoining members abutting in plane of 1/32 inch.
 4. Thermal Isolation: Provide where components penetrate or disrupt building insulation. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- C. Glazing:
1. General: As specified under SECTION 08 80 00 - GLAZING.
 2. Glazing Stops: Anchor glass holding assemblies with frame clips and machine screws.
- D. Doors:
1. Hang doors level, plumb, straight in vertical plane, with proper fit and alignment and moving parts operating freely without bind.
 2. Weatherstripping: Seal doors, meeting stiles of pairs of doors, door tubing, and stops on frames and astragals.
 3. Thresholds: Set in bed of sealant and secure.
 4. Hardware: Per SECTION 08 71 00 - DOOR HARDWARE.
- E. Dissimilar Materials: Isolate from other metals, plaster or concrete.
- F. Sealant: Install per SECTION 07 92 00 - JOINT SEALANTS.

3.4 ADJUSTING

- A. Prior to acceptance, adjust moveable parts to assure smooth operation.

3.5 CLEANING

- A. Remove protective covering per manufacturer's instructions.
- B. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- C. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 08 41 13

SECTION 08 56 19 PASS WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes pass through windows and related work as shown and specified.

1.3 PERFORMANCE REQUIREMENTS

- A. Requirements: Design and size units to withstand dead and live loads produced by wind pressure acting normal to plane of wall, calculated in accordance with CBC to a design pressure of 24 lbs. per square foot.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data and installation instructions.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.
- C. Samples: Provide full range of available colors for each material submitted.
- D. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.5.
- E. Closeout Submittals:
 - 1. O & M Manuals: Maintenance and cleaning instructions.
 - 2. Guarantee: Provide completed form.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.

1.6 GUARANTEE

- A. Provide in required form for a period of **1 year** from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 PASS THROUGH INTERIOR WINDOW, SLIDING (PTIW)

- A. Acceptable Products:
 - 1. Series 600, as manufactured by Torrance Aluminum Windows.
 - 2. Climate Shield Series, as manufactured by Mercer Industries, Inc.
 - 3. Or equivalent.

- B. Horizontal Sliding: Configuration and sizes as shown.
- C. Lock: **Standard**.
- D. Glazing: 1/4-inch tempered **Lexan**.
- E. Finishes: **Clear anodized** aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Take field measurements before fabrication; report variance between plan and field dimensions.
- B. Environmental Requirements: Do not install sealants when temperature falls below 40 degrees F.
- C. Protection: Protect pre-finished surfaces with wrapping or strippable coating; do not use adhesive papers or sprayed coatings. Maintain labels and protect glass until final acceptance.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Align window plumb and level, free of warp or twist. Attach window frame to perimeter opening in manner to accommodate construction tolerances and other irregularities. Maintain dimensional tolerances; align with adjacent work.
- C. Tolerances: Maximum variation from level or plumb of 0.06 inches every 3'-0" non-cumulative.
- D. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- E. Install hardware per manufacturer's instructions.
- F. Install glass per SECTION 08 80 00 - GLAZING.
- G. Install sealant per SECTION 07 92 00 - JOINT SEALANTS; apply as shown, make installation fully watertight.
- H. Separate concealed aluminum surfaces in contact with ferrous metals, concrete, masonry or plaster with bituminous coating compound.

3.4 ADJUSTING

- A. Prior to acceptance, adjust moveable parts to assure smooth operation.

3.5 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 08 56 19

SECTION 08 62 00 UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes unit skylights and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details and attachments to other Work.
- C. Samples: Submit 2 minimum 2 x 2-inch samples for each color specified
- D. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
- E. Closeout Submittals:
 - 1. O & M Manuals: Operation and maintenance instructions.
 - 2. Guarantee: Provide completed form.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.

1.5 GUARANTEE

- A. Provide manufacturer's warranty that products are to be free from defects in materials and workmanship for 2 years beginning at date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 TUBULAR SKYLIGHTS

- A. Acceptable Products: Soaltube as manufactured by Solatube International, Inc.
- B. Solamaster 750 DS with transition accessories.
- C. Or equivalent.
- D. Diffuser: Prismatic Diffuser.
- E. Length: As shown.
- F. Fasteners: As shown.
- G. Protective Coating: FS TT-C-494, Type II.
- H. Sealant: Refer to SECTION 07 92 00 - JOINT SEALANTS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Take field measurements; report variance between plan and field dimensions.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Skylights:
 - 1. Install to established lines and levels; shim curb as required, anchor to structure and make watertight. Provide continuous bead of sealant between frame and curb.

3.4 FIELD QUALITY CONTROL

- A. Perform NAAMM Standard FC-1, Water Penetration Test after erection.

3.5 ADJUSTING

- A. Prior to acceptance, adjust moveable parts to assure smooth operation.

3.6 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 08 62 00

SECTION 08 71 00 DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions of DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. This Section includes the following, but is not necessarily limited to:
 - 1. Door Hardware, including electric hardware.
 - 2. Storefront and Entrance door hardware.
 - 3. Low-energy door operators plus sensors and actuators.
 - 4. Thresholds, gasketing and weather-stripping.
 - 5. Door silencers or mutes.
- C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.
 - 1. DIVISION 8 – OPENINGS, SECTION 08 11 03 - STEEL DOORS AND FRAMES.
 - 2. DIVISION 8 – OPENINGS, SECTION 08 14 00- WOOD DOORS.
 - 3. DIVISION 8 – OPENINGS, SECTION 08 16 13 - FIBERGLASS DOORS
 - 4. DIVISION 8 – OPENINGS, SECTION 08 17 43 - FIBERGLASS REINFORCED POLYESTER (FRP) DOOR FRAMES.
 - 5. DIVISION 8 – OPENINGS, SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.

1.3 REFERENCES (USE DATE OF STANDARD IN EFFECT AS OF BID DATE)

- A. 2010 California Building Code, CCR, Title 24.
- B. BHMA – Builders' Hardware Manufacturers Association
- C. DHI – Door and Hardware Institute
- D. NFPA - National Fire Protection Association.
 - 1. NFPA 80 - Fire Doors and Other Opening Protectives
 - 2. NFPA 105 - Smoke and Draft Control Door Assemblies
- E. UL - Underwriters Laboratories.
 - 1. UL 10C - Fire Tests of Door Assemblies
 - 2. UL 305 - Panic Hardware

- F. WHI - Warnock Hersey Incorporated
- G. SDI - Steel Door Institute

1.4 SUBMITTALS & SUBSTITUTIONS

- A. A. General: Submit in accordance with Conditions of the Contract and DIVISION 1 Specification sections.
- B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- C. Submit six (6) copies of schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
 - 1. Include a Cover Sheet with;
 - a. Job Name, location, telephone number.
 - b. Architects name, location and telephone number.
 - c. Contractors name, location, telephone number and job number.
 - d. Suppliers name, location, telephone number and job number.
 - e. Hardware consultant's name, location and telephone number.
 - 2. Job Index information included:
 - a. Numerical door number index including; door number, hardware heading number and page number.
 - b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
 - c. Manufacturers' names and abbreviations for all materials.
 - d. Explanation of abbreviations, symbols, and codes used in the schedule.
 - e. Mounting locations for hardware.
 - f. Clarification statements or questions.
 - g. Catalog cuts and manufacturer's technical data and instructions.

3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number – HW -1)					
			(a) 1 Single Door #1 - Exterior from Corridor 101	(b) 90°	(c) RH
			(d) 3' 0"x7' 0" x 1-3/4" x (e) 20 Minute (f) WD x HM		
(g) 1	(h)	(i) ea	(j) Hinges - (k) 5BB1HW 4.5 x 4.5 NRP (l) ½ TMS	(m) 626	(n) IVE
2	6AA	1 ea	Lockset - ND50PD x RHO x RH x 10-025 x JTMS	626	SCH

- (a) - Single or pair with opening number and location.
- (b) - Degree of opening.
- (c) - Hand of door(s).
- (d) - Door and frame dimensions and door thickness.
- (e) - Label requirements if any.
- (f) - Door by frame material.
- (g) - (Optional) Hardware item line #.
- (h) - Keyset Symbol.
- (i) - Quantity.
- (j) - Product description.
- (k) - Product Number.
- (l) - Fastenings and other pertinent information.
- (m) - Hardware finish codes per ANSI A156.18.
- (n) - Manufacture abbreviation.

- D. Make substitution requests in accordance with DIVISION 1. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.
- E. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.
- F. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- G. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- H. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.
- I. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.

1.5 QUALITY ASSURANCE

- A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that

employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

1. Responsible for detailing, scheduling and ordering of finish hardware.
 2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing.
 3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.
- D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".
- E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.
- B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.
- C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.
- D. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

1.7 WARRANTY

- A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
 1. Locksets: Ten (10) years.
 2. Electronic Locks: One (1) year.
 3. Closers: Ten (10) years, except electronic closers shall be two (2) years.
 4. Exit devices: Three (3) years.
 5. All other hardware: Two (2) years.

1.8 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.9 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference at least one week prior to beginning work of this section.
- B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, and Project Inspector.
- C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitutes</u>
A. Hinges	Ives	Hager, Stanley, McKinney
B. Locks, Latches& Cylinders	Schlage	Or Approved Equal
C. Exit Devices	Von Duprin	Or Approved Equal
D. Closers	LCN	Or Approved Equal
E. Push, Pulls& Protection Plates	Ives	Trimco, BBW, DCI
F. Flush Bolts	Ives	Trimco, BBW, DCI
G. Dust Proof Strikes	Ives	Trimco, BBW, DCI
H. Coordinators	Ives	Trimco, BBW, DCI
I. Stops	Ives	Trimco, BBW, DCI
J. Overhead Stops	Glynn-Johnson	Or Approved Equal
K. Thresholds	National Guard	Pemko, Zero
L. Seals & Bottoms	National Guard	Pemko, Zero

2.2 MATERIALS

- A. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
 - 1. Hinges shall be sized in accordance with the following:
 - a. Height:
 - i. Doors up to 41" wide: 4-1/2" inches.
 - ii. Doors 42" to 48" wide: 5 inches.
 - b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
 - c. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
 - 2. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.
- B. Continuous Hinges: As manufactured by Ives, an Ingersoll-Rand Company. UL rated as required.

- C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Sparta" design, fastened with through-bolts and threaded chassis hubs.
1. Locksets to comply with ANSI A156.2, Series 4000, Grade 1; tested to exceed 3,000,000 cycles. Locksets shall meet ANSI A117.1, Accessible Code.
 2. Chassis: One piece modular assembly and multi-functional allowing function interchange without disassembly of lockset.
 3. Spindle shall be deep-draw manufactured not stamped. Spindle and spring cage to be one-piece integrated assembly.
 4. Anti-rotation plate to be interlocking to the lock chassis. Lock design utilizing bit-tabs are not acceptable.
 5. Lever Trim: Accessible design, bi-directional, independent assemblies.
 6. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.
 7. Thru-bolts to secure anti-rotation plate without sheer line. Fully threaded thru-bolts are not acceptable.
 8. Spring cage to have double compression springs. Manufacturers utilizing torsion springs are not acceptable.
 9. Latchbolt to be steel with minimum ½" throw deadlatch on keyed and exterior functions; ¾" throw anti-friction latchbolt on pairs of doors.
 10. Strikes: ANSI curved lip, 1-1/4" x 4-7/8", with 1" deep dust box (K510-066). Lips shall be of sufficient length to clear trim and protect clothing.
- D. Exit devices: Von Duprin as scheduled.
1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
 2. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
 3. Mechanism case shall have an average thickness of .140".
 4. Compression spring engineering.
 5. Non-handed basic device design with center case interchangeable with all functions.
 6. All devices shall have quiet return fluid dampeners.
 7. All latchbolts shall be deadlocking with ¾" throw and have a self-lubricating coating to reduce friction and wear.
 8. Device shall bear UL label for fire and or panic as may be required.
 9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
 10. All Exit Devices to be sex-bolted to the doors.
 11. Panic Hardware shall comply with CBC Section 1008.1.9 and shall be mounted between 30" and 44" above the finished floor surface. The unlatching force shall not exceed 15 lbs. applied in the direction of travel.

- E. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.
1. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
 2. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
 3. All parallel arm closers shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16" steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
 4. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
 5. Closers shall be installed to permit doors to swing 180 degrees.
 6. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.
 7. Provide the manufactures drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed.
 8. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. Door shall take at least 3 seconds to move from an open position of 70 degrees to a point of 3 inches from the latch jamb.
 9. Provide sex-bolted or through bolt mounting for all door closers.
- F. Flush Bolts & Dust Proof Strikes: Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.
1. Manual flush bolts only permitted on storage or mechanical openings as scheduled.
 2. Provide dust proof strikes at openings using bottom bolts.
- G. Door Stops:
1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.

2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 1133B.8.6).
 3. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- H. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.
- I. Thresholds: As Scheduled and per details.
1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
 2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in DIVISION 7 – THERMAL AND MOISTURE PROTECTION.
 3. Use ¼" fasteners, red-head flat-head sleeve anchors (SS/FHSL).
 4. Thresholds shall comply with CBC Section 1133B.2.4.1.
- J. Seals: Provide silicone gasket at all rated and exterior doors.
1. Fire-rated Doors, Resilient Seals: UL10C Classified complies with NFPA 80 & NFPA 252. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
 2. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C Classified complies with NFPA 80 & NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required.
 3. Smoke & Draft Control Doors, Provide UL10C Classified complies with NFPA 80 & NFPA 252 for use on "S" labeled Positive Pressure door assemblies.
- K. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.
- L. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.3 KEYING

- A. Furnish a masterkey system as directed by the Owner or Architect. Key system to be designated and combined by the Schlage Master Key Department even if pinned by the Authorized Key Center, Authorized Security Center or a local authorized commercial dealer.
- B. A detailed keying schedule is to be prepared by the Owner and/or Architect in consultation with a representative of Ingersoll Rand Security Consultants or an Authorized Key Center or Authorized Security Center. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.
- C. Establish a new masterkey system for this project as directed by the keying schedule.
- D. D. Furnish all cylinders in the Schlage conventional style except the exit device and removable mullion cylinders which will be supplied in Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI).
- E. Furnish Patent Protected Schlage keys and cylinders on all locks.

- F. Furnish construction keying for doors requiring locking during construction.
- G. Furnish mechanical keys as follows:
 - 1. Furnish 2 cut change keys for each different change key code.
 - 2. Furnish 1 uncut key blank for each change key code.
 - 3. Furnish 6 cut masterkeys for each different masterkey set.
 - 4. Furnish 3 uncut key blanks for each masterkey set.
 - 5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
 - 6. Furnish 1 cut control key cut to each SKD combination.
- H. Furnish Key System Management Software (SM01-287 Windows on CD)
- I. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.

2.4 FINISHES

- A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
- B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.
- C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.
- D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.5 FASTENERS

- A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
- B. Screws for butt hinges shall be flathead, countersunk, full-thread type.
- C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
- D. Provide expansion anchors for attaching hardware items to concrete or masonry.
- E. All exposed fasteners shall have a phillips head.
- F. Finish of exposed screws to match surface finish of hardware or other adjacent work.
- G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.

- C. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that only the manufacturer's furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives) 2007 Edition. A written record shall be maintained and transmitted to the Owner to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.

3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
- B. Use the templates provided by hardware item manufacturer.
- C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 30" and 44" AFF.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.
- G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.
- H. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.
- I. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.
- J. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for in the Electrical Section.
- K. Conductors shall be minimum 18 gage stranded, multicolored. A minimum 12 in. loop of conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.
- L. If a power supply is specified in the hardware sets, all conductors shall be terminated in the power supply. Make all connections required for proper operation between the power supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacturer's technical documentation.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

- B. Clean adjacent surface soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE LOCATIONS

- A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled

3.5 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and it's installation have been furnished and installed in accordance with manufacturer's instructions and as specified herein.

3.6 SCHEDULE

- A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.
- B. The Door Schedule on the Drawings indicates which hardware set is used with each door.

Manufacturers Abbreviations (Mfr.)

GLY	=	Glynn-Johnson Corporation	Overhead Door Stops
IVE	=	Ives	Hinges, Bolts, Kick Plates, Door Stops & Silencers
LCN	=	LCN	Door Closers
NGP	=	National Guard Products	Thresholds, Gasketing & Weather-stripping
SCE	=	Schlage Electronics	Electronic Door Components
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices

SPEXTRA: 80103

HARDWARE GROUP 01

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

2	EA	CONT. HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	CD-9847-EO	626	VON
1	EA	PANIC HARDWARE	CD-9847-NL-OP-110MD	626	VON
2	EA	MORTISE CYLINDER	20-001 114 XQ11-947	626	SCH
1	EA	RIM CYLINDER	20-057	626	SCH
2	EA	90 DEG OFFSET PULL	8190 12" O	630	IVE
2	EA	OH STOP & HOLDER	100H	630	GLY
2	EA	SURFACE CLOSER	4111 AVB EDA	689	LCN
2	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	PER DETAIL	AL	NGP

WEATHER-STRIPPING FURNISHED WITH DOOR & FRAME ASSEMBLY

HARDWARE GROUP 02

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	CD-98-NL-OP-110MD	626	VON
1	EA	MORTISE CYLINDER	20-001 114 XQ11-947	626	SCH
1	EA	RIM CYLINDER	20-057	626	SCH
1	EA	DOOR PULL	VR910 NL	630	IVE
1	EA	OH STOP & HOLDER	100H	630	GLY
1	EA	SURFACE CLOSER	4111 AVB EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	SET	SEALS	5050CL	CLR	NGP
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	PER DETAIL	AL	NGP

HARDWARE GROUP 03

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	VANDL VESTIBULE LOCK	ND93PD SPA	626	SCH
1	EA	OH STOP & HOLDER	100H	630	GLY
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	PER DETAIL	AL	NGP

WEATHER-STRIPPING FURNISHED WITH DOOR & FRAME ASSEMBLY

HARDWARE GROUP 04

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL VESTIBULE LOCK	ND93PD SPA	626	SCH
1	EA	LOCK GUARD	LG13	630	IVE
1	EA	OH STOP & HOLDER	100H	630	GLY
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	SET	SEALS	5050CL	CLR	NGP
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	PER DETAIL	AL	NGP

HARDWARE GROUP 05

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96PD SPA	626	SCH
1	EA	LOCK GUARD	LG13	630	IVE
1	EA	OH STOP & HOLDER	100H	630	GLY
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	SET	SEALS	5050CL	CLR	NGP
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	PER DETAIL	AL	NGP

HARDWARE GROUP 06

PROVIDE EACH RU DOOR(S) WITH THE FOLLOWING:

1	EA	CYLINDER OR PADLOCK	VERIFY TYPE WITH DOOR MFR BALANCE OF HARDWARE BY DOOR MANUFACTURER	626	SCH
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HARDWARE GROUP 07

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

2	EA	CONT. HINGE	112HD	628	IVE
2	EA	PANIC HARDWARE	9847-L-996-17	626	VON
2	EA	RIM CYLINDER	20-057	626	SCH
2	EA	OH STOP & HOLDER	100H	630	GLY
2	EA	SURFACE CLOSER	4111 AVB EDA	689	LCN

WEATHER-STRIPPING FURNISHED WITH DOOR & FRAME ASSEMBLY

HARDWARE GROUP 08

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

2	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HW HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	EU STOREROOM LOCK	ND80PDEU SPA N123-062	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

HARDWARE GROUP 09

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

1	EA	CONT. HINGE	112HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	EU STOREROOM LOCK	ND80PDEU SPA N123-062	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	WALL STOP	WS407CCV	630	IVE

WEATHER-STRIPPING FURNISHED WITH DOOR & FRAME ASSEMBLY

HARDWARE GROUP 10

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S SPA	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP
1	EA	COAT AND HAT HOOK	582	626	IVE

HARDWARE GROUP 11

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD SPA	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

HARDWARE GROUP 12

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	FLOOR STOP	FS439	682	IVE
1	SET	SEALS	5050CL	CLR	NGP

USE LCN 4111 CLOSER @ DOOR 144 IN LIEU OF THE ABOVE LISTED CLOSER

HARDWARE GROUP 13

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	DBL CYL VESTIBULE	ND60PD SPA	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

HARDWARE GROUP 14

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD SPA	626	SCH
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

HARDWARE GROUP 15

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN

WEATHER-STRIPPING FURNISHED WITH DOOR & FRAME ASSEMBLY

HARDWARE GROUP 16

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

HARDWARE GROUP 17

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	WALL STOP	WS407CCV	630	IVE

HARDWARE GROUP 18

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	DBL CYL VESTIBULE	ND60PD SPA	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	WALL STOP	WS407CCV	630	IVE

USE LCN 4031 REG CLOSER @ DOOR 122B IN LIEU OF ABOVE LISTED CLOSER

HARDWARE GROUP 19

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	DBL CYL VESTIBULE	ND60PD SPA	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

HARDWARE GROUP 20

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
1	EA	WALL STOP	WS407CCV	630	IVE

HARDWARE GROUP 21

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	DBL CYL VESTIBULE	ND60PD SPA	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	WALL STOP	WS407CCV	630	IVE

HARDWARE GROUP 22

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70PD SPA	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

HARDWARE GROUP 23

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70PD SPA	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

HARDWARE GROUP 24

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	DBL CYL VESTIBULE	ND60PD SPA	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

HARDWARE GROUP 25

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

1	EA	CONT. HINGE	112HD	628	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

HARDWARE GROUP 26

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	SET	SEALS	5050CL	CLR	NGP

END SECTION 08 71 00

SECTION 08 80 00 GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes glass and glazing and related work for interior windows, exterior and interior storefronts and doors as shown and specified.

1.3 PERFORMANCE

- A. General: Provide glazing systems that will withstand indicated loads and thermal conditions without failure, including loss or breakage of glass, failure of glazing systems to remain watertight and airtight, or deterioration of glazing materials.
- B. Glass Design: Glass thicknesses indicated are minimums. Select actual glass lite thicknesses by analyzing loads and conditions at project site. Provide glass lites in the thicknesses and in strengths required to comply with ASTM E 1300.
 - 1. Basic Wind Speed: 85 miles per hour
 - 2. Exposure Category: C
 - 3. Importance Factor: 1.0
- C. Thermal Conditions: Allow for thermal movements and stresses of glazing components and framing members resulting from a temperature change range of 120 degrees Fahrenheit in ambient air temperature and 180 degrees Fahrenheit in material surface temperature.

1.4 SUBMITTALS

- A. *Product Data:* For each glass product and glazing material indicated. For coated, tinted, and insulated glass, include documentation of solar heat gain coefficient, emissivity, visible light transmittance, outdoor visible light reflectance, and summer daytime and winter nighttime U-factor.
- B. Samples: Submit 2 minimum 3 x 3-inch samples for each glass and glazing specified.
- C. Permanent labeling: Submit example of permanent labeling for each type of safety and fire rated glass.
- D. Closeout Submittals:
 - 1. Certificates: For any safety or fire rated glass whose permanent labeling is not visible after installation, submit example of code required labeling and certify that installed products comply the applicable requirements.
 - 2. O & M Manuals: Maintenance instructions.
 - 3. Guarantee: Provide completed form.

1.5 QUALITY ASSURANCE

- A. Manufacturer/Source: Obtain each type of glass product from a single primary glass manufacturer and a single manufacturer/fabricator for each glass product type. For glass with low-e coatings, obtain glass products in fabricated units from a manufacturer/fabricator certified by the primary glass manufacturer.
- B. Installer Qualifications: Experienced Installer with minimum of 5 successful completed projects of similar materials and scope, approved by glass product manufacturer/fabricator.
- C. Glazing for Fire-Rated Door and Window Assemblies: Glazing tested per NFPA 252 and NFPA 257, as applicable, for assemblies complying with NFPA 80 and listed and labeled per requirements of authorities having jurisdiction.
- D. Safety Glazing Products: Comply with United States Consumer Product Safety Commission's "Safety Standards for Architectural Glazing Materials" (16 CFR part 1201) category I or II, as applicable; CBC Standard 24-2 and Section 2402A and 2406. For safety wired glass comply with ANSI Z97.1
- E. Glazing Industry Publications: Comply with glass product manufacturers' recommendations and the following:
 - 1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
 - 3. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 - 4. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
 - 5. Insulating Glass Certification Council (IGCC): Rating standards.
- F. Labeling: All safety and fire rate glazing shall bear a permanent label identifying the rating. The label shall be legible and visible from the inside.

1.6 WARRANTY

- A. Provide warranty for materials and labor in required form for period of **2 years** beginning at date of acceptance by Owner in addition to the warranties listed below:
- B. Coated-Glass Products: Manufacturer's standard form, signed by coated-glass product primary manufacturer or manufacturer/fabricator, as applicable, agreeing to replace coated-glass units that display peeling, cracking, and other deterioration in coating under normal use, within 10 years of date of acceptance by Owner.
- C. Laminated Glass: Manufacturer's standard form, signed by laminated-glass product manufacturer/fabricator, agreeing to replace laminated-glass units that display edge separation, delamination, and blemishes exceeding those allowed by ASTM C 1172, within 5 years of date of acceptance by Owner.
- D. Insulating Glass: Manufacturer's standard form, signed by insulating-glass product manufacturer/fabricator, agreeing to replace insulating-glass units that exhibit failure of hermetic seal under normal use evidenced by the obstruction of vision by dust, moisture, or film on interior surfaces of glass, within 10 years of date of acceptance by Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver with manufacturer's labels intact; do not remove until completion of final inspection.

PART 2 - PRODUCTS

2.1 GLASS STANDARDS

- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality Q3, Class 1 (clear) or Class 2 (tinted) as indicated. For general use where float glass is called for.
- B. Tempered Float Glass: Per ASTM C 1048; Type I; Quality-Q3; Fully tempered, class and condition indicated: For use where safety glass is required.

2.2 ACCEPTABLE MANUFACTURERS

- A. General: Manufacturers and products are subject to approval of Architect through submittal process.
- B. Basis of Design: Where glass is part of a glazed system identified as a "basis of design product" in a separate specification section, manufacturer, product, and substitution limitations and requirements shall be as described in that specification section.

2.3 MONOLITHIC (SINGLE GLAZED) UNITS

- A. General:
 - 1. Thickness: Minimum ¼ inch (6 mm) thick glass unless lesser thickness is specified below.
 - 2. Fabricate units from annealed glass unless otherwise indicated.
 - 3. Heat Treating: Provide heat strengthened glass if needed to comply with performance requirements. Provide tempered glass where shown and where required by code.
- B. Interior Clear Glass: Annealed float glass, class 1 (tempered where required)
- C. Exterior tinted to match existing storefront glass. Field verify color.

2.4 INSULATED (DOUBLE GLAZED) UNITS AT EXTERIOR

- A. General:
 - 1. Assembly: Factory-assembled units consisting of dual-sealed lites of glass separated by a dehydrated interspace, with manufacturer's standard spacer material and construction, per ASTM E 774 and E 2190.
 - 2. Thickness: Minimum ¼ inch (6 mm) thick glass unless lesser thickness is specified below.
 - 3. Overall thickness: 1 inch (25 mm) unless noted otherwise
 - 4. Fabricate units from annealed glass unless otherwise indicated.
 - 5. Heat Treating: Provide heat strengthened glass if needed to comply with performance requirements. Provide tempered glass where shown.
- B. Definition of insulating glass surfaces:
 - 1. Surface 1: Exterior face of outer lite
 - 2. Surface 2: Interspace face of outer lite

3. Surface 3: Interspace face of inner lite
4. Surface 4: Interior face of inner lite

2.5 GLAZING ACCESSORIES

- A. General: Accessories shall be window or door system manufacturer's standard type and shall comply with applicable requirement listed below.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Glazing Tape:
 1. Butyl-based: Elastomeric tape with integral resilient tube spacer, complying with ASTM C 1281 and AAMA 800 for application. Closed cell polyvinyl chloride foam: Comply with AAMA 800.
- D. Glazing Gaskets:
 1. Dense Compression Gaskets: ASTM C 864, neoprene or EPDM, or ASTM C 1115, silicone or thermoplastic polyolefin rubber.
 2. Soft Compression Gaskets: ASTM C 509, Type II.
- E. Setting Blocks: ASTM C 864, neoprene, 80 to 90 Shore A durometer hardness; length 4 inches.
- F. Spacer Shims: ASTM C 864, neoprene, 50 to 60 Shore A durometer hardness; length 3 inches, , one face self-adhesive.
- G. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- H. Glazing Sealants: ASTM C 920, type recommended by glazing product manufacturer for application indicated.
- I. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that glazing channels are clean and ready to accept glazing installation, and that weeps are unobstructed. Confirm that minimum required face and edge clearances will be maintained. Report defects. Do not proceed with glazing until unsatisfactory conditions have been corrected.
- B. Examine glazing units prior to setting. Reject units that display edge or face damage that may impede performance of unit or that will be visible when installed.

3.2 PREPARATION

- A. Environmental Requirements: Install in dry conditions. Install glass, accessories, and sealants within ambient temperature limits established by manufactures.
- B. Clean glazing channels with recommended solvent and wipe dry. Apply primers to joint surfaces to ensure adhesion of sealants, unless preconstruction sealant-substrate testing indicates no primer is required.

3.3 GLAZING INSTALLATION

- A. General: Install glass and glazing materials in accordance with instructions of manufacturers and requirements of GANA Glazing Manual.
1. Install setting blocks of size and in location required by glass manufacturer. Set blocks in bed of approved sealant.
 2. Provide spacers for glass lites as recommended, based upon size of glass unit.
 3. Comply with glass manufacturer's limits on edge pressures.
 4. Ensure that glazing units are set with proper and consistent orientation of glass units toward interior and exterior.
 5. Provide edge blocking where recommended.
 6. Install sealants in accordance with requirements of SECTION 07 92 00 - JOINT SEALANTS.
- B. Tape Glazing:
1. Place tapes on fixed stops positioned to be flush or protrude slightly when compressed by glass. Install tapes continuously. Form butt joints at corners and where required, and seal tape joints with approved sealant.
 2. Apply heel bead of glazing sealant along intersection of permanent stop and frame for continuity of air and vapor seal.
 3. Set glass lites centered in openings on setting blocks.
 4. Install removable stops, and insert dense compression gaskets at corners, working toward centers of lites, compressing glass against tape on fixed stops.
 5. Apply cap bead of elastomeric sealant over exposed edge of tape or gasket on exterior of glass unit.
- C. Sealant Glazing:
1. Install continuous spacers between glass lites and glazing stops. Install cylindrical sealant backing where recommended, in width and depth recommended to provide proper depth and width of sealant bead. Ensure sealant cannot block weep system.
 2. Install sealant under pressure to completely fill glazing channel without voids, with full bond to glass and channel surfaces.
 3. Tool sealant bead to proper profile providing wash away from glass.
- D. Gasket Glazing: Fabricate gaskets to fit openings exactly. Allow for stretching of gaskets during installation.
1. Set soft compression gasket against fixed stop or frame, secure, with bonded miter cut joints at corners.
 2. Set glass lites centered in openings on setting blocks.
 3. Install removable stops, and insert dense compression gaskets at corners, working toward centers of lites, compressing glass against soft compression gaskets and to produce a weathertight seal. Seal joints in gaskets. Allow gaskets to protrude past face of glazing stops.

3.4 CLEANING AND PROTECTION

- A. Protect installed glass from damage. Attach streamers or warning tape to framing members, away from contact with glass. Remove nonpermanent labels.
- B. Protect glass from contact with contaminating substances during construction. Immediately clean glass exposed to contamination using methods recommended by glass manufacturer.
- C. Remove and replace broken or damaged glass.
- D. Within 5 working days prior to final inspection, clean all exposed glass surfaces using methods recommended by manufacturer. Remove glazing compounds from framing surfaces.

END SECTION 08 80 00

END DIVISION 8 – OPENINGS

DIVISION 9 – FINISHES

SECTION 09 21 13 ACOUSTICAL GYPSUM PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical gypsum plaster sprayed onto solid substrates.

1.2 PRE INSTALLATION MEETINGS

- A. Pre installation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: 12 inch square sample of sprayed-on insulation showing texture variations for approval.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualifications for applicator.
- B. Material test reports indicating plaster materials to be free of asbestos, mineral fiber, polystyrene and cellulose.
- C. Product test reports indicating acoustical test data for specified finish.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A applicator who is trained and licensed by manufacturer.
- B. Mockups: Before plastering, install mockups of at least 50 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PROJECT CONDITIONS

- A. Comply with ASTM C 842 requirements or acoustical gypsum plaster manufacturer's written recommendations, whichever are more stringent.
- B. Room Temperatures: Maintain temperatures at not less than 55 deg F or greater than 80 deg F for at least seven days before application of acoustical gypsum plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.
- C. Avoid conditions that result in acoustical gypsum plaster drying out too quickly.
 - 1. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
 - 2. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.
 - 3. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

1.8 WARRANTY

- A. Manufacturer's standard warranty agreeing to repair or replace that which has cracked, flaked, dusted excessively, peeled or fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively as intended for a sound absorbent purpose; due to defective materials.
 - 1. Warranty does not include abuse, improper maintenance, unforeseeable ambient exposures, or other causes beyond anticipated conditions by manufacturer.
 - 2. Warranty Period: 10 years from date of Substantial

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide installed gypsum plaster system that meets the following requirements:
 - 1. Density: Not more than 40 lbs. per cu./ ft. per ASTM E 605.
 - 2. Compressive Strength: Not less than 64 psi per ASTM E 761.
 - 3. Bond Strength: Not less than 2400 lbs. per sq. ft. per ASTM E 736.
- B. Sound Absorption per ASTM C 423I: Conduct testing on solid backing with no air gap.
 - 1. Not less than 0.50 NRC at 1/2 inch thick
- C. Surface Burning Characteristics per ASTM E 84:
 - 1. Flame Spread: 0.
 - 2. Smoke Developed: 0.
 - 3. Combustibility: Non-Combustible per ASTM E 136.
 - 4. Toxicity: LC50 > 300 grams per University of Pittsburgh Toxicity Test.

2.2 ACOUSTICAL GYPSUM PLASTER ASSEMBLIES

- A. General: Provide proprietary gypsum plaster-vermiculite plaster materials which will result in an assembly complying with specified performance and as follows:
 - 1. Basis of Design: Design is based on Pyrok, Inc. Acoustement Plaster 40. Subject to compliance with requirements, provide named product or comparable product approved by the Architect.
 - 2. Color and Texture: As selected by Architect.
 - 3. Thickness shall be as indicated but not less than 1/2 inch.

2.3 MISCELLANEOUS MATERIALS

- A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Bonding Compound: As recommended by manufacturer.
- C. Acoustical Sealant: As specified in SECTION 07 92 00 - JOINT SEALANTS.

2.4 MIXING

- A. Mix plaster materials in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are free of oil, grease, dirt, paint, or other matter which would impair bond.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
 - 1. Mask adjoining surfaces in order to minimize damage from overspray.
- B. Prepare substrate by filling voids and cracks and offsets, remove projections that result in telegraphing presence of imperfections.
 - 1. Prime substrate with primer or bonding agent as recommended by the manufacturer.

3.3 APPLICATION

- A. Apply in accordance with manufacturer's printed instructions using any rotary-stator plastering pump or other spray equipment approved by the manufacturer.
- B. Install to thickness indicated or thickness required to achieve NRC specified. C. Ensure that texture and color are all as per control sample.

3.4 CLEANING AND PATCHING

- A. Remove overspray and fall out materials immediately upon completion of the work in each area. Clean surfaces to remove evidence of soiling. Repair or replace damaged work surfaces to acceptable conditions.
- B. Coordinate work with other work, to minimize possibility of damage to insulation resulting from performance of subsequent work. As other units of work are completed in each area, patch damaged areas or surfaces of insulation by over spraying to match original installations, or by patching procedures as required to provide acceptable results.

END SECTION 09 21 13

SECTION 09 21 16 GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following and related work as specified and shown:
 - 1. Interior gypsum wallboard.
 - 2. Primer.

1.3 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. Product data and installation instructions for each type of product and installation indicated.
- B. Closeout:
 - 1. Provide completed Guarantee form.

1.5 QUALITY ASSURANCE

- A. DELIVERY, STORAGE, AND HANDLING
- B. Delivery: Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- C. Storage: Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Building must be weather tight with indoor temperature above 60 degrees F. and indoor relative humidity at 50% or less before installation of gypsum board.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM WALLBOARD

- A. Gypsum Wallboard: ASTM C36, long edge tapered. Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated. Use 5/8-inch Type X, throughout unless indicated otherwise.
- B. Water-Resistant Gypsum Board: ASTM C 630/C 630M; 5/8-inch thickness unless indicated otherwise. Type X at rated assemblies. Fiberock Aqua-Tough, as manufactured by USG.

2.2 TRIM ACCESSORIES

- A. General: ASTM C 1047. Galvanized or aluminum-coated steel or rolled zinc.
- B. Cornerbead: Dur-A-Bead by US Gypsum or equal.
- C. Resilient Channels: RE-1, by US Gypsum or equal.
- D. Casing Beads: J-Trim L-Trim by US Gypsum or equal.

2.3 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
- C. Joint Compound for Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and surface damage, use setting-type taping compound.
 - 2. Embedding, First Coat, Fill Coat, and Finish Coat (levels 1 to 4): Per ASTM C475.
 - 3. Skim Coat: For final coat of Level 5 finish, use topping compound.
 - 4. Texture: Unaggregated spray texture compound.
- D. Joint Compound for Water-Resistant Gypsum Board: Use setting-type taping compound and setting-type topping compound.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Acoustical Sealant: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C834 tested in assemblies per to ASTM E 90.
- C. Drywall Primer (Pre-texture): Sheetrock Brand First Coat manufactured by US Gypsum or equal product formulated for use as a base for spray applied texture.
- D. Laminating Adhesive: Per gypsum board manufacturer's recommendations.
- E. Steel Drill Screws: ASTM C 1002, unless otherwise indicated; type G for gypsum board to gypsum board; type S for fastening to metal less than 0.033 inches thick (21 gage or thinner); type W for fastening to wood. ASTM C 954 for fastening to steel members from 0.033 to 0.112 inches thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Environmental Limitations: Verify correct indoor air temperature and relative humidity before installing gypsum board.
- B. Coordination: Coordinate details with other trades whose Work interfaces with the Work of this Section. Verify that inspections of Work that will be concealed by gypsum board and Work above gypsum board ceilings have been completed before applying gypsum board.

3.3 APPLICATION OF GYPSUM BOARD

- A. General:
 - 1. Install per ASTM C840 and manufacturer's written instructions unless more stringent or restrictive requirements are specified herein or required by designated fire rated or STC rated assemblies.
 - 2. Use longest available sheets to keep butt joints to a minimum.
 - 3. Cut neatly to fit tightly around penetrations.
 - 4. 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.
 - 5. Do not place tapered edges against cut edges for ends.
- B. Panel layout: Comply with the following unless specific requirements of rated assemblies differ:
 - 1. At ceilings, install long edge perpendicular to framing.
 - 2. At wall panels may be installed with long dimension vertical or horizontal except that panels receiving level 5 finish must be installed vertically.
 - 3. Do not align panel joints with edge of openings.
 - 4. Stagger abutting end joints of adjacent panels not less than 1 framing member.
 - 5. Stagger vertical joints on opposite sides of partitions not less than 1 framing member.
 - 6. In multilayer applications, stagger panel joints of adjacent layers not less than 1 framing member.
 - 7. Locate edge and end joints over supports, except where joint occur at right angles to framing.
- C. Fastening: Attach panels to all supports as described below. Attach to framing occurring at any panel edge including head, sill and at openings and cutouts as described below. Do not use nails without prior approval of Architect.
 - 1. Ceilings: Minimum nail spacing, 7 inches. Minimum screw spacing, 12 inches.
 - 2. Walls: Minimum nail spacing, 8 inches. Minimum screw spacing, 12 inches.
 - 3. Double layer application: Attach both layers to framing at minimum spacing specified above. Use longer fasteners on second layer to achieve penetration required in referenced standards.
- D. Trim Accessories: Place corner beads at outside corners. Place J metal casing beads where gypsum board abuts other materials.

3.4 GYPSUM BOARD JOINT TREATMENT AND FINISHING - SMOOTH FINISH UNO

- A. General: Finishing Standards: ASTM C 840 and GA-216 unless more stringent or restrictive requirements are specified herein. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere to achieve smooth flat true finish surfaces. Promptly remove residual joint compound from adjacent surfaces. Correct any defect or variation in appearance that would be visually discernable after application of final finish material.
- B. Prefilling: Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated.
 - 1. Level 0: (No finish or joint treatment) Allowed at non-fire-rated or non-STC-rated interior assemblies where gypsum board will be covered by a subsequent finish panel such as FRP, wall protection panels, or tackable substrate.
 - 2. Level 1: (Embed tape at joints) Minimum requirement for concealed or unfinished panels at exterior walls, air barriers, and interior fire-rated or STC-rated assemblies. Apply 1 coat of joint compound over fastener heads at concealed or unfinished fire-rated assemblies.
 - 3. Level 2: (Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges). Use where panels are substrate for ceramic tile or acoustical tile.
 - 4. Level 3: Not Used.
 - 5. Level 4: (Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges). Use at panels to receive textured gypsum board finish or vinyl wall covering.
 - 6. Level 5: (Embed tape and apply separate first, fill and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface). Use at painted smooth wall finish.

3.5 CLEAN UP

- B. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- C. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 09 21 16

SECTION 09 51 90 ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes suspended acoustical ceilings and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Submit 2 minimum 4 x 4-inch samples for each acoustical ceiling specified.
- C. Closeout Submittals:
 - 1. Manuals: Cleaning instructions.
 - 2. Guarantee: Provide completed form.
 - 3. Extra Stock: Furnish extra full-size panels and exposed suspension system components equal to 1.0% of quantity installed (minimum of one full carton) for each type specified that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.
- B. Provide acoustical panels with surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84 with a Smoke-Developed Index of 450 or less and Flame Spread rating of 25 or less.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.6 GUARANTEE

- A. Acoustical Panels: Provide in required form for a period of **2 years** from date of acceptance by Owner.
- B. Grid: Provide warranty on manufacturer's form that products are to be free from defects in materials and workmanship for 10 years beginning at date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS

- A. Acceptable Manufacturers:
 - 1. Armstrong World Industries, Inc. Sandra K. Stauffer 1-877-276-7876 Ext. 6279
 - 2. USG Interiors, Inc.
 - 3. Or equivalent.
- B. Acoustical Panel Ceiling One
 - 1. Cortega, Item No. 769, by Armstrong World Industries, Inc.
 - 2. Radar, Item No. 2310, by USG Interiors, Inc.
- C. Acoustical Panel Ceiling Two
 - 1. Cortega Second Look II, Item No. 2767, by Armstrong World Industries, Inc.
 - 2. Radar Illusion, Item No. 2742, by USG Interiors, Inc.
- D. Acoustical Panel Ceiling Three
 - 1. Ceramaguard; Item 608, Fine Fissured; by Armstrong World Industries, Inc.

2.2 ACOUSTICAL TILES

- A. Acceptable Products: Fine Fissured, Item No. 741, as manufactured by Armstrong World Industries, Inc.
- B. Alternative Products: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.

2.3 METAL SUSPENSION SYSTEMS

- A. Acceptable Products: Unless noted otherwise, an acceptable product from each of the following manufacturers has been listed.
 - 1. Prelude Plus XL Fire Guard, as manufactured by Armstrong World Industries, Inc.
 - 2. Donn DX/DXL, Alum. as manufactured by USG Interiors, Inc.
 - 3. 1200/1250 Alum. Series, as manufactured by Chicago Metallic Corporation
- B. Alternative Products: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- D. General: Provide manufacturer's standard heavy duty direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
 - 1. Armstrong World Industries, Inc.
 - a. Prelude XL Fire Guard Grid 24 X 48
 - 2. USG Interiors, Inc.
 - a. Main Runner: DX/DXL26

- b. Cross Runner: DX/DXL424
- 3. Chicago Metallic
 - a. Main Runner: 200
 - b. Cross Runner: 1210
- C. Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- D. Color: Per plan.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at 5 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than No. 12 wire.
- F. Hold Down Clips: Provide manufacturer's standard hold-down clips spaced 24 inches on center at all cross tees. (use at all cat rooms)
- G. Compression Struts: As shown.
- H. Retaining Clips: BERC 2 by Armstrong World Industries, Inc. or ACM7 by USG Interiors, Inc, 1496 by Chicago Metallic Corporation. For attachment of free end and restrained end of grid to wall as shown.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified before beginning work; report defects. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation shall comply with ASTM C636 Article 3, Interference of Ceiling Related Components; coordinate requirements with other trades.

3.3 INSTALLATION, ACOUSTICAL PANEL CEILINGS

- A. General: Install acoustical panel ceilings to comply with California Building Code, ASTM C 636, ASTM E580 per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - 1. Hold-Down and Access Clips: Fasten panels securely with hold-down clips; install access clips where removal of panels is required for access to equipment above ceiling.
- B. Secure bracing wires to ceiling suspension members and to supports as shown.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Level ceiling suspension system to a tolerance of 1/8 inch in 12 feet.

- D. Install splices and intersections with interlocking device that draws members tightly together and prevents torsional deflection.
- E. Install acoustical panels and fit accurately into suspension system runners and edge moldings; pattern and placement as shown. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 09 51 90

SECTION 09 61 00 VAPOR CONTROL FOR FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes concrete water vapor emission control and related work as shown and specified.
- B. **Add Alternate Number 1:** Bidding: Bids shall be based on the assumption that water vapor emission rate is 15 pounds per 1000 square feet per 24 hours and that application rate is one gallon per 100 square feet. If emission rate is lower or higher than 15 pounds per 1000 square feet and material application rate is therefore increased or decreased, cost may be adjusted by Change Order.

1.3 SUBMITTALS

- A. Product
- B. Compatible Products Approval: Provide evidence of review and approval of concrete additives, concrete curing compound and flooring adhesives by manufacturer.
- C. Applicator Qualifications: Provide evidence that installers meet the requirements of Article 1.4.
- D. Closeout Submittals:
 - 1. Provide completed Guarantee forms per Article 1.5.
 - 2. Provide certificate of acceptance of and exposure to continuous topical water.
 - 3. Provide completed Vapor Control Installation Certificate.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Currently approved/certified by manufacturer. Experienced in surface preparation and application and subject to inspection and control by the manufacturer.
- B. Manufacturers Participation: Manufacturer's representative shall participate to the extent necessary to insure that preparation and installation are performed correctly and that conditions of Warranty are met.
- C. Manufacturer must have a documented minimum 10 year history of producing moisture vapor and alkalinity systems. System submitted must have a documented minimum 5 year history of service.

1.5 GUARANTEE

- A. Manufacturer: Provide on manufacturer's form for period of 10 years (non-prorated) against flooring failure do to water vapor transmission or alkalinity up to pH 14 on manufacturers form. Warranty shall begin at date of acceptance by Owner and shall cover all costs to remedy failure and to replace flooring.
- B. Installer: Provide in required form for period of 2 years from date of acceptance.

PART 2 - PRODUCTS

2.1 CONCRETE WATER VAPOR EMISSION CONTROL

- A. Acceptable Products: VAP I 2000, as manufactured by Koester American Corporation
- B. Or equivalent.
- C. Confirm final specification with the finish flooring manufacturer's requirements and acceptability and compatibility with the submitted and approved finish flooring product installation requirements.
- D. Provide Emission Control Material at all new concrete.
- E. At Existing Concrete: Owner will Perform vapor test: provide and install emission control where required at Existing Concrete per Unit Pricing by Change Order; See Unit Pricing.
- F. Alternate Products: No known equals; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS. List 3 recent projects where substituted product was used.
- G. Minimum Requirements: 100% solids, two part epoxy complying with the following.
 - 1. ASTM E 96, Water Vapor Transmission (wet methods) Performance shall be documented by an independent testing laboratory at a minimum 97% vapor transmission reduction compared to untreated concrete. Net perms ($\text{grains h}^{-1} \text{ft}^{-2} \text{in Hg}^{-1}$) of the system must not exceed 0.09 per ASTM E-96-95 Standard Test Method for Water Vapor Transmission.
 - 2. No water based formulations, silicate based admixtures or silicate based topical spray materials allowed.
 - 3. ASTM D 1308; Insensitivity to alkaline environment up to pH 14.
 - 4. Certifiable for acceptance and exposure to continuous topical water exposure after final cure.
 - 5. ASTM F 2170; System must be able to perform with a 100% RH reading. ASTM F 2170 results over 75% require the installation of the moisture vapor system.
 - 6. Warranted by manufacturer for use on concrete slabs with water vapor emission of up to 30 pounds per 1000 square feet as measured by anhydrous calcium testing in accordance with ASTM F 1869.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Testing: Coordinate with Owners testing lab and flooring installers to perform tests per ASTM F 1869 sufficient to determine if installation of water vapor emission control system is necessary and if so, appropriate application rate.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Bead blast and clean all surfaces and fill all cracks, joint and defects in concrete surface to manufacturers satisfaction prior to installation.
- D. Protect adjoining surfaces.

3.2 INSTALLATION

- A. Install in conformance with manufacturer's written directions, as shown, and as specified.
- B. Apply at minimum rate of 1 gallon per 100 square feet, unless application rate is modified by change order. Allow to cure for 12 hours. Protect from traffic, water, and contaminants during cure period.

3.3 CLEANING AND PROTECTION

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. Protect each coat during specified cure period from any kind of traffic, topical water and contaminants for 24 hours minimum.

END SECTION 09 61 00

SECTION 09 65 00 RESILIENT FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes resilient flooring and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.
- B. Shop Drawings: Submit plans indicating locations of all seams for review.
- C. Samples: Submit 2 minimum 3 x 3-inch samples for each flooring specified.
- D. Certificates: Certification that no product installed contains asbestos.
- E. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4 Source Limitations: Obtain each flooring product from a single manufacturer.
- F. Closeout Submittals
 - 1. O & M Manuals: Maintenance and cleaning instructions.
 - 2. Guarantee: Provide completed form.
 - 3. Extra Stock: Furnish extra full-size floor tiles equal to 1% of quantity installed (minimum of 1 full carton) that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.4 GUARANTEE

- A. Provide manufacturer's warranty that products are to be free from defects in materials and workmanship for 2 years beginning at date of acceptance by Owner.

1.5 QUALITY ASSURANCE

- A. Moisture Resistance: Flooring system must be guaranteed to bond to floor slab with moisture vapor emission 5 pounds per 1000 square feet in 24 hours as measured by ASTM F 1869-98, anhydrous calcium chloride test.
- B. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.
- C. Mock-up: Construct 4'-0" x 4'-0" minimum sample area with seams, welds and base. Mock-up may be incorporated into project subject to approval of Architect. Approved mock-up will set the standard of quality of the work of this section.

- D. Fire-Test-Response Characteristics:
 - Critical Radiant Flux per ASTM E648: Class A.
 - Smoke Developed Index per ASTM E662: 450 or less.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION TILE

- A. Acceptable Manufacturers:
 - 1. Armstrong World Industries, Inc
 - 2. Mohawk Group.
 - 3. Or equivalent.
- B. Vinyl Composition Tile One (VCT1) See Color Schedule. Excelon Imperial Series;
- C. Vinyl Composition Tile Two (VCT2) See Color Schedule. Excelon Imperial Series;
- D. Vinyl composition Tile Three (VCT3) See Color Schedule. Excelon Imperial Series;
- E. Vinyl Composition Tile Four (VCT4) See Color Schedule. Excelon Imperial Series;
- F. Size: 12 x 12 inches; 1/8 inch thickness.

2.2 SHEET VINYL FLOORING

- A. Acceptable Manufacturers
 - 1. Armstrong World Industries, Inc.
 - 2. Mannington Mills, Inc.
- B. Alternate Manufacturers: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- C. Sheet Vinyl Flooring One (SVF1) -See Color Schedule; Mednitech.
- D. Sheet Vinyl Flooring Two (SVF2) - See Color Schedule; Mednitech.
- E. Seams:
 - 1. Seamless; solid-strand rods for heat welding.
 - 2. Color: Match flooring.
- F. Metal Cap Strips: Manufacturer's standard extruded aluminum.
- G. Backing Strips: As recommended by manufacturer.

2.3 RESILIENT BASE

- A. Acceptable Manufacturers:
 - 1. Roppe Corporation.
 - 2. Burke/Mercer Flooring Products Division of Burke Industries, Inc.

3. Armstrong World Industries, Inc.
 4. Or equivalent.
- B. Resilient Base One (RB1) Color: See Color Schedule.
 - C. Rubber, type TS, 4 inch high, continuous strip, coved top-set base with matching pre-formed inside and outside corners to match base.
 - D. Resilient Base Two (RB2) Color: See Color Schedule.
 - E. Rubber, type TS, 4 inch high, continuous strip, coved top-set base with matching pre-formed inside and outside corners to match base.

2.4 TRANSITION STRIPS

- A. Acceptable Manufacturers:
 1. Burke/Mercer Flooring Products Division of Burke Industries, Inc.
 2. Johnsonite Division of Duramax, Inc.
 3. Roppe Corporation.
- B. Alternate Manufacturers: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- C. Edging Strip at Resilient Flooring to other finishes. Color: Match floor color or as approved.

2.5 INSTALLATION MATERIALS

- A. Leveling and Patching Compounds (LVL):
 1. Ardex V 900, as manufactured by Ardex Engineered Cements
 2. VAP I Level Pro, as manufactured by Koester American.
- B. Leveling and Patching Compound Primer
 1. Ardex P 51, as manufactured by Ardex Engineered Cements.
 2. Level-Pro Primer E, as manufactured by Koester American.
- C. Adhesives:
 1. General: Moisture and alkali resistant, as recommended by flooring manufacturer to suit substrate conditions indicated.
 2. Resilient Base Adhesives:
 - a. Model No. 205 Cove Base Adhesive, as manufactured by Roppe.
 - b. Model No. 960, as manufactured by Johnsonite.
 3. Edging Strip Adhesives:
 - a. Model No. BR-721 Solvent-Free, Two-Part Epoxy Tile Adhesive, as manufactured by Burke/Mercer Flooring Products Division of Burke Industries, Inc.
 - b. Model No. 996 Two-Part Epoxy Adhesive, as manufactured by Johnsonite Division of Duramax, Inc.
 - c. Model No. ROP-605-A Two-Part Epoxy Adhesive, as manufactured by Roppe.

- D. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer. Verify product intended for use with Owner and get Owner's written acceptance PRIOR to purchase of product

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects. Perform bond, moisture and alkali testing of concrete sub-floors. No extra payment for work additional to that shown and/or specified, for complete application of resilient flooring, will be allowed if such additional work is apparent from inspection of existing premises and conditions.

3.2 PREPARATION

- A. Coordinate flooring installation with Owner's anhydrous calcium chloride testing to determine if installation of water vapor emission control system at concrete floor slabs is necessary. Refer to SECTION 01 45 29 - TESTING LABORATORY SERVICES.
- B. Do not lay flooring until other work that might cause damage to flooring is complete.
- C. Maintain temperature of building and materials at 65 degrees F minimum for 24 hours prior to and during installation, and until adhesives have cured. Provide Temporary heat as required.
- D. Take field measurements; report variance between plan and field dimensions.
- E. Do not apply materials on wet or damp surfaces.
- F. Fill cracks, holes, and depressions in substrates with leveling compound; remove bumps and ridges to produce a uniform and smooth substrate
- G. Clean substrates immediately before flooring installation.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Apply leveling and patching compound primer.
- D. Install leveling and patching compound.
- E. Apply adhesive per manufacturer's directions; do not exceed working area or time limits stated by manufacturer. Use a full spread of adhesive applied to substrate to produce a completed installation without surface imperfections

3.4 CLEANING AND PROTECTION

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. Protect flooring products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- C. At completion clean exposed surfaces in a manner that will not damage finish.

- D. Apply liquid floor polish per manufacturer's instructions.
- E. Cover flooring until Substantial Completion.

END SECTION 09 65 00

SECTION 09 67 60 RESINOUS FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section describes the requirements for furnishing and installing resinous flooring, (ERC - Floors), consisting of a two-component epoxy primer; three-component troweled epoxy resin mortar base consisting of epoxy resin, curing agent and finely graded quartz silica aggregate; three-component epoxy resin undercoat; brightly colored broadcast quartz aggregate; and two-component clear epoxy sealer.
- B. Related Sections:
 - 1. Room mock-up is specified in SECTION 01 43 00 - QUALITY ASSURANCE.
 - 2. Joint sealants are specified in SECTION 07 92 00 - JOINT SEALANTS.
 - 3. Water-vapor emission control system is specified in SECTION 09 61 00 - VAPOR CONTROL FOR FLOORING.
 - 4. Epoxy wall coating (ERC- Walls) is specified in SECTION 09 96 50 - EPOXY WALL COATING.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's technical data, installation instructions, and general recommendations for each resinous flooring material required. Include certification indicating compliance of materials with requirements.
- B. Samples: 12-inch square samples showing approximate applied thickness, color, texture, grit and special conditions. Make modifications as directed by the Architect until sample is approved.
- C. Maintenance Instructions: Furnish manufacturer's printed instructions for maintenance of special flooring, including methods and frequency recommended for maintaining. Include precautions against materials and methods that may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

- A. Materials: Provide resinous floor covering materials produced by a single manufacturer capable of showing prior successful production and installation of specified materials for not less than 10-years.
- B. Applicator: Resinous floor covering materials shall be installed by an applicator approved by the materials manufacturer, with a minimum of 5 Projects of similar size and complexity.
- C. Pre-Installation Conference: Arrange a meeting not less than 30-days prior to starting work. Attending shall be Contractor, Architect, and manufacturer/installer.

1.4 JOB CONDITIONS

- A. Proceed with work only after substrate construction and penetrating work have been completed.
- B. Proceed with installation when conditions will permit work to proceed in accordance with manufacturer's recommendations.
- C. Do not permit smoking, open flame, or spark producing equipment in areas of application.

- D. Provide for continuous ventilation during installation, using as close to 100-percent outside air as possible.
- E. Concrete substrate shall be cured for a minimum of 30-days.

1.5 WARRANTY

- A. Warranty resinous flooring to be free from defects in materials and workmanship for a period of 3-years from Date of Substantial Completion. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contract under the Contract Documents.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Stonehard, Inc. "Stoneshield HRI" or Selbatwede HD by Selby are Architect approved products.
- B. Or equivalent.

2.2 RESINOUS FLOORING

- A. Material: Nominal 3/16-inch thick system comprised of a two-component, penetrating moisture tolerant epoxy primer, three-component troweled mortar base consisting of epoxy resin, curing agent and finely graded silica aggregate, three-component, free flowing epoxy formulation undercoat consisting of resin and curing agent, and brightly colored quartz aggregate broadcast, into the undercoat, and high-performance, UV resistant, two-component, clear-epoxy sealer.
 - 1. Physical Properties: Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures specified, are as follows:
 - a. Compressive Strength, ASTM C579: 10,000-psi
 - b. Tensile Strength, ASTM C307: 2,000-psi Flexural
 - c. Strength, ASTM C580: 4,300-psi
 - d. Hardness, ASTM D2240, Shore D Durometer: 85-90
 - e. Bond Strength, ASTM D4541: >400-psi
 - f. Impact Resistance, ASTM D4226: >160-in.lbs.
 - g. Abrasion Resistance, ASTM D4060, Taber Abrader CS-17 Wheel: 0.06-gm. Max. weight loss
 - h. Coefficient of Friction, ASTM D2047: Dependent on texture
 - i. Flexural Modulus of Elasticity, ASTM C580: 2.0x10⁶ psi.
 - j. Flammability, ASTM D635: Self extinguishing; extent of burn in 0.25-inches max.
 - k. Thermal Coefficient of Linear Expansion, ASTM C531: 1.8x10⁻⁶ in/in deg. C.
 - l. Water Absorption, ASTM C413: 0.01-percent
 - m. Heat Resistance Limitation: 140-deg. F. for continuous exposure; 200-deg. F. for intermittent spills
- B. BTexture: Medium- to be determined by mock-up samples.
- C. Color: As selected by Architect from manufacturer's standards.

- D. Miscellaneous Materials:
 - 1. Cove Base Termination Strip: Clear anodized aluminum strip.
 - 2. Joint Sealant Materials: Type produced by resinous flooring manufacturer for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Comply with manufacturer's instructions for preparation of substrates to receive resinous floor covering.
- B. Clean substrate of dust, debris, and other substances detrimental to work by sandblasting, acid-etching or mechanical grinding. Remove resulting residue.
- C. Prepare cracks and joints as recommended by resinous floor covering manufacturer.
- D. Test substrate for excessive moisture content, in manner recommended by manufacturer.
- E. Mask off adjoining surfaces not to receive resinous floor covering, and close off floor drains to prevent spillage and migration of materials outside application area.

3.2 INSTALLATION

- A. General: Comply with manufacturer's instructions for installation of resinous floor covering. Mix materials in accordance with manufacturer's instructions.
- B. Apply base coat and screed and trowel to a tightly closed finish. Allow at least an 8-hour cure.
- C. Lightly grind the base and apply undercoat using a steel squeegee, followed by rolling with a looped roller.
- D. Immediately broadcast aggregate into the freshly applied undercoat. Allow at least 8-hours to cure.
- E. Scrape and sweep the floor to remove loose aggregate particles, then vacuum.
- F. Apply sealer with a rigid rubber squeegee and roll with a saturated medium nap roller.
- G. Caved Base: Provide an integral cove base ant the joint between the floor and wall to a height of 5-inches unless otherwise indicated.
- H. Finished Thickness: 3/16-inch.

3.3 FIELD QUALITY CONTROL

- A. The Owner obtains the right to invoke the following material testing procedure at any time, and any number of times during flooring application.
- B. The Owner will engage service of an independent testing laboratory to sample materials being used on the Project. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.
- C. Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures.
- D. If test results show materials being used do not comply with specified requirements, the Owner, or Architect may direct Contractor to stop work. Remove non-complying materials; pay for testing;

reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.4 CLEANUP AND PROTECTION

- A. Remove spilled and splattered materials immediately as work progresses.
- B. Protect installation as required to ensure that work will be without damage or deterioration at time of final acceptance and after completion of other construction work.
- C. Prohibit traffic on resinous floor covering for 48-hours after installation.

END SECTION 09 67 60

SECTION 09 84 00 ACOUSTIC ROOM COMPONENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes acoustical wall panels and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data, installation instructions and evidence of compliance with requirements of this section.
- B. Closeout Submittals
 - 1. Manuals: Cleaning instructions.
 - 2. Guarantee: Provide completed form.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain acoustical wall panels from a single manufacturer.
- B. Fire-Test-Response Characteristics: Per ASTM E 84.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

1.5 GUARANTEE

- A. Provide manufacturer's warranty that products are to be free from defects in materials and workmanship for 10 years beginning at date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 ACOUSTICAL WALL PANELS

- A. Acceptable Manufacturers:
 - 1. Koroseal Sound Designs
 - 2. Or equivalent.
- B. Acoustical Wall Panel One (AWP1)
- C. Acoustical Wall Panel Two (AWP2)
- D. Color: See Color Schedule
- E. Size: As shown, 1 inch thick.
- F. Substrate: Glass fiber core
- G. Edges: Chemically hardened, square.

H. Corners: Square.

1. Alternate Products: No known equals; proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for conditions affecting performance of Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Take field measurements before fabrication; report variance between plan and field dimensions.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Panels: Cut panels to sizes and shapes as shown; wrap fabric around cut ends and staple to back of panel. Install level and plumb. Butt joints tight and align each panel flush with adjacent panels. Attach with impaling clip and adhesive per manufacturer's instructions.

3.4 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 09 84 00

SECTION 09 90 00 PAINTING AND COATING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following and related work as specified and shown:
 - 1. Paints.
 - 2. Stains.
 - 3. Painting materials.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.
- B. Provide full range of colors for each material submitted.
 - 1. Field Samples:
 - a. General: In place, on material scheduled to be finished, illustrating coating color, texture and finish. Locate where directed; accepted sample may remain as part of the Work.
 - b. Size: 8'-0" x 8'-0" panel, or 1 entire unit as scheduled to be finished.
- C. Certificates: Submit statement of VOC compliance with local regulations.
- D. Closeout:
 - 1. Extra Stock: Deliver 1% or a minimum of 1 unopened gallon of each color, type and surface texture of paint installed. Label each container with color, type, texture and room locations.
 - 2. Guarantee: Provide completed form.

1.4 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society of Testing Materials (ASTM): Conform to ASTM D16 for interpretation of terms used in this Section.
 - 2. National Paint and Coatings Association (NPCA): Guide to U.S. Government Paint Specifications.
 - 3. Painting and Decorating Contractors of America (PDCA): Painting - Architectural Specifications Manual.
 - 4. Steel Structures Painting Council (SSPC): Steel Structures Painting Manual.
- B. Qualifications:
 - 1. Applicator: Specializing in performing the work of this Section with minimum 3 years documented experience.

2. Volatile Organic Compounds (VOC): Use only products in compliance with VOC content limits required by state and local regulations.

1.5 GUARANTEE

- A. Provide in required form for a period of **2 years** from date of final acceptance by Owner. Color and finish appearance shall remain unchanged throughout entire guarantee period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Paint and Stain Manufacturers
 1. Dunn-Edwards Paint Corporation
 2. Kelly-Moore Company.
 3. Frazee Industries, Inc.
 4. Sherwin-Williams.
 5. AkzoNobel Glidden Professional (formerly ICI Dulux).
 6. PPG.
 7. Or equivalent.
- B. Container Identification: Identify container with manufacturer's name, and include description of type of paint, brand name, lot number, brand code and color designation.
- C. Paint Materials:
 1. General: Provide ready mixed products, except field catalyzed coatings. Provide accessory materials such as linseed oil, shellac, thinners, cleaners and other materials not specifically indicated but required to achieve finishes specified.
 2. Patching Material: Bondex latex filler.
 3. Caulking Compound: Acrylic Latex manufactured by Tremco Inc., or approved equal.
 4. Primers, Paints and Stains: Refer to Paint Schedules at end of this section for specific product requirements.

2.2 MIXING

- A. General: Mix paints at the factory; do not alter or reduce materials except as directed by manufacturer.
- B. Colors: As selected by Architect from manufacturer's full range; factory mix match. No tinting of finish coats will be allowed at job site unless specifically approved by Architect. Mildew Resistance: Add fungicidal agent to paint per manufacturer's recommendations; approximately 4 ounces per gallon. Add agent at the factory; clearly indicate on label that paint is mildew resistant.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General: Examine conditions of surfaces in place before beginning work; report defects.

- B. Shop Applied Primer: Test for compatibility with subsequent cover materials.
- C. Moisture Content:
 - 1. General: Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - a. Plaster and Gypsum Wallboard: 12%.
 - b. Masonry, Concrete, and Concrete Unit Masonry: 12%.
 - c. Wood: 15%.
 - d. Concrete Floors: 8%.
 - 2. Acceptance:
 - a. General: Application of first coat of painting process constitutes acceptance of surface.
 - b. Gypsum Board: Inspect after application of seal coat; application of subsequent coat of painting process constitutes acceptance of surface.
- D. Stucco: Allow to dry 30 days minimum before applying elastomeric paint.
- E. Storage:
 - 1. General: Store in properly ventilated separate structure not less than 50'-0" from any other structure on the site.
 - 2. Temperature: Maintain minimum of 45 degrees F and a maximum of 90 degrees F.
 - 3. Fire Prevention: Take necessary precautions to prevent fire; remove paint-soiled rags and waste from building each day or store in metal containers with covers in the paint storage structure.
- F. Protection: Protect adjacent surfaces not scheduled for paint finish from damage resulting from painting operations.
- G. Surface Preparation:
 - 1. General: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing. Correct defects and clean surfaces that affect work of this section. Use Shellac to seal marks that may bleed through surface finishes.
 - 2. Impervious Surfaces: Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow surface to dry.
 - 3. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
 - 4. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify that required acid-alkali balance has been achieved. Allow to dry.
 - 5. Gypsum Board Surfaces: Fill minor defects with filler compound; spot prime defects after repair.
 - 6. Galvanized Surfaces: Remove surface contamination and oils; wash with solvent. Apply coat of etching primer.

7. Concrete and Unit Masonry: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter at surfaces scheduled to receive paint finish. Remove oil and grease with a solution of trisodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
8. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
9. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand/power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
10. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Verify compatibility of specified primer and paint with shop applied primer.
11. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.
12. Previously Painted Surfaces: Verify compatibility of new paint with existing. Remove existing paint and/or prime surfaces per manufacturers written instructions and as necessary for full adhesion of new paint.

3.2 PREPARATION

A. Environmental Requirements:

1. Relative Humidity Requirements: Do not apply exterior coatings during rain or snow, or when the relative humidity exceeds 85%.
2. Temperature:
 - a. General: Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the manufacturer.
 - b. Exterior Paints: 50 degrees F minimum during and for 48 hours after application; do not apply when temperature is over 85 degrees F, except in protected or shaded areas.
 - c. Interior Paints: 65 degrees F for minimum of 48 hours before, during and for 48 hours after application.
3. Ventilation: Provide adequate ventilation of all interior spaces during application and curing of all painting products.
4. Lighting Level: Provide minimum 80 foot candles measured at mid-height of room.

3.3 APPLICATION

- A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified in Paint Schedules at end of this Section.
- B. Performance:
 1. General: Apply each coat to uniform finish, slightly darker than preceding coat unless otherwise approved. As a minimum, dry film thickness of each coat shall meet manufacturer's specification.

2. Wood and Metal Surfaces: Sand lightly between coats to achieve required finish. Vacuum clean surfaces free of loose particles; use tack cloth just prior to applying next coat. Allow applied coat to dry before next coat is applied.
 3. Clear Finishes: Tint fillers to match wood; work fillers into the grain before set and wipe excess from surface.
- C. Finishing Mechanical and Electrical Equipment: Refer to DIVISION 22 – PLUMBING, DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING and DIVISION 26 – ELECTRICAL for schedule of color coding and identification banding of equipment, duct work, piping, and conduit. Paint shop-primed equipment. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, to match adjacent wall surfaces. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint. Paint dampers exposed behind louvers and grilles to match face panels. Paint exposed pre-finished electrical and mechanical equipment occurring in finished areas as directed by Architect. Paint any equipment or components that penetrate metal roofing or siding to match surface penetrated. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

3.4 CLEANING

- A. General: Upon completion, remove masking materials, reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing, and thoroughly clean all exposed surfaces per manufacturer's instructions. Keep premises free from accumulation of waste and debris. At completion of work remove surplus materials and debris.
- B. Touch-up: After detailed inspection of paint work, touch up or refinish abraded, stained or otherwise disfigured work, as required by the Architect.
- C. Cleaning: Remove containers, rags and debris from the site; observe special care in control or disposal of flammable materials.

INTERIOR SURFACES – 2010 CALGreen/2009 LEED									
SURFACE	PAINT TYPE	COATS	MANUFACTURER'S PAINT NUMBERS						
			DUNN-EDWARDS	KELLY-MOORE	FRAZEE	SHERWIN-WILLIAMS	GLIDDEN PROFESSIONAL	PPG	SAFE COAT
Wood, Transparent	Sanding Sealer	1	N/A	4883		B26V43/CM15	Wood Pride 1916V		
	Acrylic Urethane	2	Defthane Water Based Polyurethane	2094		A68V91	Wood Pride 1808	42786	Poly-ureseal BP
Wood, Stained	Stain Finish	1	Valspar Graintone	Varathane Wiping Stain	Zar Ultra-Mac	Minwax 250voc	Wood Pride 1700V	44500	DuroStain
	Sanding Sealer	1	N/A	Valspar NAS1820 Luster Lac Premium Hi Build Water		CM15 White			
	Spar Varnish	2	Defthane Water Based Polyurethane	McCloskey's Spar Heirloom Varnish		SW: WoodClassics A68		42786	AcriGlaze
Wood, Electrical Back Boards	Acrylic	2	EVSH50	-	-	-	-	42-7	-
Wood Stage Flooring	Flat Latex	2	-	550 Acry-Plex Dark Secrets	-	Tread-Plex B90	3018	-	-
Concrete or Concrete Block, Eggshell	Acrylic Block Filler	1	SBPR00	521		B25W25	3010	4-100	
	Acrylic Enamel	2	SWLL30	1610		B20-2600	1412	9-300	
Concrete or Concrete Block, Semi-Gloss	Acrylic Block Filler	1	SBPR00	521		B25W25	3010	4-100	
	Finish	2	SWLL50	1650		B31-2600	1415	9-500	
Steel, Unprimed	Red Oxide Primer	1	BRPR00(white) BRPR00-1-R) (red)	5725-120		B66W310	4020	90-712	
	Enamel	2	EVSH50	1650		B31-2600/	1415	9-500	

Steel, Primed; [Existing Painted]	Red Oxide Primer	Touch-up	BRPR00(white) BRPR00-1-R) (red)	5725-120		B66W310	4020	90-712	
	Enamel	2	EVSH50	1650		B31-2600	1415	9-500	
Steel, Galvanized	Acrylic Galv. Primer	1	UGPR00	1725		B66W310	4020	90-712	
	Enamel	2	EVSH50	1650		B31-2600	1415	9-500	
Aluminum, Mill Finish	Acrylic Metal Primer	1	UGPR00	1725		B66W310	4020	90-712	
	Enamel	2	EVSH50	1650		B31-2600	1415	9-500	
Concrete Floors	Acrylic Floor Coating	3	Rustoleum Porch and Floor	1786 or 1789			3018		
Gypsum Board or Plaster, Eggshell	Epoxy Wall Paint	1				Pro-Indust. HighPerf.			
	Acrylic Enamel	2	SWLL30	1610		B20-2600	1411	9-300	
Gypsum Board or Plaster, Semi-Gloss	Vinyl Wall Sealer	1	VNPR00	973		B28W400	1000	9-900	
	Enamel	2	SWLL50	1650		B31-2600	1415	9-500	
Gypsum Board or Tack Board, Vinyl Wall Covering	Acrylic Primer	1	UGPR00	973		B51	3210	17-921	
Canvas and Cotton Fabric	Acrylic Primer	1	UGPR00	973		B51	3210	17-921	
	Enamel	2	EVSH50	1650		B31-2600	1415	9-500	

END SECTION 09 90 00

SECTION 09 96 50 EPOXY WALL COATINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section describes the requirements for furnishing and installing epoxy wall coating system at walls (ERC- Walls). Epoxy wall coating system consist of a two-component epoxy primer, two-component epoxy saturant, woven fiberglass engineering fabric, and two-component high solids epoxy glaze coating.
- B. Related Sections:
 - 1. Room mock-up is specified in SECTION 01 43 00 - QUALITY ASSURANCE.
 - 2. Joint sealants are specified in SECTION 07 92 00 - JOINT SEALANTS.
 - 3. Water-vapor emission control system is specified in SECTION 09 61 00 - VAPOR CONTROL FOR FLOORING.
 - 4. Epoxy wall coating (ERC- Walls) is specified in SECTION 09 96 50 - EPOXY WALL COATING.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's technical data, installation instructions, and general recommendations for each material required. Include certification indicating compliance of materials with requirements.
- B. Samples: 12-inch square samples showing approximate applied thickness, color, texture, and special conditions. Make modifications as directed by the Architect until sample is approved.
- C. Maintenance Instructions: Furnish manufacturer's printed instructions for maintenance of epoxy wall coating, including methods and frequency recommended for maintaining. Include precautions against materials and methods that may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

- A. Materials: Provide epoxy wall coating materials produced by a single manufacturer capable of showing prior successful production and installation of specified materials for not less than 10-years.
- B. Applicator: Approved by the materials manufacturer, with a minimum of 5 Projects of similar size and complexity.
- C. Pre-Installation Conference: Arrange a meeting not less than 30-days prior to starting work. Attending shall be Contractor, Architect, and manufacturer/installer.

1.4 JOB CONDITIONS

- A. Proceed with work only after substrate construction and penetrating work have been completed.
- B. Proceed with installation when conditions will permit work to proceed in accordance with manufacturer's recommendations.
- C. Do not permit smoking, open flame, or spark producing equipment in areas of application.
- D. Provide for continuous ventilation during installation, using as close to 100-percent outside air as possible.

1.5 WARRANTY

- A. Warranty epoxy wall coatings to be free from defects in materials and workmanship for a period of 3-years from Date of Substantial Completion. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contract under the Contract Documents.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Stonehard, Inc. "Stonglaze VSD", Selbatwede "Selbaglas" wall
- B. Or equivalent.

2.2 EPOXYWALLCOATING

- A. Material: Nominal 25-mil thick system comprised of a two-component epoxy saturant, a woven fiberglass engineering fabric and a two-component, high-performance, high-solids epoxy glaze coating.
 - 1. Physical Properties: Provide wall system in which physical properties of coating, when, tested in accordance with standards or procedures specified, are as follows:
 - a. Percent Solids: 92-percent.
 - b. Hardness, ASTM D2240, Shore D Durometer: 80-85. Bond Strength, ASTM D4541: >400-psi
 - c. Impact Resistance, ASTM D2794: >70-in.lbs.
 - d. Abrasion Resistance, ASTM D4060, Taber Abrader CS-17 Wheel: 0.08-gm. Max. weight loss
 - e. Fire Resistance of Dry Film: Self-extinguishing.
 - f. Heat Resistance Limitation: 140-deg. F. for continuous exposure; 200-deg. F. for intermittent spills
 - g. VOC, ASTM D2364: 0.4-lbs./gal.
- B. Color: As selected by Architect from manufacturer's standards.
- C. Miscellaneous Materials:
 - 1. Joint Sealant Materials: Type produced by epoxy wall coating manufacturer for type of service and joint condition indicated.
 - 2. Exposed ERC Terminations: Where a chairrail does not cover and protect the top ERC wall termination, an Anodized aluminum termination piece at top and (where applicable) sides of ERC is to be installed. Use similar edge as used at coved base. See drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Comply with manufacturer's instructions for preparation of substrates to receive epoxy wall coating.

- B. Gypsum board shall be clean and free of bond inhibiting materials, including previously-applied coatings. Preparation of existing coatings shall be by mechanical means and may require light sanding.

3.2 INSTALLATION

- A. General: Comply with manufacturer's installation instructions to produce a uniform monolithic wearing surface of specified thickness.
- B. Saturant: Mix and apply material in accordance with manufacturer's instructions.
- C. Fiberglass Engineering Fabric: Pre-cut and apply woven fiberglass engineering fabric in accordance with manufacturer's recommended procedures.
- D. Coating: Mix material in accordance with manufacturer's instructions. Solvent reduction of any kind is not permitted. Apply material immediately after mixing using rollers or an airless sprayer. Comply with manufacturer's recommended coverage rate.
- E. Cure epoxy wall coating materials in accordance with manufacturer's instructions taking care to prevent contamination during application and prior to completion of curing process. Close area of application for a minimum of 24-hours.

3.3 FIELD QUALITY CONTROL

- A. The Owner retains the right to invoke the following material testing procedure at any time, and any number of times during epoxy wall coating application.
- B. The Owner will engage service of an independent testing laboratory to sample materials being used on the Project. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.
- C. Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures.
- D. If test results show materials being used do not comply with specified requirements, the Owner or Architect may direct Contractor to stop work, remove non-complying materials; pay for testing; reapply epoxy wall coating materials to properly prepared surfaces that had previously been coated with unacceptable materials.

3.4 CLEANUP AND PROTECTION

- A. Remove spilled and splattered materials immediately as work progresses.
- B. Protect installation as required to ensure that work will be without damage or deterioration at time of final acceptance and after completion of other construction work.
- C. Remove temporary coverings and clean epoxy wall coating system just prior to final inspection. Use cleaning materials and procedures recommended by epoxy wall coating system manufacturer.

END SECTION 09 96 50

END DIVISION 9 – FINISHES

DIVISION 10 – SPECIALTIES

SECTION 10 14 00 SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes signage and related work as specified and shown:
 - 1. Engraved Laminated Acrylic Signs.
 - 2. Subsurface Copy Acrylic Signs.
 - 3. Metal Signs.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, finishes, installation and anchorage instructions for review.
- B. Samples: Provide full range of available colors for each material submitted.
- C. Shop Drawings: Show text type, size and spacing, dimensions, mounting heights, layout, material descriptions, finishes, fabrication and installation details for each sign.
- D. Closeout Submittals:
 - 1. O & M Manuals: Maintenance and cleaning instructions.
 - 2. Guarantee: Provide completed forms per Article 1.5.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements: Design Parking signs, Room Identification Signs (S-RI), Maximum Occupant Load signs (S-RC), Toilet Room Signs (S-TRW, S-TRD), Exit Signs (S-TE), and Miscellaneous Signs, as required by ADA and CBC Sections:
 - 1. General: Comply with Section 1114B.1.1 for design and construction.
 - 2. International Symbol of Accessibility: Section 1117B.5.8 and sections as follows:
 - a. Design: Section 1117B.5.8.1 and Figure 11B-6.
 - b. Color of Symbol: Section 1117B.5.8.1.1.
 - 3. Braille Symbols: California Braille Grade 2, per Section 1117B.5.6.
 - 4. Proportions of Letters and Numbers: Section 1117B.5.3.
 - 5. Character Height: Section 1117B.5.4.
 - 6. Contrast and Finish of Symbols: Section 1117B.5.2.
 - 7. Raised Characters and Pictorial Symbol Signs: Section 1117B.5.5.
 - a. Letter Type: Section 1117B.5.5.1.

- b. Symbol Size: Section 1117B.5.5.2.
- c. Pictorial Symbol Signs (Pictograms Nongeometric): Section 1117B.5.5.3.
- 8. Information Posed: Section 1117B.5.8.1.3.
- 9. Mounting Location and Height (where permanent identification is provided or where signage is required for rooms and spaces): Section 1117B.5.7.
- 10. Doorways leading to Men's, Boys', Women's, and Girls' Sanitary Facilities: Provide signs that comply with applicable requirements of Sections 1115B.6; and 1117B.5.1 to 1117B.5.8.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with the 2010 California Building Code (CBC).
 - 2. Comply with the 2010 Americans with Disabilities Act (ADA) Accessibility Guidelines.

1.6 GUARANTEE

- A. Provide in required form for a period of **2 years** from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 FABRICATION

- A. General: Unless specified otherwise, sign copy and size shall be as shown.
- B. Colors: See Color Schedule
- C. Engraved Laminated Acrylic Signs:
 - 1. General: 1/8 inch thick non-glare acrylic core with laminated, non-glare acrylic face in contrasting color. Engrave through face ply to expose contrasting core. Core may be opaque acrylic in selected color, or clear acrylic with selected color painted on back. Ease edges. Comply with CBC Section 1117B.5.
 - 2. Letters: Raised, raised 1/32 inch; sans-serif, uppercase; min height, 5/8 inches; max height, 2 inches; width-to-height ratio between 3:5 and 1:1; stroke ratio between 1:5 and 1:10; copy as shown.
 - 3. Symbols: Raised 1/32 inch; international symbols as shown.
 - 4. Braille: Dots 1/10 inch on center in each cell with 2/10 inch space between cells, raised minimum of 1/40 inch above background. Contracted grade 2.
- D. Acrylic Signs with Subsurface Copy:
 - 1. General: Apply vinyl sheet stencil to back face of clear acrylic panel. Fill resulting copy with contrasting, non-fading enamel recommended by acrylic manufacturers for optimum adherence to acrylic surface. Ease edges. Comply with CBC Section 1117B.5.
 - 2. Thickness:
 - a. Toilet Room Door Signs: 1/4 inch thick per CBC Section 1115B.5.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Environmental Requirements: Do not install acrylic signs when temperature is below 70 degrees F.

3.2 INSTALLATION

- A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Wall Mounted: Use mechanical fasteners at exterior locations and adhesive at interior locations.
- C. Glass Mounted: Use clear adhesive. Install backplate aligned with sign on opposite side of glass.

3.3 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion, clean exposed surfaces in a manner that will not damage finish.

END SECTION 10 14 00

SECTION 10 14 16 PLAQUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes plaques and related work as specified and shown:

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions, profiles, and finishes.
- B. Shop Drawings: Show layout, mounting methods, grounds, mounting heights, reinforcement, accessories, and installation details.
- C. Samples: Show representative texture, character style, spacing, finish, and method of attachment.
- D. Closeout Submittals:
 - 1. O & M Manuals: Maintenance and cleaning instructions
 - 2. Guarantee: Provide completed forms per Article 1.4

1.4 GUARANTEE

- A. Provide in required form for a period of **1 year** from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 PLAQUES (PLQ)

- A. Manufacturer's standard bronze dedication plaque:
 - 1. Size: 24 inches by 30 inches
 - 2. Border: Raised bevel; polished face
 - 3. Background: Matte surface; oxidized with clear lacquer finish.
 - 4. Letters: Helvetica medium; polished face.
 - 5. Layout:
 - 2 inch high: (Project Name)
 - 1 inch high: (Owner Name) 2 inch high: (Year)
 - 1 inch high: Contractor
 - 1 inch high: County Board of Supervisors
 - 1 inch high: Architect
- B. Acceptable Manufacturers:
 - 1. A.R.K. Ramos.
 - 2. Metal Arts; Div. of L&H Mfg.

3. Metallic Arts.
4. Or equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Verify adequacy and location of backing for plaque mounting. Coordinate with the work of other trades including adjacent finishes.

3.3 INSTALLATION

- A. Mount plaques using fastening methods recommended in writing by manufacturer for type of wall surface and mounting indicated.
- B. Face Mounting: Mount plaques using exposed tamper proof fasteners with rosettes attached through face of plaque into wall surface.

3.4 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 10 14 16

SECTION 10 28 00 TOILET, BATH AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes toilet and bath accessories and related work as shown and specified.

B. Owner-Furnished Products:

1. **Toilet Tissue Dispensers:**
2. **Paper Towel**
3. **Standing trash receptacles: Owner furnished, owner installed.**

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.
- B. Samples: If specifically requested.
- C. Closeout:
 1. Manuals: Cleaning instructions.
 2. Guarantee: Provide completed form.

1.4 GUARANTEE

- A. Provide in required form for a period of **2 years** from date of acceptance by Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Finishes: Type 304 stainless steel; No. 4 satin finish, unless specified otherwise.
- B. Fasteners: Same material as accessory unit; tamper resistant where exposed and galvanized steel where concealed.
- C. Templates and Backplates: Furnish to applicable trades for each accessory with location and mounting height.
- D. Keying: Key lockable accessories alike.

2.2 TOILET ROOM ACCESSORIES

- A. Acceptable Manufacturers:
 1. American Specialties, Inc.
 2. Bobrick Washroom Equipment, Inc.
- B. Alternate Manufacturers: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.

- C. Combination Paper Towel Dispenser and Waste Receptacle:
 - 1. Recessed (PTD-R):
 - a. Model No. 0462AD.
 - b. Model No. B-369.
- D. Grab Bars, Concealed Mounting (GB): Series No. 3800 with snap-on flange covers. Size and configuration as shown.
- E. Feminine Napkin Dispenser: Dual napkins and tampons, 25-cent coin operation.
 - 1. Surface Mounted (FND-S)
 - a. Model No. B-2800.
- F. Sanitary Napkin Disposal Unit:
 - 1. Recessed (SND-R):
 - a. Model No. 9471.
 - b. Model No. B-353.
 - 2. Surface Mounted (SND-S):
 - a. Model No. 0473-A.
 - b. Model No. B-254.
 - c. Model No. B-270.
 - 3. Partition Mounted (SND-P):
 - a. Model No. 0472.
 - b. Model No. B-254.
 - 4. Accessible (SND-A)
- G. Mirrors: ASTM C1048, Fully Tempered, Type 1-Transparent Flat, Class 1-Clear, Quality-q1 Mirror, 1/4 inch thick; sizes as shown.
 - 1. Framed Tempered Glass Mirror (FTGM):
 - a. Model No. 0600.
 - b. Model No. B-290.
- H. Shelves (SSH): Length as shown.
 - 1. Model No. 0690.
 - 2. Model No. B-295.

2.3 TOILET ROOM MULTI-PURPOSE ACCESSORIES

- A. Acceptable Manufacturers:
 - 1. American Specialties, Inc.
 - 2. Bobrick Washroom Equipment, Inc.

2.4 SHOWER ROOM ACCESSORIES

- A. Acceptable Manufacturers:
 - 1. American Specialties, Inc.
 - 2. Bobrick Washroom Equipment, Inc.
- B. Alternate Manufacturers: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- C. Shower Curtain Rod (SHW): Length per opening width.
 - 1. Model No. 1204.
 - 2. Model No. B-6047.
- D. Vinyl Shower Curtain (SHW):
 - 1. Model No. 1200-V.
 - 2. Model No. 204.
 - 3. Size: Minimum 6 inches wider than opening by 72 inches high.
 - 4. Color: White.
 - 5. Flammability Resistance: NFPA 701.
- E. Shower Curtain Hooks (SHW): One hook per curtain grommet.
 - 1. Model No. 1200-SHU.
 - 2. Model No. 204-1.
- F. Folding Shower Seat (FSS):
 - 1. Model No. 8206.
 - 2. Model No. B-5181.
- G. Soap Dish:
 - 1. Recessed (SD):
 - a. Model No. 0400.
 - b. Model No. B-4380.
 - 2. Recessed, with Bar (SD-B):
 - a. Model No. 0398.
 - b. Model No. B-4390.
- H. Robe Hook:
 - 1. Single (RBH-S):
 - a. Model No. 7340.
 - b. Model No. B-6717.

2.5 CUSTODIAL ACCESSORIES

- A. Acceptable Products:
 - 1. Model No. 1315-4, as manufactured by American Specialties, Inc.
 - 2. Model No. B-224, as manufactured by Bobrick Washroom Equipment, Inc.
- B. Alternate Products: Proposed equals are subject to substitution process per SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS.
- C. Mop Strip with Utility Shelf (MSUS): 4 mop holders and 3 rags hooks.
 - 1. Model No. 1315-4; 3'-0" length.
 - 2. Model No. B-224 x 36.

2.6 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of **6** keys to Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Take field measurements; report variance between plan and field dimensions.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Install units level, plumb, and firmly anchored in locations and at heights as shown.
- C. Install toilet and bath accessories with concealed vandal proof fasteners where fasteners are exposed to view. Mount accessories back-to-back, where possible. Attach accessories securely to walls or toilet partitions as recommended by manufacturer for each item and each condition; adhesive installation is not permitted.
- D. Install grab bars to withstand a load of at least 250 pounds per foot, per ASTM F 446. Secure grab bars to preset mounting plates screwed to studs or backing plate, using brass or stainless steel vandal proof fastenings. Where mounted on toilet partitions, provide back-to-back sleeves per manufacturer's recommendations.
- E. Install continuous wood shim along sides and top of mirrors at walls where mirror extends above top of wainscot. Paint visible edge of wood shim to match wall paint color.
- F. Hang shower doors level, straight and plumb; completely watertight.
- G. Install electric hand dryer per DIVISION 26 – ELECTRICAL.

3.3 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 10 28 00

SECTION 10 44 00 FIRE PROTECTION SPECIALITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes fire protection specialties and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Closeout Submittals:
 - 1. O & M Manuals: Maintenance and testing requirements
 - 2. Guarantee: Provide completed forms per Article 1.6.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire extinguisher cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- D. Fire-rated Extinguisher Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

- A. Coordinate size of fire extinguisher cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.6 GUARANTEE

- A. Labor and Materials: Submit in specified form covering labor and materials for a period of 1 year from date of acceptance by Owner.
- B. Provide manufacturer's warranty that products are to be free from defects in materials and workmanship for 6 years beginning at date of acceptance by Owner.
- C. Failures include, but are not limited to, the following:
 - 1. Failure of hydrostatic test according to NFPA 10.
 - 2. Faulty operation of valves or release levers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Potter Roemer; Div. of Smith Industries, Inc.
 - 2. JL Industries, Inc.
 - 3. Larsen's Manufacturing Company.
 - 4. Or equivalent.

2.2 FIRE EXTINGUISHERS (FE)

- A. General: Manufacturer's standard fire extinguishers, using dry chemical agent with a UL rating 2A-10BC, 5 pounds at locations indicated on the Drawings.
- B. Mounting Brackets: At surface mounted extinguisher provide manufacturer's standard steel bracket, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2.3 FIRE EXTINGUISHER CABINETS

- A. Non Fire Rated Recessed Cabinets (FE-R):
 - 1. Potter Roemer: Alta Series 7010-DV-2-RED.
 - 2. JL Industries: Ambassador Series 1015-E-16 red door and tub with SAF-T-LOK.
 - 3. Larsen's: Architectural Series 2409-R1 Vertical Duo, red door and tub.

2.4 EMERGENCY ENTRY SYSTEMS (EEKB)

- A. Acceptable Manufacturers: Knox Company.
- B. Emergency Entry Key Box:
 - 1. Key Box Model: Knox Box 3200 series, **surface mounted**.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordination: Coordinate with the related work of other trades. Verify that proper backing is in place before beginning work.
- B. Protection: Protect products from damage during installation and until final acceptance.

3.2 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

3.3 ADJUSTMENT

- A. Prior to acceptance adjust moveable parts to assure smooth operation.

3.4 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean inside and outside surfaces in a manner that will not damage finish.

END SECTION 10 44 00

END DIVISION 10 – SPECIALTIES

DIVISION 11 – EQUIPMENT

SECTION 11 40 00 STAINLESS STEEL COUNTERS AND CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes foodservice equipment and related work as shown and specified.

1.3 SUBMITTALS

- A. Product Data: Before purchase of any standard manufacturer's items, submit manufacturer's specifications, data, and installation instructions for review.
- B. Shop Drawings:
 - 1. General: Submit 3 sets for review.
 - 2. Drawings: Submit custom manufactured and/or fabricated equipment, indicated at 3/4 inch scale detail, showing construction methods, type and gage of metal, hardware and fittings, plan front elevation, a minimum of one cross-section, and utility types, sizes and locations. Illustrate complicated parts of typical items in cut-away perspective. For control systems, indicate service connections, characteristics, and wiring diagrams.
 - 3. Utilities: Show locations of plumbing, electrical and refrigeration lines required. This Contractor is responsible for the accuracy of location of all outlets required for this Work.
 - 4. Calculations: Submit structural calculations for seismic supports prepared by a structural engineer registered in the State of California.
- C. Certificates:
 - 1. Submit manufacturer certification that products meet or exceed UL and specified requirements.
- D. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.
- E. Closeout Submittals:
 - 1. O & M Manuals: Operation and maintenance instructions, including lubrication and periodic maintenance requirement schedules.
 - 2. Guarantee: Provide completed form.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.

1.5 GUARANTEE

- A. Provide in required form for a period of 1 year from date of acceptance by Owner.
 - 1. Repairs and Replacements:
 - a. General: Made at a time and at hours satisfactory to the Owner.
 - b. Time Allowance for Repairs: 72 hours.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Provide equipment in sections sized to fit openings.
- B. Protect materials during shipment, storage and installation. Repair or replace damaged parts, as directed by Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A167, Type 304 commercial grade, No. 4 finish.
- B. Accessories:
 - 1. Finish Hardware: Manufacturer's standard.
 - 2. Fittings: Sink drains with crumb cup and waste fittings, faucets, electrical outlets, etc., manufacturer's standard.
 - 3. Service Outlet Covers and Escutcheons: Stainless steel.

2.2 FASTENERS

- A. As recommended by manufacturer, and as shown; use stainless steel fasteners in stainless steel surfaces.

2.3 SEALANT

- A. Manufacturers or fabricators standard; bacteria resistant.

2.4 FABRICATION

- A. General: Shop assemble work where possible; accommodate site installation of other services or equipment.
- B. Assembly:
 - 1. General: Fabricate sheet material for work surfaces, facings, shelves, and drain boards of straight lengths in one continuous sheet when less than 12'-0" in length. Fit and attach integral sinks. Weld metal joints for lengths over 12'-0". Weld and form edges, ends, and joints smooth. Grind welds of stainless steel smooth and flush; polish to match adjacent surfaces. Cut and drill components for service outlets and fixtures. Bolt and screw with countersunk flat head fasteners at visible or accessible surfaces. Use concealed fastenings where possible.

2. Legs:
 - a. General: Provide stainless steel legs with adjustable feet. Fasten legs to equipment securely and rigidly. Install rubber or nylon button feet on bearing surface of any item positioned on a finished surface.
 - b. Anchorage: Fix leg mounted units by dowelling to floor with 1/4 inch stainless steel pins, where vibration or oscillation is anticipated.
3. Drain Piping: Provide indirect drain piping from equipment to terminate over nearest waste receptor.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions of work in place before beginning work; report defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Scheduling:
 1. Schedule Work to immediately follow installation of utilities and precede installation of room finishes.
 2. Coordinate the work with location and placement of utilities. Coordinate characteristics of utilities with requirements of food service equipment.
- B. Take field measurements before fabrication; report variance between plan and field dimensions.
- C. Protection: Protect adjoining surfaces during installation; repair damaged surfaces.

3.3 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
- B. Weld and grind joints in steel work tight, without open seams, where necessary due to limitations of sheet sizes or installation requirements. Cut, fit, and patch where necessary. Provide cutting and patching of items of this section required for installation or services of equipment. Cut and drill components for service outlets, fixtures, and fittings.
- C. Isolate dissimilar metals with heavy coat of paint to prevent electrolysis.
- D. Use anchoring devices appropriate for equipment and expected usage.
- E. Provide clean joint with adjacent building finishes and between abutting components per SECTION 07 92 00 - JOINT SEALANTS.
- F. Install equipment identified in Equipment Schedule at the end of this Section, as shown and here-in specified.

3.4 ADJUSTMENT

- A. Prior to acceptance, adjust moveable parts to assure smooth operation.
- B. At completion of work, provide qualified and trained personnel to demonstrate operation of each item of equipment and instruct Owner in operating procedures and maintenance.

3.5 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

END SECTION 11 40 00

END DIVISION 11 – EQUIPMENT

DIVISION 12 – FURNISHINGS

NOT USED AT THIS TIME

DIVISION 13 – SPECIAL CONSTRUCTION

NOT USED AT THIS TIME

DIVISION 14 – CONVEYING EQUIPMENT

NOT USED AT THIS TIME

DIVISION 21 – FIRE SUPPRESSION

SECTION 21 05 00 BASIC MATERIALS & METHODS

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and DIVISION 01 – GENERAL REQUIREMENTS, and shall include all Mechanical Sections specified herein.

1.2 SCOPE OF THIS SECTION

- A. All work to be furnished and installed under this Section shall comply with all the requirements of DIVISION 1, and shall include, but not necessarily be limited to, the following:
 - 1. Compliance with all codes and standards applicable to this jurisdiction.
 - 2. Shop Drawings for Equipment
 - 3. Coordination Documents
 - 4. Record Drawings
 - 5. Start-up Service and Building Commissioning
 - 6. Instruction, Maintenance, and O & M Manuals
 - 7. Work associated with Delivery, Storage, and Handling of products
 - 8. Work associated with provision of Temporary Facilities
 - 9. Preparation of Posted Operating Instructions
 - 10. Meeting Project Safety and Indemnity requirements
 - 11. Proper Cleaning and Closing
 - 12. Supplying proper Warranty information
 - 13. Supply specified Guarantee documentation
 - 14. Design and provision of Supports and Anchors
 - 15. Design and provision of Seismic Restraints and Vibration Isolation
 - 16. Pipe Portals
 - 17. Access Panels and Doors
 - 18. Identification Markers
 - 19. Coordination of Electrical requirements for equipment provided

1.3 DESCRIPTION OF WORK

- A. The Contract Specifications are intended to provide all material and labor to install complete fire protection systems for the building and shall interface with all existing building systems affected by new construction.

- B. The Contractor shall refer to the architectural interior details, floor plans, elevations, and the structural and other Contract Drawings and he shall coordinate his work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of the equipment, and risers and are not to be scaled; all dimensions and existing conditions shall be checked at the building.
- C. The Contractor shall comply with the project closeout requirements as detailed in General Requirements of DIVISION 1.
- D. Where project involves interface with existing building the Contractor should thoroughly familiarize themselves with existing conditions and be aware that in some cases information is not available as to concealed conditions, which exist in portions of the existing building affected by this work.

1.4 DESCRIPTION OF BID DOCUMENTS

- A. Specifications:
 - 1. Specifications, in general, describe quality and character of materials and equipment.
 - 2. Specifications are of simplified form and include incomplete sentences.

1.5 DEFINITIONS

- A. "Above Grade": Not buried in the ground and not embedded in concrete slab on ground.
- B. "Actuating" or "Control" Devices: Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.
- C. "Below Grade": Buried in the ground or embedded in concrete slab on ground.
- D. "Concealed": Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures. In general, any item not visible or directly accessible.
- E. "Connect": Complete hook-up of item with required service.
- F. "Exposed": Not installed underground or "concealed."
- G. "Furnish": To supply equipment and products as specified.
- H. "Indicated," "Shown" or "Noted": As indicated, shown or noted on Drawings or Specifications.
- I. "Install": To erect, mount and connect complete with related accessories.
- J. "Motor Controllers": Manual or magnetic starters (with or without switches), individual push buttons or hand-off-automatic (HOA) switches controlling the operation of motors.
- K. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.
- L. "Provide": To supply, install and connect as specified for a complete, safe and operationally ready system.
- M. "Reviewed," "Satisfactory" or "Directed": As reviewed, satisfactory, or directed by or to Architect/Engineer/Owner.
- N. "Rough-In": Provide all indicated services in the necessary arrangement suitable for making final connections to fixture or equipment.
- O. "Shall": An exhortation or command to complete the specified task.

- P. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified products.
- Q. "Supply": To purchase, procure, acquire and deliver complete with related accessories.
- R. "Typical" or "Typ": Exhibiting the qualities, traits, or characteristics that identify a kind, class, number, group or category. Of or relating to a representative specimen. Application shall apply to all other similarly identified on plan or detail.
- S. "Will": A desire to complete the specified task. Allows some flexibility in application as opposed to "Shall."
- T. "Wiring": Raceway, fittings, wire, boxes and related items.
- U. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

1.6 RELATED WORK SPECIFIED ELSEWHERE

- A. All DIVISION 21 – FIRE SUPPRESSION sections included herein.
- B. DIVISION 2 – EXISTING CONDITIONS.
 - 1. Coordination of excavation of trenches and the installation of piping on site.
- C. DIVISION 9 – FINISHES:
 - 1. DIVISION 21 installers shall perform all painting, except where specifically stated otherwise in DIVISION 9.
- D. DIVISION 26 – ELECTRICAL is related to work of:
 - 1. Fire protection alarms and relays.
 - 2. Detectors and monitoring.
 - 3. Power connections to all equipment.
 - 4. Life safety provisions.

1.7 CODES AND STANDARDS

- A. The Contractor is cautioned that code requirements not explicitly detailed in these specifications or drawings, but which may be reasonably inferred or implied from the nature of the project, must be provided as part of the contract.
- B. Perform all tests required by governing authorities and required under all DIVISION 21 Sections. Provide written reports on all tests.
- C. Electrical devices and wiring shall conform to the latest standards of NEC; all devices shall be UL listed and labeled.
- D. All excavation work must comply with all provisions of state laws including notification to all owners of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.
- E. Provide in accordance with rules and regulations of the following:
 - 1. Building Codes enforced by the Authority Having Jurisdiction in California:
 - a. 2010 Building Standards Administrative Code, Part 1, Title 24 C.C.R.

- b. 2010 California Building Code (CBC), Part 2, Title 24 C.C.R.
(2009 International Building Code and 2010 California Amendments)
 - c. 2010 California Electrical Code (CEC), Part 3, Title 24 C.C.R.
(2008 National Electrical Code and 2010 California Amendments)
 - d. 2010 California Mechanical Code (CMC) Part 4, Title 24 C.C.R.
2009 Uniform Mechanical Code and 2010 California Amendments)
 - e. 2010 California Plumbing Code (CPC), Part 5, Title 24 C.C.R.
(2009 Uniform Plumbing Code and 2010 California Amendments)
 - f. 2010 California Energy Code (CEC), Part 6, Title 24 C.C.R.
 - g. 2010 California Fire Code, Part 9, Title 24 C.C.R.
(2009 International Fire Code and 2010 California Amendments)
 - h. 2010 California Green building Standards Code (CALGreen), Part 11, Title 24 C.C.R.
 - i. 2010 California Referenced Standards, Part 12, Title 24 C.C.R.
 - j. Title 19 C.C.R. Public Safety, State Fire Marshal Regulations.
 - k. NFPA Standards enforced in California:
 - i. 2010 CBC (State Fire Marshall) Chapter 35 amendments to NFPA standards.
 - ii. NFPA 13, Automatic Sprinkler Systems, 2010 Edition
 - iii. NFPA 14, Standpipe Systems (CA Amended), 2007 Edition
 - iv. NFPA 17a, Wet Chemical Systems, 2002 Edition
 - v. NFPA20, Stationary Pumps, 2007 Edition
 - vi. NFPA 24, Private Fire Mains (CA Amended), 2010 Edition
 - vii. NFPA 72, National Fire Alarm Code (CA Amended), 2010 Edition
 - viii. NFPA 80, Fire Door and Other Opening Protectives, 2007 Edition
 - ix. NFPA 2001, Clean Agent Fire Extinguishing Systems, 2008 Edition.
2. Local, city, county and state codes and ordinances
 3. Local Bureau of Buildings
 4. Local Health Department
 5. Local and State Fire Prevention Districts
 6. State Administrative Codes
- F. Provide in accordance with appropriate referenced standards of the following:
1. NFPA - National Fire Protection Association.
 2. CSA - Canadian Standards Association.
 3. ANSI - American National Standards Institute.

4. ASME - American Society of Mechanical Engineers.
5. ASTM - American Society for Testing Materials.
6. AWS - American Welding Society.
7. AWWA - American Water Works Association.
8. FM - Factory Mutual.
9. MSS - Manufacturer's Standardization Society.
10. NEMA - National Electrical Manufacturer's Association.
11. UL - Underwriter's Laboratories.
12. ADA - Americans with Disabilities Act.
13. ETL - Electrical Testing Laboratories.
14. IAPMO - International Association of Plumbing and Mechanical Officials.

1.8 QUALITY ASSURANCE

- A. Manufacturer's Nameplates: Nameplates on manufactured items shall be aluminum or Type 304 stainless steel sheet, not less than 20 USG (0.0375"), riveted or bolted to the manufactured item, with nameplate data engraved or punched to form a non-erasable record of equipment data.
- B. Current Models. All work shall be as follows:
 1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
 2. Replacement parts shall be readily available and stocked in the USA.
- C. Experience: Unless more stringent requirements are specified in other sections of DIVISION 21, manufactured items shall have been installed and used, without modification, renovation or repair, on other projects for not less than one year prior to the date of bidding for this project.
- D. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.
 1. All pipe, pipe fittings and valves shall be manufactured in North America.

OR

2. Upon request, the engineer shall be furnished certification by the manufacturer, stating samples representing each lot have been tested and inspected as indicated in governing ASTM specifications have been met. Certification shall be accompanied by test reports as prepared in accordance with relevant ASTM sections governing Test Methods and Inspection. Tension Tests reports shall include breaking load, machined diameter of the test bars, and calculated tensile strength. Certification shall include the legal name and address of the manufacturer.

1.9 GENERAL REQUIREMENTS

- A. Examine all existing conditions at building site.
- B. Review contract documents and technical specifications for extent of new work to be provided.
- C. Provide and pay for all permits, licenses, fees and inspections.

- D. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. This work shall include furnishing and installing all access doors required for mechanical access.
- E. Coordinate equipment and materials installation with other building components.
- F. Verify all dimensions by field measurements.
- G. Arrange for chases, slots, and openings in other building components to allow for installations.
- H. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- I. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of the work.
- J. Coordinate the cutting and patching of building components to accommodate the installation of equipment and materials. Contractor to provide for all cutting and patching required for installation of his work unless otherwise noted.
- K. Install fire protection services and overhead equipment to provide the maximum headroom possible.
- L. Install equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, without interference with other installations.
- M. Coordinate the installation of materials and equipment above ceilings with ductwork, piping, conduits, suspension system, light fixtures, cable trays, and other installations.
- N. Coordinate connection of systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- O. Coordinate with Owner in advance to schedule shutdown of existing systems to make new connections. Provide valves in new piping to allow existing system to be put back in service with minimum down time.
- P. All materials (such as insulation, piping, wiring, controls, etc.) located within air plenum spaces, air shafts, and occupied spaces shall have a flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) Method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories, Inc., label or listing, or satisfactory certified test report from an approved testing laboratory to prove the fire hazard ratings for materials proposed for use do not exceed those specified.
- Q. Products made of or containing lead, asbestos, mercury or other known toxic or hazardous materials are not acceptable for installation under this Division. Any such products installed as part of the work of the Division shall be removed and replaced and all costs for removal and replacement shall be borne solely by the installing Contractor.

1.10 MINOR DEVIATIONS

- A. The Contractor shall review the structural and architectural conditions and drawings affecting his work. It is the specific intention of this section that the contractor's scope of work shall include:
 - 1. Proper code complying support systems for all equipment whether or not scheduled or detailed on drawings or in these specifications
- B. The Contractor shall study the operational requirements of each system, and shall arrange his work accordingly, and shall furnish such fittings, offsets, supports, accessories, as are required for the proper and efficient installation of all systems from the physical space available for use by this section. This requirement extends to the Contractor's coordination of this section's work with the "Electrical Work." Should conflicts occur due to lack of coordination, the time delay, cost of rectification, demolition, labor and materials, shall be borne by the Contractor and shall not be at a cost to the Owner.
- C. Advise the Architect, in writing, in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.

1.11 PRODUCT SUBSTITUTIONS

- A. The Contractor shall certify the following items are correct when using substituted products other than those scheduled or shown on the drawings as a basis of design:
 - 1. The proposed substitution does not affect dimensions shown on drawings.
 - 2. The Contractor shall pay for changes to building design, including engineering design, detailing, structural supports, and construction costs caused by proposed substitution.
 - 3. The proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
 - 4. Maintenance and service parts available locally are readily obtainable for the proposed substitute.
- B. The Contractor further certifies function, appearance, and quality of proposed substitution are equivalent or superior to specified item.
- C. The Contractor agrees that the terms and conditions for the substituted product that are found in the contract documents apply to this proposed substitution.
- D. Product substitutions shall also comply with SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS. Should any conflict arise between this specification Section and SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS, the latter shall take precedence.

1.12 SHOP DRAWINGS AND EQUIPMENT SUBMITTALS

- A. See SECTION 21 10 00 - FIRE PROTECTION.

1.13 COORDINATION DOCUMENTS

- A. The coordination work shall be prepared as follows:
 - 1. Two dimensional paper or AutoCAD/Revit based documents:
 - a. The Sheet Metal (Mechanical) Contractor shall prepare Drawings to an accurate scale of 1/4" = 1'-0" or larger, on reproducible media sheets or AutoCAD/Revit files. Lettering shall be minimum 1/8" high. Provide a "Hold Harmless Release" to obtain paper or

AutoCAD files of the HVAC design from the Architect, or Engineer. Drawings are to be same size as Contract Drawings and shall indicate location, size and elevation above finished floor, of all HVAC equipment, ductwork, and piping. Plans shall also indicate proposed ceiling grid and lighting layout, as shown on electrical plans and reflected ceiling plans.

- b. The Plumbing Contractor shall obtain reproducible plans or AutoCAD files from the Mechanical Contractor, and indicate all plumbing lines including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
 - c. The Fire Protection Contractor shall obtain reproducible plans or AutoCAD files with the detailed mechanical and plumbing work shown. The Sprinkler Contractor shall indicate location of all sprinkler heads and piping, including valves and fittings, dimensions from column lines, and bottom of pipe elevations above finished floor.
 - d. Plans are to incorporate all addenda items and change orders.
 - e. Distribute plans to all trades and provide additional coordination as needed.
2. Three dimensional or BIM based documents:
- a. The Sheet Metal (Mechanical) Contractor shall prepare a three dimensional model of the work using the project BIM model. Provide a "Hold Harmless Release" to obtain the BIM model of the project structural, architectural, and HVAC design from the Architect. If a BIM model is not available use the available two-dimensional CAD files to construct a three dimensional model for coordination purposes.
 - b. The Plumbing Contractor shall provide BIM input to indicate all major plumbing lines exceeding 3" in diameter including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
 - c. The Fire Protection Contractor shall provide BIM input information locating all sprinkler heads and piping, including valves and fittings, dimensions from column lines, and bottom of pipe elevations above finished floor.
 - d. BIM models are to incorporate all addenda items and change orders.

1.14 START-UP SERVICE AND BUILDING COMMISSIONING

- A. Prior to start-up, be assured that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrication, venting, controls, and installed and properly set relief and safety valves.
- B. Provide services of factory-trained technicians for start-up of pumps, and other major pieces of equipment. Certify in writing compliance with this Paragraph, stating names of personnel involved and the date work was performed.
- C. Refer to other DIVISION 21 Sections for additional requirements.

1.15 INSTRUCTION, MAINTENANCE, AND O&M MANUALS

- A. O&M Manuals: Upon completion of the work, the Contractor shall submit to the Architect complete set of operating instructions, maintenance instructions, part lists, and all other bulletins and brochures pertinent to the operation and maintenance for equipment furnished and installed as specified in this section, bound in a durable binder. Refer to DIVISION 1.

- B. The Contractor shall be responsible for proper instruction of Owner's personnel for operation and maintenance of equipment, and apparatus installed as specified in DIVISION 21 to be no less than 2 hours for each piece of equipment.

1.16 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Store equipment and materials in an environmentally controlled area at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage. Piping shall be stored in bundles covered with visqueen. Piping showing signs of rust shall be removed from site and replaced.
- C. Coordinate deliveries of materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.17 POSTED OPERATING INSTRUCTIONS

- A. Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. Attach or post operating instructions adjacent to each principal system and equipment including start-up, operating, shutdown, safety precautions and procedure in the event of equipment failure. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal.

1.18 SAFETY AND INDEMNITY

- A. The Contractor shall be solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal hours of work.
- B. No act, service, Drawing, review, or Construction Review by the Owner, Architect, the Engineers or their consultants, is intended to include the review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify and defend the Owner, the Architect, the Engineers and their consultants, and each of their officers, employees and agents from any and all liability claim, losses or damage arising, or alleged to arise from bodily injury, sickness, or death of a person or persons, and for all damages arising out of injury to or destruction of property arising directly or indirectly out of, or in connection with, the performance of the work under the Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the Construction Contract Documents; but not including the sole negligence of the Owner, the Architect, the Engineers, and their consultants or their officers, employees and agents.

1.19 CLEANING AND CLOSING

- A. All work shall be inspected, tested, and approved before being concealed or placed in operation.

- B. Upon completion of the work, all equipment installed as specified in this section, and all areas where work was performed, shall be cleaned to provide operating conditions satisfactory to the Architect.

1.20 WARRANTIES

- A. All equipment shall be provided with a minimum one-year warranty to include parts and labor. Refer to individual Equipment Specifications for extended or longer-term warranty requirements.
- B. Provide complete warranty information for each item, to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.
- C. Service during warranty period: Contractor shall provide maintenance as specified elsewhere during the 12-month warranty period.

1.21 GUARANTEE

- A. The Contractor shall guarantee and service all workmanship and materials to be as represented by him and shall repair or replace, at no additional cost to the Owner, any part thereof which may become defective within the period of one (1) year after the Date of Final Acceptance, ordinary wear and tear excepted.
- B. Contractor shall be responsible for and pay for any damages caused by or resulting from defects in his work.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.
- B. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words "or approved equal" shall be considered to be subsequent to all manufacturers' names used herein, unless specifically noted that substitutes are not allowed.

2.2 SUPPORTS AND ANCHORS

- A. General: Comply with applicable codes pertaining to product materials and installation of supports and anchors, including, but not limited to, the following:
 1. UL and FM Compliance: Provide products, which are UL listed and FM approved.
 2. ASCE 7-05: "American Society of Civil Engineers."
 3. International Building Code (IBC)
 4. MSS Standard Compliance: Manufacturer's Standardization Society (MSS).
 5. SMACNA: "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 6. NFPA: Pamphlet number 13 and 14 for fire protection systems.
 7. Provide copper plated or plastic coated supports and attachment for copper piping systems. Field applied coatings or tape is unacceptable.

8. Manufacturer: Hilti Inc., B-Line, Anvil International, Michigan, Tolco, Kin-Line, Simpson, or Superstrut.
- B. Horizontal Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated hangers and supports of one of the following MSS types listed.
1. Adjustable Steel Clevis Hangers: MSS Type 1.
 2. Adjustable Steel Swivel Band Hangers: MSS Type 10.
 3. U-Bolts: MSS Type 24.
 4. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
 - a. Plate: Unguided type.
 - b. Plate: Guided type.
 - c. Plate: Hold-down clamp type.
 5. Pipe Saddle Supports: MSS Type 36, including steel pipe base support and cast iron floor flange.
 6. Pipe Saddle Supports with U-Bolt: MSS Type 37, including steel pipe base support and cast iron floor flange.
 7. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast iron floor flange.
 8. Single Pipe Roller with Malleable Sockets: MSS Type 41.
 9. Adjustable Roller Hangers: MSS Type 43.
 10. Pipe Roll Stands: MSS Type 44.
 11. Pipe Guides: Provide factory-fabricated guides of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.
- C. Horizontal Cushioned Pipe Clamp: Where pipe hangers are called out to absorb vibration or shock install a piping clamp with thermoplastic elastomer insert. Cush-A-Clamp or equal.
- D. Vertical Piping Clamps: Provide factory-fabricated two-bolt vertical piping riser clamps, MSS Type 8.
- E. Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments of one of the following MSS types listed.
1. Steel Turnbuckles: MSS Type 13.
 2. Steel Clevises: MSS Type 14.
 3. Swivel Turnbuckles: MSS Type 15.
 4. Malleable Iron Eye Sockets: MSS Type 16.
 5. Steel Weldless Eye Nuts: MSS Type 17.
- F. Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments of one of the following types listed.

1. Concrete Inserts: HCI-MD (for metal deck) or HCI-WF (for wood forms) cast-in anchors by Hilti Inc. or MSS Type 18 or Blue Banger Hanger by Simpson
 2. Steel Brackets: One of the following for indicated loading:
 - a. Light Duty: MSS Type 31.
 - b. Medium Duty: MSS Type 32.
 - c. Heavy Duty: MSS Type 33.
 3. Horizontal Travelers: MSS Type 58.
 4. Concrete Screw Anchors: KWIK HUS EZ-I by Hilti Inc., Titen HD (or Rod Hanger version) by Simpson Strong-Tie Co. Inc. or approved equal.
 5. Torque-Controlled Expansion Anchor: KWIK BOLT-TZ by Hilti Inc., Strong-Bolt 2 by Simpson Strong-Tit Co. Inc. or approved equal.
- G. Saddles and Shields (for heat traced pipe): Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
1. Pipe Covering Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
 2. Insulation Protection Shields: MSS Type 40, 18" minimum, or of the length recommended by manufacturer to prevent crushing of insulation. High-density insulation insert lengths shall match or exceed shield length.
 3. Thermal Hanger Shields: Constructed of 360° insert of waterproofed calcium silicate (60 psi flexural strength minimum) encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation. Shield length shall match or exceed length of calcium silicate insert.
 4. Thermal Hanger Couplings: Constructed of high strength plastic coupling to retain tubing and join insulation at clevis hangers and strut-mounted clamps. Klo-Shure Insulation Coupling or equal.
- H. Miscellaneous Materials:
1. Metal Framing: Provide products complying with NEMA STD ML1.
 2. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A36.
 3. Cement Grout: Portland Cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand by volume, with minimum amount of water required for placement and hydration.
 4. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required. Weld steel in accordance with AWS standards.
 5. Pipe Brackets: "HoldRite" copper plated brackets. Insulate brackets attached to metal studs with felt.

2.3 SEISMIC RESTRAINT/VIBRATION ISOLATION REQUIREMENTS

- A. Equipment, piping, ductwork and all system appurtenances (including weight of normal operating contents) shall be adequately restrained to resist seismic forces. Restraint devices shall be designed and selected to meet seismic requirements as defined in the latest edition of the UBC, with State Amendments, and applicable local codes in accordance with Seismic Zone D and the applicable Importance Factors and Soil Factors.
- B. All anchorages and/or seismic restraints shall be designed by a registered professional Civil or Structural Engineer licensed in the state of the project. Design shall include:
 - 1. Number, size and location of anchors for floor or roof-mounted equipment. For curb mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure.
 - 2. Number, size and location of vibration isolators, seismic restraint devices and their anchorage for vibration-isolated and suspended equipment.
 - 3. Number, size and location of braces and anchors for suspended piping and ductwork on shop drawings.
 - a. The contractor must select a single seismic restraint system pre-designed to meet the requirements of the current version of the UBC, with State Amendments.
 - b. Installations not addressed by the selected system must be designed, detailed and submitted along with the shop drawings.
 - c. Maximum seismic loads shall be indicated on drawings at each brace location.
 - d. Drawings shall bear the stamp and signature of the registered professional engineer licensed in the state of the project who designed the layout of the braces.
 - 4. Manufacturers: Mason, M.W. Sausse, Kinetics or approved equal.
 - 5. In addition, provide calculations, test data or California OSHPD approval number substantiating that the curb can accept the prescribed seismic forces. Provide calculations, test data or California OSHPD approval number verifying the horizontal and vertical ratings of the seismic restraint devices.
- C. Submittals:
 - 1. Confirmation of responsible design party (Shop Drawings received without this information will be rejected without review. Architect will be informed of potential delay of project.)
 - a. The seismic manufacturer's representative or engineer responsible for preparing the specified seismic submittal package shall send the following documentation of qualification:
 - i. The name and professional engineer's license number of the structural engineer who will be responsible for preparing, designing, and stamping the seismic shop drawing information.
 - 2. Shop Drawings submittal
 - a. Stamped seismic restraint calculations.
 - b. The type, size and deflection of each isolator proposed.
 - c. Details for all the isolators with snubbers proposed and seismic bracing.

- d. Details for steel frames to be used in conjunction with the isolation and seismic restraint of the items.
- e. Clearly outlined procedures for installing and adjusting the isolators, seismic restraints and snubbers.

2.4 ACCESS PANELS AND ACCESS DOORS

- A. Provide all access doors and panels to serve equipment under this work, including those which must be installed, in finished architectural surfaces. Frame of 16-gauge steel, door of 20 gauge steel. 1" flange width, continuous piano hinge, key operated, prime coated. Refer to Architectural Specifications for the required product Specification for each surface. Contractor is to submit schedule of access panels for approval. Exact size, number and location of access panels is not shown on Plans. Access doors shall be of a size to permit removal of equipment for servicing. Access door shall have same rating as the wall or ceiling in which it is mounted. Provide access panel for each concealed valve. Use no panel smaller than 12" x 12" for simple manual access, or smaller than 24" x 24" where personnel must pass through. Provide cylinder lock for access door serving mixing or critical valves in public areas.
- B. Included under this work is the responsibility for verifying the exact location and type of each access panel or door required to serve equipment under this work and in the proper sequence to keep in tune with construction and with prior approval of the Architect. Access doors in fire rated partitions and ceilings shall carry all label ratings as required to maintain the rating of the rated assembly.
- C. Acceptable Manufacturers: Milcor, Karp, Nystrom, or Elmdor/Stoneman.
- D. Submit markup of architectural plans showing size and location of access panels required for equipment access for approval by Architect.

2.5 IDENTIFICATION MARKERS

- A. Mechanical Identification Materials: Provide products of categories and types required for each application as referenced in other DIVISION 21 Sections. Where more than single type is specified for application, selection is installer's option, but provide single selection for each product category. Stencils are not acceptable.
- B. Plastic Pipe Markers:
 - 1. Snap-On Type: Provide pre-printed, semi-rigid snap-on, color coded pipe markers, complying with ANSI A13.1.
 - 2. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers, complying with ANSI A13.1. Secure both ends of markers with color coded adhesive vinyl tape.
 - 3. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.
- C. Underground-Type Plastic Line Markers: Provide 6" wide x 4 mils thick multi-ply tape, consisting of solid metallic foil core between 2 layers of plastic tape. Markers to be permanent, bright colored, continuous printed, intended for direct burial service.

D. Valve Tags:

1. Brass Valve Tags: Provide 1 1/2" diameter 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Fill tag engraving with black enamel.
2. Plastic Laminate Valve Tags: Provide 3/32" thick engraved plastic laminate valve tags, with piping system abbreviations in 1/4" high letters and sequenced valve number 1/2" high, and with 5/32" hole for fasteners.
3. Valve Tag Fasteners: Provide solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
4. Access Panel Markers: Provide 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

E. Plastic Equipment Signs:

1. Provide 4-1/2" x 6" plastic laminate sign, ANSI A.13 color coded with engraved white core lettering.
2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
3. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters, such as pressure drop, entering and leaving conditions, rpm, etc.

F. Acceptable Manufacturers: Craftmark, Seton, Brady, Marking Services, Inc., or Brimar.

2.6 ELECTRICAL

A. General:

1. All electrical material, equipment, and apparatus specified herein shall conform to the requirements of DIVISION 26.
2. Provide all motors for equipment specified herein. Provide motor starters, controllers, transfer switches, and other electrical apparatus and wiring which are required for the operation of the equipment specified herein.
3. Set and align all motors and drives in equipment specified herein.
4. Provide expanded metal or solid sheet metal guards on all V-belt drives to totally enclose the drive on all sides. Provide holes for tachometer readings. Support guards separately from rotating equipment.

5. Provide for all rotating shafts, couplings, etc., a solid sheet metal, inverted "U" cover over the entire length of the exposed shaft and support separately from rotating equipment. Cover shall extend to below the bottom of the shaft and coupling, and shall meet the requirements of the State Industrial Safety Regulations.
 6. Specific electrical requirements (i.e., horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.
- B. Quality Assurance:
1. Electrical components and materials shall be UL or ETL listed/labeled as suitable for location and use - no exceptions.
- C. Low Voltage Control Wiring:
1. General: 14 gauge, Type THHN, color coded, installed in conduit.
 2. Manufacturer: General Cable Corp., Alcan Cable, American Insulated Wire Corp., Senator Wire and Cable Co., or Southwire Co.

PART 3 - EXECUTION

3.1 GENERAL

- A. Workmanship shall be performed by licensed journeymen or master fitter and shall result in an installation consistent with the best practices of trades.
- B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal, or otherwise irregular work unless so indicated on Drawings or approved by Architect.

3.2 MANUFACTURER'S DIRECTIONS

- A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.

3.3 INSTALLATION

- A. Coordinate the work between the various Fire Protection Sections and with the work specified under other Divisions. If any cooperative work must be altered due to lack of proper supervision or failure to make proper and timely provisions, the alternations shall be made to the satisfaction of the Engineer and at the Contractor's cost. Coordinate wall and ceiling work with the General Contractor, and his subcontractors in locating ceiling air outlets, wall registers, etc.
- B. Inspect all material, equipment, and apparatus upon delivery and do not install any damaged or defected materials.

3.4 SUPPORTS AND HANGERS

- A. Installation of Building Attachments: Install building attachments at required locations within concrete or on structural steel for proper piping support. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed. Fasten insert securely to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through opening at top of inserts.

- B. Proceed with installation of hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to, proper placement of inserts, anchors, and other building structural attachments.
- C. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- D. Install hangers within 12 inches of every change in piping direction, end of pipe run or concentrated load, and within 36 inches of every major piece of equipment. Hangers shall be installed on both sides of flexible connections. Where flexible connection connects directly to a piece of equipment only one hanger is required.
- E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- F. Support sprinkler piping independently of other piping.
- G. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- H. Hanger Spacing in accordance with following minimum schedules (other spacings and rod sizes may be used in accordance with NFPA):

1. Steel Pipe:

<u>Pipe Size</u>	<u>Max. Hanger Spacing</u>	<u>Rod Size</u>
1/2" to 1 1/4"	5 feet	3/8"
1 1/2" to 2"	7 feet	3/8"
2 1/2" to 3"	10 feet	1/2"
4" and larger	12 feet	5/8"

2. Plastic Pipe:

<u>Pipe Size</u>	<u>Max. Hanger Spacing</u>	<u>Rod Size</u>
1/2" to 2"	4 feet	3/8"
2 1/2" and larger	6 feet	1/2"

I. Sloping, Air Venting, and Draining:

- 1. Slope all piping as specified and as indicated, true to line and grade, and free of traps and air pockets. Provisions for Movement:
- 2. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- 3. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connecting equipment.

4. Insulated Piping: Comply with the following installation requirements:
 - a. Clamps: Attach clamps, including spacers, (if any), to piping with clamps projecting through insulation.
 - b. Shields: Where low compressive strength insulation or vapor barriers are indicated on cold or chilled water piping, install shields or inserts.
 - c. Saddles: Where insulation without vapor barrier is indicated install protection saddles.
- J. Installation of Anchors:
 1. Install anchors at proper locations to prevent excessive stresses and to prevent transfer of loading and stresses to connected equipment.
 2. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure.
 3. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
 4. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends.
- K. Adjusting:
 1. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
 2. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
 3. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- L. Electrical Requirements:
 1. Fire Protection Contractor shall coordinate with DIVISION 26 work to provide complete systems as required to operate all devices installed under this Division of work.
 2. Installation of Electrical Connections: Furnish, install, and wire (except as may be otherwise indicated) all fire protection motors and controls in accordance with the following schedule and in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC, and NECA's "Standard of Installation" to ensure that products fulfill requirements.
 3. DIVISION 21 has responsibilities for electrically powered or controlled fire protection equipment which is specified in DIVISION 21 Specifications or scheduled on DIVISION 21 Drawings. The specific division of responsibilities between DIVISION 21 and 26 for furnishing or wiring this equipment is as follows:
 - a. DIVISION 21 Responsibilities:
 - i. MOTORS: Furnish and install all motors necessary for mechanical equipment.
 - ii. MAGNETIC STARTERS: Furnish all magnetic starters whether manually or automatically controlled which are necessary for mechanical equipment. Furnish these starters with all control relays or transformers necessary to interface with

controls. If the starter is factory installed on a piece of DIVISION 21 equipment, also furnish and install the power wiring between starter and motor.

- iii. VARIABLE FREQUENCY DRIVES: Provide all VFD's associated with equipment. If the drive is installed on a piece of factory assembled equipment the wiring between motor and drive is to be provided as part of the factory equipment.
- iv. DISCONNECTS: Provide the disconnects which are part of factory wired Division 21 equipment. Factory wiring to include wiring between motor and disconnect or combination starter/disconnect.
- v. CONTROLS: Division 21 Contractor is responsible for the following equipment in its entirety. This equipment includes but is not limited to the following:
 - vi. Control relays necessary for controlling DIVISION 21 equipment.
 - vii. Control transformers necessary for providing power to controls for DIVISION 21 equipment.
 - viii. Low or non-load voltage control components.
 - ix. Non-life safety related valve actuators.
 - x. Float switches.
 - xi. Solenoid valves, EP and PE switches.

M. Fire And Life Safety Equipment:

1. Fire Sprinkler System: DIVISION 21 is responsible for providing necessary controls including flow switches and alarm bells.
2. Specialized fire suppression systems: DIVISION 21 is responsible for providing necessary system controls and any required control interface wiring to these controls. DIVISION 26 is responsible for bringing power to point of connection with the system.

N. DIVISION 26 has responsibilities for electrically powered or controlled mechanical equipment which is specified in DIVISION 21 Specifications or scheduled on DIVISION 21 Drawings. The specific division of responsibilities between DIVISION 21 and 26 for furnishing or wiring this equipment is as follows:

1. DIVISION 26 Electrical Responsibilities:
 - a. MOTORS: Provide the power wiring for the motors.
 - b. MAGNETIC STARTERS: Except where magnetic starters are factory installed on DIVISION 21 factory assembled equipment, DIVISION 26 is to install magnetic starters furnished by DIVISION 21 and install the necessary power wiring to the starter and from the starter to the motor. In the case of factory installed starters, DIVISION 26 is to install the necessary power wiring to the starter.
 - c. VARIABLE FREQUENCY DRIVES: Physically mount all VFD's, which are not specified to be installed on DIVISION 21 factory assembled equipment. Provide the necessary power wiring to the VFD and from the VFD to the motor except in the case of factory installed VFD's where wiring between the motor and VFD is to be by DIVISION 21. Where disconnects are installed between a VFD and a motor provide the interlocking wiring

between the disconnect and VFD to insure that the drive is shutdown simultaneously with motor.

- d. DISCONNECTS: Provide all disconnects necessary for DIVISION 21 mechanical equipment which are not provided as part of factory wired DIVISION 21 equipment. Provide power wiring to all disconnects. In addition provide power wiring between motor and disconnect when the disconnect is not factory installed. See also Variable Frequency Drive above for special wiring requirements.
- e. CONTROLS: DIVISION 26 Contractor is responsible for providing power to control panels and control circuit outlets.

O. Fire And Life Safety Equipment:

- 1. Fire Sprinkler System: DIVISION 26 is responsible for providing power wiring to fire protection controls including flow switches and alarm bells.
- 2. Specialized Fire Suppression Systems: DIVISION 26 is responsible for providing power wiring to suppression system and its controls.
- 3. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
- 4. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
- 5. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner, or Architect/Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
- 6. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
- 7. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

- P. Motors and Motor Control Equipment: Conform to the standards of the NEMA. Equip motors with magnetic or manual line starters with overload protection. Motor starters and line voltage controls shall be installed under Electrical Section but located and coordinated as required under this Section of the work. Starters shall be combination type with non-fusible disconnect switches. All single phase fractional horsepower motors shall have built-in overload protection.

3.5 IDENTIFICATION MARKERS

- A. General: Where identification is to be applied to surfaces which require insulation, painting, or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- B. Piping System Identification:
 - 1. Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.
 - 2. Locate pipe markers as follows:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
 - d. At access doors, manholes, and similar access points which permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced horizontally at maximum spacing of 20' along each piping run, with minimum of one in each room. Vertically spaced at each story transversed.
- C. Underground Piping Identification: During backfilling/topsoiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.
- D. Equipment Identification: Locate engraved plastic laminate signs on or near each major item of mechanical equipment and each operational device. Provide signs for the following:
 - 1. Main control and operating valves, including safety devices.
 - 2. Meters, gauges and similar units.
 - 3. Pumps, compressors, and similar motor-driven units.
 - 4. Tanks and pressure vessels.
 - 5. Sprinkler and standpipe equipment.
- E. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations. Equipment signs shall include an identification of the area or other equipment served by the equipment being labeled.

3.6 VIBRATION AND DYNAMIC BALANCING

- A. Vibration tolerances shall be as specified by the "International Research and Development Corporation", Worthington, Ohio, measured by the displacement, peak to peak, as follows:
 - 1. Pump and Electric Motors: Below severity chart labeled "SLIGHTLY ROUGH", maximum vibration velocity of 0.157 in/sec, peak.

2. Compressors: Same as pumps.
- B. Correction shall be made to all equipment which exceeds vibration tolerances specified above. Final vibration levels shall be reported as described above.

3.7 TESTING

- A. Provide all tests specified hereinafter and as otherwise required. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing, that the specified tests have been performed and that the installation complies with the specified requirements and provide a report of the test observations signed by qualified inspector.

END SECTION 21 05 00

SECTION 21 07 00 FIRE SUPPRESSION INSULATION

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, and SECTION 21 05 00 - BASIC MATERIALS AND METHODS, and other Sections in DIVISION 21 specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this Section shall include, but not necessarily be limited to, providing insulation for the following:
 - 1. All heat traced piping.
- B. Types of mechanical insulation specified in this Section include the following:
 - 1. Fiberglass pipe insulation.
 - 2. Insulation jackets.
 - 3. Insulation accessories.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 21 05 00 - BASIC MATERIALS AND METHODS.
- B. SECTION 22 05 33 - HEAT TRACING.

1.4 DEFINITIONS

- A. Ambient: The air temperature to be maintained in a conditioned room. Typically between 70°F and 78°F.
- B. Insert: Spacer placed between the pipe support system and the piping to allow for the space required for insulation.
- C. Insulation Group (IG): Definition of Insulation Materials and Operating Temperatures.
- D. Insulation Shield: Buffer material placed between the pipe support system and the insulation to prevent the insulation material from crushing.
- E. Jacket: Protective covering over the pipe insulation; may be factory applied such as “all service jacket” or field applied to provide additional protection; of such materials as canvas, PVC, aluminum or stainless steel.
- F. Piping Insulation: Thermal insulation applied to prevent heat transmission to or from a piping system.
- G. Vapor Barrier Jacket: Insulation jacket material that impedes the transmission of water vapor.
- H. Freezing Climate: Where outdoor design temperature is less than 33° F, as stated in ASHRAE fundamentals under 99% column for winter design conditions.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Provide products conforming to the requirements of the following:
1. American Society for Testing and Materials (ASTM): Manufacture and test insulation in accordance with the ASTM Standards, including:
 - a. B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plat.
 - b. C165 - Recommended Practice for Measuring Compressive Properties of Thermal Insulation.
 - c. C177 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission.
 - d. C302 - Test Method for Density of Preformed Pipe-Covering-Type Thermal Insulation.
 - e. C305 - Test for Thermal Conductivity of Pipe Insulation.
 - f. C449 - Specification of Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - g. C547 - Specification for Mineral Fiber Preformed Pipe Insulation.
 - h. C921 - Practice for Determining Properties of Jacketing Materials for Thermal Insulation.
 - i. C1104 – Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
 - j. C1071 - Standard Specification for Thermal and Acoustical Insulation.
 - k. C1338 – Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings..
 - l. E84 - Test Method for Surface Burning Characteristics of Building Materials.
 - m. E119 - Test for Fire Resistance.
 2. National Fire Protection Association (NFPA): Manufacture insulation in accordance with the following NFPA standards:
 - a. 255 Test Methods, Surface Burning Characteristics of Building Materials.
- B. Do not provide materials with flame proofing treatments subject to deterioration due to the effects of moisture or high humidity.
- C. Products Containing Prohibited Chemicals:
1. Products containing the following prohibited chemicals for use as flame retardants or for other purposes will not be acceptable:
 - a. Pentabrominated diphenyl ether (CAS#32534-81-9)
 - b. Octabrominated diphenyl ether (CAS#32536-52-0)
 - c. Decabrominated diphenyl ether (CAS#1163-19-50)
- D. Flame/Smoke Rating: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) Method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories, Inc.,

label or listing; or satisfactory certified test report from an approved testing laboratory to prove the fire hazard ratings for materials proposed for use do not exceed those specified.

- E. Corrosiveness: Provide insulation such that when tested in accordance with the following test, the steel plate in contact with the insulation shows no greater corrosion than sterile cotton in contact with a steel plate for comparison.
 - 1. Test Specimen: Two specimens shall be used, each measuring 1" by 4" by approximately ½" thick.
 - 2. Apparatus: Provide a humidity test chamber in which two polished-steel test plates, 1" wide, 4" long and 0.020" thick, shall be placed. Plates shall be clear finish, cold-rolled strip steel, American quality, quarter hard, temper No. 3, weighing 0.85 lb/sq. ft.
 - 3. Procedure: The steel test plates shall be rinsed with cp benzol until their surfaces are free from oil and grease and allowed to dry. One piece of cold-rolled steel shall be placed between the two insulation specimens and secured with tape or twine. The test specimen and uncovered plate shall be suspended vertically in an atmosphere having a relative humidity of 95% (plus or minus 3%), and a temperature of 120°F (plus or minus 3°F), for 96 hours, and then be examined for corrosion.

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation. Also furnish necessary test data certified by an independent testing laboratory. Submit samples.
- B. Provide a statement with the submittal indicating that no product submitted contains an amount equal to or greater than 0.10% by mass of the following chemicals:
 - 1. Pentabrominated diphenyl ether (CAS#32534-81-9)
 - 2. Octabrominated diphenyl ether (CAS#32536-52-0)
 - 3. Decabrominated diphenyl ether (CAS#1163-19-50)
- C. Maintenance Data: Submit maintenance data and replacement material lists for all insulation. Include this data and product in maintenance manual.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coating to the site in containers with manufacturer's stamp or label affixed showing fire hazard indexes of products.
- B. Store and protect insulation against dirt, water, chemical, and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Johns Manville, Owens-Corning, Knauf, Armstrong, Pittsburgh-Corning, Certainteed, Halstead, Rubatex, 3M FireMaster, Pabco, Reflectix, or approved equal. Manufacturer and insulation types listed below indicate a minimum acceptable level of quality required for each classification.

2.2 PIPE INSULATIONS

- A. Glass Fiber: Molded fibrous glass pipe insulation shall comply with the requirements of ASTM C 547 and meet ASTM C 585 for sizes required in the particular system. For all fluid distribution temperatures below 45°F the system shall be of a wicking type.
1. Non-Wicking: Johns Manville Micro-Lok plain with PVC cover Meeting ASTM C547; Rigid Molded Noncombustible or Micro-Flex CTS (pipe sizes larger than 6"):
 - a. 'K' Value: 0.23 at 75°F.
 - b. Maximum Service Temperature: 850°F.
 - c. Vapor Retarder Jacket: AP-T PLUS white kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or AP jacket with outward clinch expanding staples or vapor barrier mastic as needed.
 2. Wicking: Owens Corning VaporWick Meeting ASTM C547; Rigid Molded Noncombustible:
 - a. 'K' Value: 0.23 at 75°F.
 - b. Maximum Service Temperature: 850°F.
 - c. Jacket: Polymer facing with factory-applied adhesive closure to provide positive mechanical and vapor sealing of longitudinal seams.
- B. Field Applied Jackets (For Interior Applications):
1. All longitudinal seams shall be located on bottom of pipes.
 2. PVC Plastic: Johns Manville Zeston 2000. One piece molded type fitting covers and jacketing material, gloss white. Connect with tacks and pressure sensitive color matching vinyl tape.
 3. Canvas Jacket: UL listed fabric, 6 oz/sq. yd. plain weave cotton, treated with dilute fire retardant lagging adhesive.
 4. Aluminum Jacket: 0.016" thick sheet, smooth finish, with longitudinal slip joints and 2" laps, die shaped fitting covers with factory attached protective liner.
 5. Secure aluminum jackets with 3/8" or 1/2" stainless steel bands on 12" centers.
- C. Field Applied Jackets (For Exterior Applications):
1. All longitudinal seams, on horizontal pipe runs, shall be installed on the bottom of pipes.
 2. Aluminum Jacket: 0.016" (minimum) thick sheet, smooth finish, with longitudinal slip joints and 2" laps, die shaped fitting covers with factory attached protective liner.
 3. Stainless Steel Jacket: Type 304 stainless steel, 0.010" minimum smooth finish.
 4. Secure stainless steel or aluminum jackets with 3/8" or 1/2" stainless steel bands on 12" centers.
 5. Manufacturers: Pabco, Childers, RPR, or approved equal.
- D. Removable Covers:
1. Provide removable covers on pumps, valves, vents, fittings, flanges, strainers, etc., where periodic maintenance or removal of insulation may is required.
 2. Use of premolded fittings with PVC covers is acceptable.
 3. Use of lace-on type insulating blankets is acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that piping has been tested for leakage in accordance with specifications before applying insulation materials. All piping shall be inspected by Owner's Representative prior to installation of insulation. Any insulation applied prior to inspection shall be removed and new insulation applied at no additional cost to Owner. Notify Owner's Representative five (5) working days prior to insulation installation.
- B. Verify that all surfaces are clean, dry and free of foreign material.

3.2 INSTALLATION

- A. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- B. Remove and replace any insulation that has become wet or damaged during the construction process.
- C. Piping Insulation:
 - 1. Locate insulation and cover seams in least visible locations unless otherwise specified.
 - 2. Neatly finish insulation at supports, protrusions, and interruptions.
 - 3. Provide insert between support shield and piping on piping 1½" diameter or larger. Fabricate of Johns Manville Thermo-12, or other heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths:
 - a. 1½" to 2½" pipe size 10" long
 - b. 3" to 6" pipe size 12" long
 - c. 8" to 10" pipe size 16" long
 - d. 12" and over 22" long
 - 4. Use of metal saddles is acceptable as specified in SECTION 21 05 00 - BASIC MATERIALS AND METHODS. Fill interior voids with segments of insulation matching adjoining pipe insulation.
 - 5. Use of pipe hangers designed as an insulation coupling is acceptable in lieu of saddles and other devices. Klo-Shure coupling or equal.
 - 6. For pipe exposed in mechanical equipment rooms or in finished spaces below 7 feet above finished floor, finish with Johns Manville Zeston 2000 PVC jacket and fitting covers, or aluminum or stainless steel jacket.
 - 7. Where pumps, valves, strainers, etc., with insulation require periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage. Use of premolded covers or lace-on type insulation blankets is required.
 - 8. For exterior applications: provide weather protection jacket. Insulated pipe lengths, pumps, fittings, joints, and valves shall be covered with aluminum jacket or stainless steel jacket. Jacket seams shall be located on bottom side of horizontal piping. All lateral joints shall be caulked with a minimum 20-year silicone sealant (clear). All longitudinal joints, except those

at the bottom of a horizontal pipe run, shall be caulked with a minimum 20-year silicone sealant (clear).

9. When maintenance or service access for equipment will result in foot traffic over floor mounted insulated piping the contractor is to fabricate a permanent removable walkway to prevent damage to the piping and insulation.

3.3 PIPING INSULATION SCHEDULE

- A. All insulation thicknesses shall meet or exceed state energy code requirements as noted below. Increase thickness ½" if exposed to exterior ambient air. Minimum thermal resistance in range of 4.2 to 4.6 per inch of thickness. Insulation thicknesses are based on fiberglass insulation and may be adjusted for equivalent insulation values for materials with superior "K" factors.
- B. Fiberglass Insulation:

	PIPE SIZE (inches)	THICKNESS (inches)	REMARKS
Piping exposed to freezing	All Sizes	2	

END OF SECTION 21 07 00

SECTION 21 10 00 FIRE PROTECTION

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 - General Requirements, SECTION 21 05 00 - BASIC MATERIALS AND METHODS, and other Sections in DIVISION 21 specified herein.

1.2 DEFINITIONS

- A. Pipe sizes used in this Section are nominal pipe size (NPS) specified in inches.
- B. Working plans as used in this Section refer to documents (including drawings and calculations) prepared pursuant to requirements in NFPA 13 for obtaining approval of authority having jurisdiction.
- C. NICET - National Institute For Certification In Engineering Technologies
- D. Other definitions for fire protection systems are included in referenced NFPA standards.

1.3 DESCRIPTION OF WORK

- A. The work includes the removing and modifying existing and, providing and installing a complete and fully operable automatic sprinkler system as described in this Section of the Specification and as shown on the contract construction drawings and shall be in accordance with rules, regulations and standards as required by the following authorities having jurisdiction.
 - 1. State of California.
 - 2. County of El Dorado
 - 3. Building Department.
 - 4. Fire Prevention Division, Fire Marshal's Office.
- B. Work to be in accordance with criteria of the following design and installation standards:
 - 1. National Fire Protection Association standards, most current adopted editions:
 - a. #13 -Standard for the Installation of Sprinkler Systems
 - b. #14 – Standard for the Installation of Standpipes and Hose Systems
 - c. #20 – Standard for the Installation of Stationary Pumps for Fire
 - d. #22 – Standard for Water Tanks for Private Fire Protection Water Tanks
 - e. #25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
 - f. #70 – National Electrical Code
 - g. #101 – Life Safety Code
 - 2. 2009 International Fire Code (IFC) with state amendments.
 - 3. 2009 International Building Code (IBC) with state amendments.
 - 4. Factory Mutual Approval Guide (Product listing, only). Factory Mutual Approval Guide and FM Pamphlet #20 "Rules for Installing Sprinklers" (Product listing and project review).

5. Underwriters Laboratories, Inc.
 6. Industrial Risk Insurance Underwriters.
 7. Owner's insurance agency.
- C. Work includes but is not limited to the following:
1. Automatic Wet Type Sprinkler System.
 2. Remodeling of existing systems.
 3. All cutting and patching.
 4. Provide all pipe, fittings, sprinklers, valves, signs, flow switches, tamper switches, protective painting, test connections, drains and tests necessary to make the entire system complete and operative.
 5. Coordinate with plumbing contractor for capacity of all sprinkler main, test, and auxiliary drain connections.
 6. Valve tags and instruction plates shall be mounted and/or hung per local fire department requirements.
 7. All sleeves and inserts.
 8. Provide hose valve with cap downstream of sprinkler system pressure reducing valves for the purpose of testing. Hose valve shall be sized to provide full flow through pressure reducing valve.

1.4 SUBMITTALS

- A. Product Data: Submit six copies of manufacturer's technical data and installation instructions for fire protection materials and products.
1. Thirty days after the awarding of contract, contractor shall submit list of manufacturer's names and model numbers for approval to Architect. This list shall identify any prior approved substituted items contractor wishes to use. Do not submit technical data until list has been approved. This is mandatory.
 2. Prior to construction submit for approval items including but not be limited to the following:
 - a. Coordinated layout drawings. Lettering shall be minimum 1/8" high.
 - b. Sprinklers and escutcheons - designating area of use.
 - c. Valves, valve boxes, flow switches, and tamper switches.
 - d. Provide Fire Marshal approval numbers for flow switches and tamper switches.
 - e. Pipe, fittings, sway bracing, inserts, anchors and hangers.
 - f. Inspector's test and drain station.
 - g. Fire department connections.
 - h. Fire extinguishers.
 - i. Hose valves, pressure relief valves, and pressure reducing valves.

- j. Fire pumps with performance curve.
 - k. Fire hydrants.
- B. Working Plans: Prepare scaled working plans for fire protection pipe and fittings including, but not necessarily limited to, pipe and tube sizes, locations, and elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Indicate interface between and spatial relationship to piping and adjacent equipment. Lettering shall be minimum 1/8" high. All design work shall be done under supervision of licensed engineer.
 - 1. Spacing of fire sprinklers shall be coordinated with lights, air conditioning outlets, sound speakers, architectural reflected ceiling plan; obstruction from light fixtures and other architectural features; and sprinkler piping shall be coordinated with HVAC ductwork & piping, plumbing, electrical conduit, cable trays and structure prior to the installation. Drawings shall be composite type including mechanical, plumbing and lighting equipment with sprinkler and sprinkler drain piping.
- C. Submittal Drawings: Submit shop drawings to Agency having jurisdiction for approval bearing engineer of record stamp bearing preparer's NICET stamp. Submit six approved copies, bearing stamp and/or signature of authority having jurisdiction to the Engineer for approval.
 - 1. Contractor shall submit sprinkler head locations to Architect for approval.
 - 2. Each calculation shall include legible schematic of system showing all hydraulic reference points.
- D. Hydraulic Calculations: Prepare hydraulic calculations of fire protection systems. Submit to authority having jurisdiction for approval. Submit six approved copies, bearing stamp, and/or signature of Agency having jurisdiction to Owner's representative for review and approval.
 - 1. Contractor shall submit published piping friction loss data from manufacturer with hydraulic calculations.
- E. Certificate of Installation: Submit certificate upon completion of fire protection piping work, which indicates that work has been tested in accordance with NFPA 13, and also that system is operational, complete, and has no defects.
- F. Maintenance Data: Submit maintenance data and parts lists for fire protection materials and products. Include this data, product data, shop drawings, approval drawings, approval calculation, certificate of installation, and record drawings in maintenance manual; in accordance with requirements of the General Conditions and of DIVISION 1.
- G. Operating and Maintenance Instructions: Provide the Owner with three sets of operating and maintenance instructions covering completely the operation and maintenance of sprinkler equipment and controls. Manual shall be assembled in a 3-ring binder and arranged in following sections:
 - 1. Site Utilities: Drawings showing location, size, depth of all connections, valve boxes, manholes, etc., as installed.
 - 2. Section No. 1: A chart tabulating all types of pipe fittings, valves, and piping specialties installed in each system.
 - 3. Section No. 2: A chart tabulating all pressures, valve settings for fire department and sprinkler pressure reducing valves. Provide pressure reducing valve flow test documentation.

4. Section No. 3: Manufacturer's brochures of all sprinkler heads.
5. Section No. 4: Manufacturer's brochures of fire pumps, jockey pump and controllers.
6. Section No. 5: Tamper switches and flow switches.
7. Section No. 6: Fire Department connections.
8. Section No. 7: Fire Extinguishers.
9. Section No. 8: Fire Hydrants.
10. Section No. 9: Reproducible copies of approved working drawings prepared to facilitate the actual installation of ductwork and piping. Drawings shall indicate location of all concealed valves, and other apparatus.
11. Section No. 10: 2 copies of NFPA 25 "Standard for Inspection, Testing and Maintenance of Water Based Fire Protection Systems."
12. Section No. 11: Approval Calculations.
13. Section No. 12: Certificate of Installation.
14. Section No. 13: Guarantees.
15. The Contractor is responsible for proper instruction of Owner's personnel for operation and maintenance of all material, equipment and apparatus provided.

1.5 DESIGN DESCRIPTION

- A. This section of the specification combined with any of the contract drawings are intended as a guide to establish a basis of design for the systems required.
- B. Contractor shall examine the existing installation, the Architectural, Interior Design, Structural, Mechanical and Electrical drawings, layout and install a completely hydraulically sized sprinkler system for all areas. Space shall be provided for any valving and equipment to be used.
 1. System shall start 5'-0" from perimeter wall and extend throughout the building.
 2. Contractor shall contact Owner's insurance agency to incorporate insurer's design requirements in this layout document. Factory Mutual shall review layout drawings and calculations. Incorporate all of their design criteria into documents.
- C. Office Areas: The main building shall be served with a wet type sprinkler system.
- D. Base Building construction shall include upright heads with tees with 1" outlets for future drop in areas with no ceiling. Areas with ceilings, including finished core areas, lobbies, corridors or as noted herein shall have concealed recessed pendent heads installed as part of the base building construction. Unfinished areas shall be provided with upright type heads. Heads will be relocated to the finished ceiling tile under the tenant improvement contract.
- E. All areas shall be sprinklered as the construction progresses, including accessible pipe chases, etc.
- F. All electrical devices used for this system shall be compatible with the fire alarm system, refer to DIVISION 26.

- G. Seismic Requirement: All automatic sprinkler systems to be seismically braced. Seismic Requirement: All automatic sprinkler and standpipe system to be seismically braced and anchored for IBC Seismic Zone D, FM and NFPA 13. Submit shop drawings on methods and materials.
 - 1. Do not use NFPA Earthquake Zone Chart.

1.6 HYDRAULIC DESIGN

- A. System shall be a straight line or gridded system per NFPA No. 13 with the following exceptions:
 - 1. For all systems the design area shall be the hydraulically most demanding rectangular area.
 - 2. Minimum pressure for any sprinkler head shall not be less than 7 psi.
- B. Total Combined Inside & Outside Hose Allowances: Hydraulic calculations shall include an allowance for hose streams, added at the point of connection to the water supply.
- C. Safety Factor: 10 Psi, or 10 percent of static and residual pressure, whichever is greater.
- D. Light Hazard Areas: Water density of 0.10 GPM per square foot calculated for an area of 1500 square feet in the most remote location.
- E. Ordinary Group I Hazard Areas: Water density of 0.15 GPM per square foot calculated for an area of 1500 square feet in the most remote locations.
- F. Ordinary Group II Hazard Areas: Water density of 0.20 GPM per square foot calculated for an area of 1500 square feet in the most remote locations.
- G. Extra Group I Hazard Areas: Water density of 0.30 GPM per square foot calculated for an area of 2500 square feet in the most remote locations.
- H. Head spacing shall not exceed the limits described in NFPA Pamphlet No. 13.
 - 1. Light Hazard: 225 sq.ft. (for smooth ceiling).
 - 2. Ordinary Hazard: 130 sq. ft.
 - 3. Extra Hazard: 100 sq. ft.
- I. Maximum floor areas protected by any one sprinkler system riser:
 - 1. Light Hazard: 52,000 sq.ft.
 - 2. Ordinary Hazard: 52,000 sq.ft.
 - 3. Extra Hazard: 40,000 sq. ft.
- J. Flow Data: Contractor is to verify flow data (static pressure, residual pressure and GPM flowing) available at site and provide design for available pressure and flow.

1.7 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 21 05 00 - BASIC MATERIALS AND METHODS.
- B. DIVISION 26 – ELECTRICAL. Coordinate for electrical wiring of detectors, flow alarm switches, tamper switches, fire alarm bell, for electrical wiring of fuel oil and water tank level alarms, connection by life safety section for remote monitoring and starting of fire pump, and power to fire pumps. All electrical devices used for this system shall be compatible with the fire alarm system. Coordinate with electrical for electric fire pump motor size and emergency generator sizing.

- C. DIVISION 9 – FINISHES.
- D. Coordination with Plumbing for drain.

1.8 QUALITY ASSURANCE

- A. The Contractor for the fire protection installation shall be duly qualified Fire Protection Contractor, experienced and regularly engaged in the installation of fire protection systems with a license classification of C-16. Where local authorities require additional licensing of the Fire Protection Contractor, and/or workmen, such a license shall be mandatory for a prospective Contractor.
 - 1. Contractor is to verify flow data (static pressure, residual pressure and GPM flowing) available at site and provide design for available pressure and flow.
 - 2. The Fire Protection contractor shall be the Engineer of Record for the automatic sprinkler system.
 - 3. Permits - The Fire Protection Contractor shall obtain permits for the installation or construction as required for approval and installation of the fire protection system. The Fire Protection Contractor shall submit working plans to the authorities having jurisdiction to obtain approval.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of DIVISION 1. Handle components carefully to prevent damage, denting, and scoring. Do not install damaged components. Damaged components shall be replaced with new components.
- B. Store/protect products under provisions of DIVISION 1. Store components in clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage.

1.10 GUARANTEE

- A. Provide a one-year (12 months) guarantee under provisions of DIVISION 1. The guarantee shall include parts, shipping, labor, travel costs, living expenses, required fees, and any other associated cost or expense to repair or replace products or systems. The guarantee period is to begin on the date of acceptance of the fire protection installation by the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All products to be commercial grade, new and of the manufacturer's latest design model. Products manufacturers outside of North America will not be accepted without written approval from engineer.
- B. All products to be UL listed and/or FM approved, except for items, which are not required to be listed by code.
- C. All products shall be delivered and stored in original containers. Containers shall be clearly marked or stamped with manufacturer's name and rating.
- D. The following items to be included but specified under SECTION 21 05 00 - BASIC MATERIALS AND METHODS.
 - 1. Hangers and supports.
 - 2. Escutcheons plates, flashings and sleeves.

3. Access panel and doors.
4. Identification markers and signs.
5. Expansion compensators and flexible connectors.
6. Anchors, and seismic restraints.

2.2 PIPE AND FITTINGS - ABOVE GROUND

- A. General: The piping products listed below by manufacturer's name and model numbers are the only acceptable materials listed for this project. Substitutions of pipe must be submitted and approved in writing by the Architect. No copper pipe shall be allowed in the wet fire sprinkler system.
- B. Piping or fittings that show substantial rust or breaks in coating will be removed and replaced.
- C. Allied Tube & Conduit: Schedule 40 black steel, ASTM A-135 stamped on pipe, UV cured acrylic finish; Stockham, Grinnell or Warwick Class 150 threaded malleable, ASTM A197, ASTM A126, or Victaulic roll-grooved fittings and couplings, only.
- D. Allied Tube: Schedule 10 black steel pipe, ASTM A-135 stamped on pipe, UV cured acrylic finish; Victaulic roll-grooved fittings and couplings.
- E. Plenum Rated CPVC pipe listed for fire protection use. Blazemaster.
- F. Dry standpipe, dry sprinkler and pre-action sprinkler piping and fittings shall be Schedule 40 galvanized steel, ASTM A-123.
- G. Shop-weld thread-o-lets may be used in lieu of tee fittings, but field (site) welding will not be permitted.
- H. Mechanical Couplings: Victaulic grooved couplings style 07, 75 or 77, or equal by Gruvlok.
- I. Mechanical Tees: Victaulic style 920, Gruvlok. U-bolt mechanical tees are not acceptable.
- J. Flexible sprinkler connector for ductwork sprinkler application: Flexhead or equal Factory Mutual approved system.
- K. Use rigid couplings where flexibility is not required or provide necessary sway bracing.
- L. Prohibited Piping and Fittings: Copper pipe / CPVC pipe, pipe less than schedule 40 for threaded or less than schedule 10 for roll grooving; Super 40 "Dyna-Flow", "Dyna-Thread", "Fireflow", XL, Thinwall, "Eddylite" by Bullmoose and Threadable Lightwall pipe are not allowed. POZ-LOK, U-bolt Victaulic style 921 mechanical tees, Victaulic style 99 Roust-A-Bout, Victaulic style 90 Plainlock, Hooker style fitting, quick disconnect, boltless, snap-joint, field drilling or welding of any main or branch lines, and any device specifically prohibited by the local authority having jurisdiction is not allowed. No unions shall be permitted for any size pipe. Plain end fittings are not allowed.

2.3 PIPE AND FITTINGS – UNDERGROUND

- A. Class 52 ductile iron pipe and fittings, white, cement lined, mechanical or Tyton joint fittings. Piping to be factory encased with 8 mil polyethylene tube or sheet. Fittings to be double field wrapped with 2" wide, 20 mil vinyl tape, 50% overlap.
- B. Manufacturer: United States Pipe and Foundry, Griffin or Pacific States, only.

- C. Polyvinyl Chloride (PVC) Plastic Pipe:
1. Pipe and fittings: Pipe shall conform to AWWA C900 and shall be plain end or gasket bell-end, pressure Class 150 with cast-iron-pipe-equivalent OD. Fittings shall be gray-iron or ductile-iron conforming to AWWA C110, and shall have cement lining conforming to AWWA C104, standard thickness.
 2. Joints and Jointing Material: Joints for pipe shall be push on joints as specified in ASTM D3139. Joints between pipe and metal fittings, valves, and other accessories shall be push on joints as specified in ASTM D3139 or shall be compression type joints / mechanical joints as respectively specified in ASTM D3139 and AWWA C111. Provide each joint connection with an elastomeric gasket suitable for bell or coupling or push-on joints with which it is to be used.
 3. Transition from PVC to ductile iron pipe shall occur a minimum of 5 feet from building.
- D. All underground piping for fire mains shall be installed, clamped, anchored, flushed and hydrostatically pressure tested according to the requirements of the authorities and/or agencies having jurisdiction, and NFPA Pamphlets Nos. 13 and 24 and F. M. Handbook of Industrial Loss Prevention.
- E. Anchor underground riser stub to nearest underground connection by means of rodding. Retaining glands with setscrews above grade are not allowed.

2.4 SPRINKLER HEADS - GENERAL

- A. Sprinkler heads shall be regular automatic closed-type heads of ordinary degree temperature rating except that sprinkler heads installed in the vicinity of heating equipment or in special occupancy areas shall be of the temperature rating as described in NFPA No. 13.
- B. Provide quick response heads in all new light hazard occupancies. For existing sprinkler systems, response type to match existing type unless otherwise noted.
- C. Provide corrosion-resistant sprinkler heads where they are exposed to weather, moisture or corrosive vapors.
- D. The Contractor shall furnish spare heads. The heads shall be packed in a suitable container and shall be representative of, and in proportion to, the number of each type and temperature rating head installed. In addition to the spare heads, the contractor shall furnish not less than two special sprinkler head wrenches. Refer to NFPA 13 Section "Stock of Spare Heads".
- E. Provide 1" clearance with escutcheon around penetrations through suspended ceilings per ASCE requirements.

2.5 SPRINKLER HEADS AND ESCUTCHEONS

- A. Sprinkler heads installed shall be upright or pendent, as conditions require, and shall be of the following type and finish for the areas designated. Unless otherwise specified, sprinklers shall be small frame type, center bulb capsule for finished areas, fusible link for unfinished areas, and ½" orifice. Extended coverage heads not allowed in unfinished areas. Extended coverage sprinkler heads are not allowed.

<u>Building Area</u>	<u>Sprinkler Head</u>	<u>Sprinkler Finish</u>	<u>Escutcheon Finish</u>	<u>Temp. Deg.</u>
Unfinished & Office, & Mechanical Rooms	Upright/Pendant	Brass	None	165°F
Electrical, Telephone & Switchgear Rooms	Upright	Brass	None	286° F
Finished Ceilings	Semi-recessed Pendant	White	White	165° F
	Concealed Pendant	Brass	White Coverplate	165° F>>
Soffit	Flush Sidewall	White	White	165°F
Sidewall	Horizontal Sidewall	Brass	None	165°F

B. Manufacturer: Tyco, Reliable, Star or Viking or equivalent.

2.6 VALVING

A. 2" or Smaller:

1. Control Valve: OS&Y rising stem type gate valve bronze body, bonnet and disc, copper alloy stem, threaded ends, 175 PSI WOG min. Provide with tamper switch.
2. Check Valve: Swing check type with bronze body, cap and disc, threaded ends, 175 PSI WOG min.
3. Drip Valve: 3/4", cast brass automatic ball drip type, threaded ends, 175 PSI WOG min.
4. Testing Valve: 1-1/4", test and drain, sight glass, 1/2" test orifice, lever operated, 300 psi WOG. Drain to mop sink or drain riser.
5. Main Drain Valve: 2", angle gate valve, bronze body, copper alloy stem, threaded ends, 175 psi WOG. Drain to mop sink or drain riser.

B. 2-1/2" or Larger:

1. Control Valve: Grooved butterfly valve with tamper switch, ductile iron body, aluminum bronze disc, stainless steel stem and EPDM Liner, 200 PSI WOG min, victanlic 700.
2. Control Valve: OS&Y rising stem type gate valve, cast iron body and bonnet, bronze stem, seat and disc, flanged ends, 175 PSI WOG min. Provide with tamper switch.
3. Check Valve: Swing check type with cast iron body, bolted cap and disc, flanged ends, 175 PSI WOG min.
4. Manufacturer: Grinnell, Stockham, Milwaukee, Mueller, Kennedy, Elkart or AGF.

2.7 WET SPRINKLER ALARM CHECK VALVE

A. Contractor shall provide, where required, a completely engineered horizontal wet alarm check valve, retarding chamber, and trim assembly. Viking #H-2, Star or Reliable.

2.8 INTEGRAL INSPECTORS ALARM TEST AND SYSTEM DRAIN

- A. Combination system drain and visible orifice insert/sight glass for testing system alarm; with screwed or grooved inlet and outlet connections, Malleable iron hand wheel, EPDM valve seats, maximum working pressure 300 Psi, 1/2" orifice insert, Bronze housing with 1/2" pressure relief valve, Watts Regulator Model FP 53L, 175PSI, UL listed and FM Approved. Victaulic TestMaster II style 720, or approved equal.
- B. Water pressure gauge, range 0-300 Psi, in 5 Psi increments, brass case - 3-1/2" diameter, 1/4" NPT male pipe connection, UL listed. Locate pressure gage on riser per code. Star Sprinkler, Ashcroft or approved equal.
- C. Pressure gauge test valve, brass 1/4" screwed ends, 300 Psi WOG. United or approved equal.
- D. All relief, main, auxiliary and equipment drains shall be routed separately to floor drain or air gap fitting (by plumbing).

2.9 TAMPER SWITCHES

- A. Switch shall be mounted so as not to interfere with normal operation of the valve and be adjusted to operate when handle of valve has traveled more than one-fifth the distance of its normal operating position. Electrical Contractor shall provide conduit from switch to fire alarm panel.
- B. Housing shall be of aluminum, acid-treated, primed and finished in baked red enamel. Removal of housing shall cause switch to operate. Inside shall be single pole, double throw micro switch with connection for electrical conduit.
- C. Install on all control valves.
- D. Manufacturer: Potter-Electric, Notifier, Ellenco, or Simplex.

2.10 WATER FLOW ALARM - VANE TYPE

- A. Indicator shall be for either vertical or horizontal installation. Indicator shall not be installed in a fitting that changes direction of water flow and shall have a sensitivity setting to signal any flow of water that equals or exceeds the discharge from one sprinkler head. Provide retarding device to prevent false alarms from line surges.
- B. Whenever a water flow alarm is installed in the piping system, an approved floor control valve shall be provided upstream of the alarm indicator. In addition, a drain is required downstream of the alarm indicator.
- C. Each water flow alarm shall be wired to a Fire System. All wiring and conduits as required will be provided under DIVISION 26. An alarm will automatically activate the local fire alarm system.
- D. Manufacturer: Potter-Electric, Ellenco, Notifier, or Simplex.

2.11 EXTERIOR ALARM

- A. Electric bell, 10" diameter, U.L. listed, weather-proof back box housing, 120 VAC, 99 dB at 10 FT; Potter model PBA12010 or equal.
- B. Electric Horn: Potter-Electric, Ellenco, Notifier, or Simplex weatherproof, 120 VAC.

PART 3 - EXECUTION

3.1 GENERAL

- A. This system to be installed by an experienced firm regularly engaged in the installation of automatic sprinkler system as specified by the requirements of the Specifications.

3.2 PERFORMANCE OF WORK

- A. Examine areas and conditions under which materials are to be installed. Layout the system to suit the different types of construction and equipment as indicated on the drawings and in accordance with NFPA Pamphlet No. 13, 14, 20 and 24.
- B. Work to start immediately after authorization has been given to proceed so that the overall progress of the construction is not delayed.
- C. Coordinate with other trades as necessary to properly interface components of the sprinkler system.
- D. Follow manufacturer's directions and recommendations in all cases.
- E. The omission from the drawings or Specifications of any details of construction, installation, materials, or essential specialties shall not relieve the Contractor from furnishing the same in place for a complete system.

3.3 TEMPORARY FIRE PROTECTION

- A. Provide all temporary valving, piping, Siamese connections and other components as directed by the fire agency office during all phases of construction.

3.4 INSTALLATION - GENERAL

- A. Fire protection system shall be installed in accordance with the approved Drawings. The finished ceiling is not to be erected until all fire protection piping has been installed, tested, and inspected. Sprinkler heads located in the electrical equipment, elevator, or similar rooms shall be furnished with deflectors to prevent water spray on equipment.
- B. Before connection to the overhead piping, all underground piping shall be flushed with water flowing at velocity and quantity required by the installation standards specified above in this Section of the Specifications.
- C. The arrangement of all pipes shall conform to all architectural requirements and field conditions, shall be as straight and direct as possible, forming right angles or parallel lines with building walls and other pipes, and shall be neatly spaced. Offsets will be permitted only where required to permit the pipes to follow the walls. Standard fittings shall be used for offsets. All risers shall be erected plumb and true, shall be parallel with the walls and other pipes, and shall be neatly spaced. All work shall be coordinated with HVAC, Plumbing, Electrical and Structural work in order to avoid interference and unnecessary cutting of floors or walls. All underground or concealed work shall be inspected before the construction is closed up.
- D. All sprinkler heads to be installed in ceilings throughout the scope of work building as listed in Part 2 sections. All areas without ceilings shall have rough brass upright or pendent heads as shown on drawings.
- E. Sprinkler heads in all finished areas are to be installed on a true axis line in both directions, with maximum deviation from the axis line of 1/2 inch plus or minus and shall be plus or minus 1" within

center of tile. At the completion of the installation, if any heads are found to exceed the above-mentioned tolerance, they shall be removed and reinstalled.

- F. No pipes or other apparatus shall be installed so as to interfere in any way with full swing of doors.
- G. The arrangement, positions, and connections of pipes, drains, valves, etc., shall be as required by NFPA Pamphlet #13 for all areas to be sprinklered. However, the right is reserved by the Architect to change the location of any item to accommodate conditions, which may arise during progress of the work, without additional compensation for such changes provided that no additional heads are required prior to the installation of the work.
- H. Where required, piping shall be installed concealed in building construction, or through steel beams, to obtain adequate head room.
- I. All pipe throughout the job shall be reamed smooth before being installed. Pipe shall not be split, bent, flattened, or otherwise injured either before or during installation.
- J. Provide protective pans under pipes passing over high voltage electrical bus duct or switchgear equipment. The pan shall be constructed of 12 gauge black iron with a 6 inch lip, the corners being welded to make the pans watertight. Each pan shall be given three coats of Rust-Oleum paint and shall be supported by pipe hangers. The pan shall drain clear of the bus duct or switchgear.
- K. All pipe interiors shall be thoroughly cleaned of foreign matter before installation, and shall be kept clean during installation by plugging or other approved means. Piping shall be covered with visqueen during storage. Piping that shows signs of rusting will be removed from job site and replaced.
- L. Field Connections: Any modifications to system required by field conditions, physical equipment changes or compliance with code regulations shall be made promptly without cost to Owner.
- M. Interference: No piping or sprinkler devices shall interfere with the operations of any door, window or mechanical and electrical systems. No part of this system shall visibly be installed in the physical parameter of any window. Sprinkler mains and branch piping shall not interfere with existing or future ceiling, light fixtures and HVAC diffusers.
- N. Threaded Pipe: Threads shall be clean cut, standard and tapered. Threads shall be made up using flaked graphite and lubricating oil, piping compound or Teflon tape applied to the male threads only.
- O. Grooved Pipe: Installation shall be as prescribed in the Victaulic Piping Manual only. Holes in the piping are to be made in the fabrication shop, not at the job site. Contractor shall provide at the project site a sample of each type of coupling (threaded, standard grooved coupling and mechanical type), showing complete assembly with pipe connections. Couplings will not be installed until samples are approved by the Architect. Architect's approval does not eliminate the Contractor's final approval by the fire agency's office.
- P. Keep all pipe and other openings closed to prevent entry of foreign matter. Cover all equipment and apparatus to protect against dirt, water, chemical or mechanical damage, before and during construction period. Restore to original condition all apparatus and equipment damaged prior to final acceptance, including restoration of damaged shop coats of paint.
- Q. Location of sprinkler piping is critical.
 - 1. Where ceiling space is at a minimum under beams location of ductwork takes precedence, coordinate accordingly.

2. Include in base bid three (3) two-hour coordination meetings with Owner, Architect, and Engineer for coordination of sprinkler pipe routing.
 3. Coordinate beam and shear wall penetrations with Structural Engineer. Obtain written approval for all beam penetrations from Structural Engineer.
- R. Tracer wire shall be wrapped and taped to non-metallic underground piping at maximum 20 foot intervals.

3.5 SLEEVES AND FLASHINGS

- A. Wherever pipes are exposed and pass through walls, floors, partitions or ceilings, they shall be fitted with chromium plated steel escutcheons held in place with setscrews. Care shall be taken to protect the escutcheons during the course of construction.
- B. Penetrations through fire rated walls and floors shall be sealed with listed mastic of similar fire rating.

3.6 HANGERS, INSERTS, SUPPORTS, AND SWAY BRACING

- A. Hangers and supports shall be installed per NFPA #13 sections on Hangers and Protection of Piping Against Damage Where Subject to Earthquake. Provide restraint from movement at end sprinkler on branch line per NFPA 13.
- B. Bending of threaded hanger rod is not allowed. All powder driven anchor pins in concrete are not allowed.
- C. Upgrade existing end sprinklers on branch line with new restraint from movement device.

3.7 SAFETY TESTING & VERIFICATION

- A. Flush, test, and inspect sprinkler piping systems according to NFPA 13 Chapter "System Acceptance."
- B. Provide NFPA 13 Contractor's Material & Test Certificate Form 85A for above ground piping and Form 85B for underground piping.
- C. Provide manpower to test the function and performance of all Life Safety System components and devices per floor and per zone basis in accordance with the local requirements.

3.8 IDENTIFICATION

- A. In addition to the requirements of SECTION 21 05 00 - BASIC MATERIALS AND METHODS, provide pipe markers every 20 feet, once in every room, and at each building level traversed, minimum. Stencil riser/zone numbers on risers.
- B. Provide hydraulic design data nameplates on the riser of each sprinkler system in accordance with NFPA 13
- C. Equipment such as valves, drains, etc., shall be provided with signs that identify type of equipment and service. The tag shall be securely fastened to the handle or spindle of the valve by a brass chain. Furnish four schedules of valves so tagged. There shall also be furnished four diagrammatic charts showing schematically the complete sprinkler system with major control valves and numbers thereof. One set of Schedules and charts shall be mounted in glazed frames located where directed.

3.9 AS-BUILT RECORD DRAWINGS AND CERTIFICATION

- A. As-built Record Drawings are to be kept up-to-date and the Master Copy kept at the job site. Prior to final acceptance of work being approved, these drawings are to be turned over to the Owner's Representative for approval.
- B. Written certification from the insuring agents, and authorities having jurisdiction that the tests were satisfactory.
- C. After installation is complete and tests satisfactorily approved, deliver test certificates and approval by the local Fire Authorities and the FMA to the Architect. Final acceptance of sprinkler/standpipe system by Owner's Representative shall be contingent upon receipt of certificate and approval from authorities having jurisdiction and for the delivery of final As-Built Drawings.

END SECTION 21 10 00

END DIVISION 21 – FIRE SUPPRESSION

DIVISION 22 – PLUMBING

SECTION 22 05 00 BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and DIVISION 1 – GENERAL REQUIREMENTS, and shall include all Plumbing Sections specified herein.

1.2 SCOPE OF THIS SECTION

- A. All work to be furnished and installed under this Section shall comply with all the requirements of DIVISION 1, and shall include, but not necessarily be limited to, the following:
 - 1. Compliance with all codes and standards applicable to this jurisdiction.
 - 2. Shop Drawings for Equipment
 - 3. Coordination Documents
 - 4. Record Drawings
 - 5. Start-up Service and Building Commissioning
 - 6. Instruction, Maintenance, and O & M Manuals
 - 7. Work associated with Delivery, Storage, and Handling of Products
 - 8. Work associated with provision of Temporary Facilities
 - 9. Preparation of Posted Operating Instructions
 - 10. Meeting Project Safety and Indemnity Requirements
 - 11. Proper Cleaning and Closing
 - 12. Supplying proper Warranty Information
 - 13. Supply specified Guarantee Documentation
 - 14. Design and provision of Supports and Anchors
 - 15. Design and provision of Seismic Restraints and Vibration Isolation
 - 16. Pipe Portals
 - 17. Pipe Stands
 - 18. Equipment Supports
 - 19. Access Panels and Doors
 - 20. Identification Markers
 - 21. Coordination of Electrical requirements for equipment provided

1.3 DESCRIPTION OF WORK

- A. The Contract Documents, including Specifications and Construction Drawings, are intended to provide all material and labor to install complete plumbing systems for the building and shall interface with all existing building systems affected by new construction.
- B. The Contractor shall refer to the architectural interior details, floor plans, elevations, and the structural and other Contract Drawings and he shall coordinate his work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of the fixtures, equipment, and pipe lines and are not to be scaled; all dimensions and existing conditions shall be checked at the building.
- C. The Contractor shall comply with the project closeout requirements as detailed in General Requirements of DIVISION 1.
- D. Where project involves interface with existing building and site systems, every effort has been made to note existing utilities and services. However, the Contractor should thoroughly familiarize themselves with existing conditions and be aware that in some cases information is not available as to concealed conditions, which exist in portions of the existing building affected by this work.

1.4 DESCRIPTION OF BID DOCUMENTS

- A. Specifications:
 - 1. Specifications, in general, describe quality and character of materials and equipment.
 - 2. Specifications are of simplified form and include incomplete sentences.
- B. Drawings:
 - 1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation.
 - 2. Before proceeding with work check and verify all dimensions.
 - 3. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
 - 4. Make adjustments that may be necessary or requested, in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
 - 5. Where existing pipes, conduits and/or ducts prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits and/or ducts. Verify exact location and elevation of existing piping prior to any construction.
 - 6. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect or Engineer for his interpretation and decision as early as possible.

1.5 DEFINITIONS

- A. "Above Grade": Not buried in the ground and not embedded in concrete slab on ground.
- B. "Actuating" or "Control" Devices: Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.
- C. "Below Grade": Buried in the ground or embedded in concrete slab on ground.

- D. "Concealed": Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures. In general, any item not visible or directly accessible.
- E. "Connect": Complete hook-up of item with required service.
- F. "Exposed": Not installed underground or "concealed."
- G. "Furnish": To supply equipment and products as specified.
- H. "Indicated," "Shown" or "Noted": As indicated, shown or noted on Drawings or Specifications.
- I. "Install": To erect, mount and connect complete with related accessories.
- J. "Lead Free": Materials containing not more than 0.2 percent lead when used with respect to solder and flux and not more than a weighted average of 0.25 percent when used with respect to the wetted surfaces of pipes and pipe fittings, plumbing fittings, and fixtures, providing a specified definition and formula for determining "weighted average".
- K. "Motor Controllers": Manual or magnetic starters (with or without switches), individual push buttons or hand-off-automatic (HOA) switches controlling the operation of motors.
- L. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.
- M. "Provide": To supply, install and connect as specified for a complete, safe and operationally ready system.
- N. "Reviewed," "Satisfactory" or "Directed": As reviewed, satisfactory, or directed by or to Architect/Engineer/Owner.
- O. "Rough-In": Provide all indicated services in the necessary arrangement suitable for making final connections to fixture or equipment.
- P. "Shall": An exhortation or command to complete the specified task.
- Q. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified products.
- R. "Supply": To purchase, procure, acquire and deliver complete with related accessories.
- S. "Typical" or "Typ": Exhibiting the qualities, traits, or characteristics that identify a kind, class, number, group or category. Of or relating to a representative specimen. Application shall apply to all other similarly identified on plan or detail.
- T. "Will": A desire to complete the specified task. Allows some flexibility in application as opposed to "Shall."
- U. "Wiring": Raceway, fittings, wire, boxes and related items.
- V. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

1.6 RELATED WORK SPECIFIED ELSEWHERE

- A. All DIVISION 22 – PLUMBING sections included herein.
- B. DIVISION 2 – EXISTING CONDITIONS.
 - 1. Coordination of excavation of trenches and the installation of piping on site.

- C. DIVISION 3 – CONCRETE.
 - 1. All concrete work for Plumbing Division shall be included in DIVISION 22 under the appropriate Sections and shall include:
 - a. Housekeeping pads for the plumbing equipment.
 - b. Coordination of floor drain and floor sink installations in sloped floors.
- D. DIVISION 5 – METALS.
- E. DIVISION 7 – THERMAL AND MOISTURE PROTECTION.
 - 1. Flashing and sheet metal
 - 2. Sealants and caulking
 - 3. Firestopping
- F. DIVISION 9 – FINISHES:
 - 1. DIVISION 22 installers shall perform all painting, except where specifically stated otherwise in DIVISION 9.
 - 2. Painting of all exposed steel, piping, insulation, equipment, and materials.
 - 3. All exposed gas piping located interior and exterior to the building must be painted yellow.
- G. DIVISION 26 – ELECTRICAL is related to work of:
 - 1. Power connections to all plumbing equipment.

1.7 CODES AND STANDARDS

- A. The Contractor is cautioned that code requirements not explicitly detailed in these specifications or drawings, but which may be reasonably inferred or implied from the nature of the project, must be provided as part of the contract.
- B. Perform all tests required by governing authorities and required under all DIVISION 22 Sections. Provide written reports on all tests.
- C. Electrical devices and wiring shall conform to the latest standards of NEC; all devices shall be UL listed and labeled.
- D. All plumbing work shall comply with the Americans with Disabilities Act (ADA).
- E. All excavation work must comply with all provisions of state laws including notification to all owners of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.
- F. Provide in accordance with rules and regulations of the following:
 - 1. Building Codes enforced by the Authority Having Jurisdiction in California:
 - a. 2010 Building Standards Administrative Code, Part 1, Title 24 C.C.R.
 - b. 2010 California Building Code (CBC), Part 2, Title 24 C.C.R. (2009 International Building Code and 2010 California Amendments)
 - c. 2010 California Electrical Code (CEC), Part 3, Title 24 C.C.R. (2008 National Electrical Code and 2010 California Amendments)

- d. 2010 California Mechanical Code (CMC) Part 4, Title 24 C.C.R. (2009 Uniform Mechanical Code and 2010 California Amendments)
 - e. 2010 California Plumbing Code (CPC), Part 5, Title 24 C.C.R. (2009 Uniform Plumbing Code and 2010 California Amendments)
 - f. 2010 California Energy Code (CEC), Part 6, Title 24 C.C.R.
 - g. 2010 California Fire Code, Part 9, Title 24 C.C.R. (2009 International Fire Code and 2010 California Amendments)
 - h. 2010 California Green building Standards Code (CALGreen), Part 11, Title 24 C.C.R.
 - i. 2010 California Referenced Standards, Part 12, Title 24 C.C.R.
 - j. Title 19 C.C.R. Public Safety, State Fire Marshal Regulations.
- 2. Local, city, county and state codes and ordinances
 - 3. Local Bureau of Buildings
 - 4. Local Health Department
 - 5. Local and State Fire Prevention Districts
 - 6. State Administrative Codes
- G. Provide in accordance with appropriate referenced standards of the following:
- 1. NFPA - National Fire Protection Association
 - 2. CSA - Canadian Standards Association
 - 3. ADC - Air Diffuser Council
 - 4. ANSI - American National Standards Institute
 - 5. ASHRAE - American Society of Heating, Refrigerating & Air Conditioning Engineers
 - 6. ASME - American Society of Mechanical Engineers
 - 7. ASTM - American Society for Testing Materials
 - 8. AWS - American Welding Society
 - 9. AWWA - American Water Works Association
 - 10. FM - Factory Mutual
 - 11. MSS - Manufacturer's Standardization Society
 - 12. NEMA - National Electrical Manufacturer's Association
 - 13. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
 - 14. UL - Underwriter's Laboratories
 - 15. ADA - Americans with Disabilities Act
 - 16. ETL - Electrical Testing Laboratories
 - 17. ASSE - American Society of Sanitary Engineers
 - 18. PDI - Plumbing and Drainage Institute

19. IAPMO - International Association of Plumbing and Mechanical Officials
20. CISPI - Cast Iron Soil Pipe Institute

1.8 QUALITY ASSURANCE

- A. Manufacturer's Nameplates: Nameplates on manufactured items shall be aluminum or Type 304 stainless steel sheet, not less than 20 USG (0.0375"), riveted or bolted to the manufactured item, with nameplate data engraved or punched to form a non-erasable record of equipment data.
- B. Current Models. All work shall be as follows:
 1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
 2. Replacement parts shall be readily available and stocked in the USA.
- C. Experience: Unless more stringent requirements are specified in other sections of DIVISION 22, manufactured items shall have been installed and used, without modification, renovation or repair, on other projects for not less than one year prior to the date of bidding for this project.

1.9 GENERAL REQUIREMENTS

- A. Examine all existing conditions at building site.
- B. Review contract documents and technical specifications for extent of new work to be provided.
- C. Provide and pay for all permits, licenses, fees and inspections.
- D. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. This work shall include furnishing and installing all access doors required for mechanical access.
- E. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to Equipment Specifications in DIVISIONS 2 through DIVISIONS 33 for rough-in requirements.
- F. Coordinate plumbing equipment and materials installation with other building components.
- G. Verify all dimensions by field measurements.
- H. Arrange for chases, slots, and openings in other building components to allow for plumbing installations.
- I. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- J. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- K. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials. Contractor to provide for all cutting and patching required for installation of his work unless otherwise noted.
- L. Where mounting heights are not detailed or dimensioned, install plumbing services and overhead equipment to provide the maximum headroom possible.

- M. Install plumbing equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, without interference with other installations.
- N. Coordinate the installation of plumbing materials and equipment above ceilings with ductwork, piping, conduits, suspension system, light fixtures, cable trays, sprinkler piping and heads, and other installations.
- O. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- P. Coordinate with Owner in advance to schedule shutdown of existing systems to make new connections. Provide valves in new piping to allow existing system to be put back in service with minimum down time.
- Q. All materials (such as insulation, piping, wiring, controls, etc.) located within air plenum spaces, air shafts, and occupied spaces shall have a flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) Method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories, Inc., label or listing, or satisfactory certified test report from an approved testing laboratory to prove the fire hazard ratings for materials proposed for use do not exceed those specified.
- R. Coordinate installation of floor drains and floor sinks with work of other trades, such that finished floor slopes to drains and floor sinks are flush with surrounding floor.
- S. Products made of or containing lead, asbestos, mercury or other known toxic or hazardous materials are not acceptable for installation under this Division. Any such products installed as part of the work of the Division shall be removed and replaced and all costs for removal and replacement shall be borne solely by the installing Contractor.
- T. Pipes, pipe fittings, plumbing fittings and fixtures that come into contact with the wetted surface of a public water system or any plumbing in a facility providing water for human consumption shall be "Lead Free".

1.10 MINOR DEVIATIONS

- A. The Drawings are diagrammatic and show the general arrangements of all plumbing work and requirements to be performed. It is not intended to show or indicate all offsets, fittings, and accessories which will be required as a part of the work of this Section.
- B. The Contractor shall review the structural and architectural conditions affecting his work. It is the specific intention of this section that the contractor's scope of work shall include
 - 1. Proper code complying support systems for all equipment whether or not scheduled or detailed on drawings or in these specifications
 - 2. Minor deviations from the plumbing plans required by architectural and structural coordination.
- C. The Contractor shall study the operational requirements of each system, and shall arrange his work accordingly, and shall furnish such fittings, offsets, supports, accessories, as are required for the proper and efficient installation of all systems from the physical space available for use by this section. This requirement extends to the Contractor's coordination of this section's work with the

"Electrical Work." Should conflicts occur due to lack of coordination, the time delay, cost of rectification, demolition, labor and materials, shall be borne by the Contractor and shall not be at a cost to the Owner.

- D. Minor deviations in order to avoid conflict shall be permitted where the design intent is not altered.
- E. Advise the Architect, in writing, in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.

1.11 PRODUCT SUBSTITUTIONS

- A. The Contractor shall certify the following items are correct when using substituted products other than those scheduled or shown on the drawings as a basis of design:
 - 1. The proposed substitution does not affect dimensions shown on drawings.
 - 2. The Contractor shall pay for changes to building design, including engineering design, detailing, structural supports, and construction costs caused by proposed substitution.
 - 3. The proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
 - 4. Maintenance and service parts available locally are readily obtainable for the proposed substitute.
- B. The Contractor further certifies function, appearance, and quality of proposed substitution are equivalent or superior to specified item.
- C. The Contractor agrees that the terms and conditions for the substituted product that are found in the contract documents apply to this proposed substitution.
- D. Product substitutions shall also comply with SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS. Should any conflict arise between this specification Section and SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS, the latter shall take precedence.

1.12 SHOP DRAWINGS AND EQUIPMENT SUBMITTALS

- A. Prior to construction submit for review all materials and equipment in accordance with DIVISION 1 requirements.
- B. After approval of preliminary list of materials, the Contractor shall submit Shop Drawings and manufacturer's Certified Drawings to the Architect for approval.
- C. The Contractor shall submit **approved** Shop Drawings and manufacturer's equipment cuts, of all equipment requiring connection by DIVISION 26, to the Electrical Contractor for final coordination of electrical requirements. Contractor shall bear all additional costs for failure to coordinate with DIVISION 26.
- D. Submittals and Shop Drawings shall be submitted as a complete package bound in a 3-ring binder with tabs for each specification section. The approved submittals shall be converted into Operations & Maintenance Manuals at the completion of the project. Submit six (6) typed copies of submittals. Refer to DIVISION 1 for additional requirements.

1.13 COORDINATION DOCUMENTS

- A. The Contractors shall prepare coordinated Shop Drawings to coordinate the installation and location of all equipment, piping and all system appurtenances with other trades. The Drawings shall include

all equipment rooms and floor plans. The Drawings shall be Overlay Drawings showing each discipline on a single sheet. The Drawings shall be keyed to the structural column identification system, and shall be progressively numbered. Prior to completion of the Drawings, the Contractor shall coordinate the proposed installation with the Architect and the structural requirements, and all other trades (including HVAC, Fire Protection, Electrical, Ceiling Suspension, and Tile Systems), and provide reasonable maintenance access requirements. When conflicts are identified, modify system layout as necessary to resolve. Do not fabricate, order or install any equipment or materials until coordination documents are approved by the General Contractor, Architect, and Owner. Within thirty (30) days after award of Contract, submit proposed coordination document Shop Drawing schedule, allowing adequate time for review and approval by parties mentioned above. Drawings should be prepared and submitted for approval on a floor-by-floor basis to phase with building construction.

B. The coordination work shall be prepared as follows:

1. Two dimensional paper or AutoCAD/Revit based documents:
 - a. The Sheet Metal (Mechanical) Contractor shall prepare Drawings to an accurate scale of $1/4" = 1'-0"$ or larger, on reproducible media sheets or AutoCAD/Revit files. Lettering shall be minimum $1/8"$ high. Provide a "Hold Harmless Release" to obtain paper or AutoCAD files of the HVAC design from the Architect, or Engineer. Drawings are to be same size as Contract Drawings and shall indicate location, size and elevation above finished floor, of all HVAC equipment, ductwork, and piping. Plans shall also indicate proposed ceiling grid and lighting layout, as shown on electrical plans and reflected ceiling plans.
 - b. The Plumbing Contractor shall obtain reproducible plans or AutoCAD files from the Mechanical Contractor, and indicate all plumbing lines including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
 - c. The Fire Protection Contractor shall obtain reproducible plans or AutoCAD files with the detailed mechanical and plumbing work shown. The Sprinkler Contractor shall indicate location of all sprinkler heads and piping, including valves and fittings, dimensions from column lines, and bottom of pipe elevations above finished floor.
 - d. Plans are to incorporate all addenda items and change orders.
 - e. Distribute plans to all trades and provide additional coordination as needed.
2. Three dimensional or BIM based documents:
 - a. The Sheet Metal (Mechanical) Contractor shall prepare a three dimensional model of the work using the project BIM model. Provide a "Hold Harmless Release" to obtain the BIM model of the project structural, architectural, and HVAC design from the Architect. If a BIM model is not available use the available two-dimensional CAD files to construct a three dimensional model for coordination purposes.
 - b. The Plumbing Contractor shall provide BIM input to indicate all major plumbing lines exceeding 3" in diameter including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
 - c. The Fire Protection Contractor shall provide BIM input information locating all sprinkler heads and piping, including valves and fittings, dimensions from column lines, and bottom of pipe elevations above finished floor.

- d. BIM models are to incorporate all addenda items and change orders.
- C. Advise the Architect in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.
- D. Provide means of access to all valves, controllers, operable devices, and other apparatus that may require adjustment or servicing.
- E. Verify in field exact size, location, invert, and clearances regarding all existing material, equipment and apparatus, and advise the Architect of any discrepancies between those indicated on the Drawings and those existing in the field prior to any installation related thereto.
- F. Final Coordination Drawings with all appropriate information added are to be submitted as Record Drawings at completion of project.
- G. Provide copy of Record Drawings to Testing and Balancing Contractor for their use when doing their work.

1.14 RECORD DRAWINGS

- A. Before commencing installation, obtain an extra set of prints from Architect, marked "Record." Keep this set of Drawings at the job site at all times, and use it for no other purpose but to mark on it all the changes and revisions to the Contract Drawings resulting from coordination with other trades. At the completion of the project:
 - 1. Obtain a clean set of reproducibles from the Architect or Engineer, at cost plus, and transfer the revisions to these reproducibles in a neat and orderly fashion.

OR

- 2. Edit project electronic image files, such as AutoCAD/Revit, to incorporate all site markups, changes, and revisions to the Contract Drawings. Submit plots of Record Drawings and six copies CD Roms labeled with all record electronic image drawing files.
- B. Provide copy of Record Drawings to Testing and Balancing Contractor for use when doing his work.
- C. Mark Drawings to indicate revisions to piping size and location, both exterior and interior; including locations of control devices, valves, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e. – valves, traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- D. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.
- E. Refer also to Special Conditions in DIVISION 1 for full scope of requirements.

1.15 START-UP SERVICE AND BUILDING COMMISSIONING

- A. Prior to start-up, be assured that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrication, venting, controls, and installed and properly set relief and safety valves.

- B. Provide services of factory-trained technicians for start-up of temperature controls, boilers, pumps, and other major pieces of equipment. Certify in writing compliance with this Paragraph, stating names of personnel involved and the date work was performed.
- C. Refer to other DIVISION 22 Sections for additional requirements.

1.16 INSTRUCTION, MAINTENANCE, AND O&M MANUALS

- A. O&M Manuals: Upon completion of the work, the Contractor shall submit to the Architect complete set of operating instructions, maintenance instructions, part lists, and all other bulletins and brochures pertinent to the operation and maintenance for equipment furnished and installed as specified in this section, bound in a durable binder. Refer to DIVISION 1.
- B. The Contractor shall be responsible for proper instruction of Owner's personnel for operation and maintenance of equipment, and apparatus installed as specified in DIVISION 22 to be no less than 2 hours for each piece of equipment.

1.17 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Store equipment and materials in an environmentally controlled area at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage. Piping shall be stored in bundles covered with visqueen. Piping showing signs of rust shall be removed from site and replaced.
- C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.18 TEMPORARY FACILITIES

- A. Refer to DIVISION 1 for the requirements of temporary water and sewer for construction and safety. Provide temporary water, and sewer, etc. services as necessary during the construction period and as required to maintain operation of existing systems.

1.19 POSTED OPERATING INSTRUCTIONS

- A. Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. Attach or post operating instructions adjacent to each principal system and equipment including start-up, operating, shutdown, safety precautions and procedure in the event of equipment failure. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal.

1.20 SAFETY AND INDEMNITY

- A. The Contractor shall be solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal hours of work.

- B. No act, service, Drawing, review, or Construction Review by the Owner, Architect, the Engineers or their consultants, is intended to include the review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify and defend the Owner, the Architect, the Engineers and their consultants, and each of their officers, employees and agents from any and all liability claim, losses or damage arising, or alleged to arise from bodily injury, sickness, or death of a person or persons, and for all damages arising out of injury to or destruction of property arising directly or indirectly out of, or in connection with, the performance of the work under the Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the Construction Contract Documents; but not including the sole negligence of the Owner, the Architect, the Engineers, and their consultants or their officers, employees and agents.

1.21 CLEANING AND CLOSING

- A. All work shall be inspected, tested, and approved before being concealed or placed in operation.
- B. Upon completion of the work, all equipment installed as specified in this section, and all areas where work was performed, shall be cleaned to provide operating conditions satisfactory to the Architect.

1.22 WARRANTIES

- A. All equipment shall be provided with a minimum one-year warranty to include parts and labor. Refer to individual Equipment Specifications for extended or longer-term warranty requirements.
- B. Provide complete warranty information for each item, to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.
- C. Service during warranty period: Contractor shall provide maintenance as specified elsewhere during the 12-month warranty period.

1.23 GUARANTEE

- A. The Contractor shall guarantee and service all workmanship and materials to be as represented by him and shall repair or replace, at no additional cost to the Owner, any part thereof which may become defective within the period of one (1) year after the Date of Final Acceptance, ordinary wear and tear excepted.
- B. Contractor shall be responsible for and pay for any damages caused by or resulting from defects in his work.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.
- B. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words "or approved equal" shall be considered to be subsequent to all manufacturers' names used herein, unless specifically noted that substitutes are not allowed.

2.2 SUPPORTS AND ANCHORS

- A. General: Comply with applicable codes pertaining to product materials and installation of supports and anchors, including, but not limited to, the following:
1. UL: Provide products which are UL listed.
 2. FM: Provide products which are FM approved.
 3. ASCE 7-05: "American Society of Civil Engineers."
 4. International Building Code (IBC)
 5. MSS Standard Compliance: Manufacturer's Standardization Society (MSS).
 6. SMACNA: "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 7. NFPA: Pamphlet number 13 and 14 for fire protection systems.
 8. Provide copper plated or plastic coated supports and attachment for copper piping systems. Field applied coatings or tape is unacceptable.
 9. Manufacturer: Hilti Inc, B-Line, Anvil International, Michigan, Tolco, Kin-Line, Simpson, or Superstrut.
- B. Horizontal Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated hangers and supports of one of the following MSS types listed.
1. Adjustable Steel Clevis Hangers: MSS Type 1.
 2. Adjustable Steel Swivel Band Hangers: MSS Type 10.
 3. U-Bolts: MSS Type 24.
 4. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
 - a. Plate: Unguided type.
 - b. Plate: Guided type.
 - c. Plate: Hold-down clamp type.
 5. Pipe Saddle Supports: MSS Type 36, including steel pipe base support and cast iron floor flange.
 6. Pipe Saddle Supports with U-Bolt: MSS Type 37, including steel pipe base support and cast iron floor flange.
 7. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast iron floor flange.
 8. Single Pipe Roller with Malleable Sockets: MSS Type 41.
 9. Adjustable Roller Hangers: MSS Type 43.
 10. Pipe Roll Stands: MSS Type 44.
 11. Pipe Guides: Provide factory-fabricated guides of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

- C. Horizontal Cushioned Pipe Clamp: Where pipe hangers are called out to absorb vibration or shock install a piping clamp with thermoplastic elastomer insert. Cush-A-Clamp or equal.
- D. Vertical Piping Clamps: Provide factory-fabricated two-bolt vertical piping riser clamps, MSS Type 8.
- E. Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments of one of the following MSS types listed.
 - 1. Steel Turnbuckles: MSS Type 13.
 - 2. Steel Clevises: MSS Type 14.
 - 3. Swivel Turnbuckles: MSS Type 15.
 - 4. Malleable Iron Eye Sockets: MSS Type 16.
 - 5. Steel Weldless Eye Nuts: MSS Type 17.
- F. Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments of one of the following types listed.
 - 1. Concrete Inserts: HCI-MD (for metal deck) or HCI-WF (for wood forms) cas-in anchors by Hilti Inc. or MSS Type 18 or Blue Banger Hanger by Simpson
 - 2. Steel Brackets: One of the following for indicated loading:
 - a. Light Duty: MSS Type 31.
 - b. Medium Duty: MSS Type 32.
 - c. Heavy Duty: MSS Type 33.
 - 3. Horizontal Travelers: MSS Type 58.
 - 4. Concrete Screw Anchors: KWIK HUS EZ-I by Hilti Inc., Titen HD by Simpson or approved equal.
 - 5. Torque-Controlled Expansion Anchor: KWIK BOLT-TZ by Hilti Inc., Strong-Bolt 2 by Simpson Strong-Tie Co. Inc or approved equal.
- G. Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
 - 1. Pipe Covering Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
 - 2. Insulation Protection Shields: MSS Type 40, 18" minimum, or of the length recommended by manufacturer to prevent crushing of insulation. High-density insulation insert lengths shall match or exceed shield length.
 - 3. Thermal Hanger Shields: Constructed of 360° insert of waterproofed calcium silicate (60 psi flexural strength minimum) encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation. Shield length shall match or exceed length of calcium silicate insert. Alternately Polyisocyanurate Urethane with a minimum flexural strength of 60psi, fully encased in 360 PVC (1.524 mm thick) SNAPPITZ. Provide assembly of same thickness as adjoining insulation.
 - 4. Thermal Hanger Couplings: Constructed of high strength plastic coupling to retain tubing and join insulation at clevis hangers and strut-mounted clamps. Klo-Shure Insulation Coupling or equal.

H. Miscellaneous Materials:

1. Metal Framing: Provide products complying with NEMA STD ML1.
2. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A36.
3. Cement Grout: Portland Cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand by volume, with minimum amount of water required for placement and hydration.
4. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required. Weld steel in accordance with AWS standards.
5. Pipe Brackets: "HoldRite" copper plated brackets. Insulate brackets attached to metal studs with felt.

2.3 SEISMIC RESTRAINT/VIBRATION ISOLATION REQUIREMENTS

- A. Equipment, piping, and all system appurtenances (including weight of normal operating contents) shall be adequately restrained to resist seismic forces. Restraint devices shall be designed and selected to meet seismic requirements as defined in Chapter 16 of the latest edition of the Building Code with State Amendments, and applicable local codes in accordance with Seismic Zone C, D, E, F, 3, 4 and the applicable Importance Factors and Soil Factors.
- B. All anchorages and/or seismic restraints shall be designed by a registered professional Civil or Structural Engineer licensed in the state of the project. Design shall include:
1. Number, size and location of anchors for floor or roof-mounted equipment. For curb mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure.
 2. Number, size and location of vibration isolators, seismic restraint devices and their anchorage for vibration-isolated and suspended equipment.
 3. Number, size and location of braces and anchors for suspended piping and ductwork on shop drawings.
 - a. The contractor must select a single seismic restraint system pre-designed to meet the requirements of the current version of the Building Code with State Amendments.
 - b. Installations not addressed by the selected system must be designed, detailed and submitted along with the shop drawings.
 - c. Maximum seismic loads shall be indicated on drawings at each brace location.
 - d. Drawings shall bear the stamp and signature of the registered professional engineer licensed in the state of the project who designed the layout of the braces.
 4. Manufacturers: Mason, M.W. Sausse, Kinetics or approved equal.
- C. Isolated Equipment:
1. Spring type isolators shall be freestanding and laterally stable and complete with 1/4" neoprene acoustical friction pads or neoprene cup between the spring and the base plate. All mountings shall have leveling bolts. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflections compressed spring height and solid spring height. A steel housing shall be included to resist motion due to earthquake loads. A minimum clearance of ¼" shall be maintained around

restraining bolts and between the housing and the spring so as not to interfere with the spring action. The housing shall be out of contact during normal operations. Mountings used out of doors shall be hot dipped galvanized. Manufacturer: Mason Industries #SLR series or approved equal.

2. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" neoprene acoustical friction pad between the base plate and the support. 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% of the rated deflection. Manufacturer: Mason Industries #SLF series or approved equal.
3. Spring hangers shall consist of rigid steel frames containing minimum 1-1/4" thick neoprene elements at the top and steel springs that are free standing and laterally stable seated in a steel washer reinforced neoprene cup at the bottom. 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% of the rated deflection. The neoprene element and the cup shall have a neoprene bushing projecting through the steel box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 arc from side to side before contacting the rod bushing and short circuiting the spring. Manufacturer: Mason Industries #30N or approved equal.
4. All-directional seismic snubber restraints shall consist of interlocking steel members restrained by a one-piece molded bushing or bridge bearing neoprene. A minimum air gap of 1/4" shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end shall be removable to allow inspection of internal clearances. Manufacturer: Mason Industries #Z-1225.
5. Vibration isolation manufacturer shall furnish integral structural steel bases designed to prevent excessive base flexure at start up, prevent misalignment of equipment and provide attachment points for seismic restraints. Bases shall be rectangular in shape and constructed of welded wide flange structural steel main members with cross bracing located at or near each restraint location. Where height saving brackets are required, they shall be employed in all mounting locations to maintain a 1" clearance below the base. Manufacturer: Mason Industries #WF.
6. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations. Bases for split case pumps shall be large enough to provide for suction and discharge elbows and shall be 6" deep for pumps thru 75 HP and 10" deep for pumps 100 HP thru 250HP. Forms shall include minimum concrete reinforcing consisting of #4 bars welded in place on 6" centers running both ways in a layer 1-1/2" above the bottom. Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base. Manufacturer: Mason Industries #BMK or K.
7. Suspended isolated equipment and vessels shall be protected with cable restraints. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation, starting or stopping. Seismic sway braces shall consist of galvanized steel aircraft cables. Cables braces shall be designed to resist seismic tension loads with a minimum safety factor of 2. Brace end connections shall be steel assemblies that swivel

to the final installation angle. Steel angles or struts, when required, shall be clamped to the threaded hanger rods at the seismic sway brace locations utilizing a minimum of two ductile iron clamps. Manufacturer: Mason Industries #SCB, SRC and UC.

8. Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Kevlar tire cord frictioning. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2" and larger shall have two spheres reinforced with a ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16" to 24" may be single sphere. Sizes 3/4" to 1 1/2" may have threaded bolted flange assemblies, one sphere and cable retention. 14" and smaller connectors shall be rated at 250 psi up to 190F with a uniform drop in allowable pressure to 190 psi at 250F. 16" and larger connectors are rated 180 psi at 190F and 135 psi at 250F. Safety factors to burst and flange pullout shall be a minimum of 3/1. All joints must have permanent markings verifying a 5 minute factory test at twice the rated pressure. Concentric reducers to the above specifications may be substituted for equal ended expansion joints. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods, as control rods are not desirable in seismic work. If control rods are used, they must have 1/2" thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi maximum on the washer area. Expansion joints shall be installed on the equipment side of the shut off valves. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves. Manufacturer: Mason Industries #SFDEJ, SFEJ, SFDCR, SFU and CR.
 9. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" and larger shall be flanged. Smaller sizes shall have male nipples. Hoses must have sufficient length to accept 1/2" intermittent motion without failure. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Manufacturer: Mason Industries #BSS.
- D. Rigidly Mounted Equipment: Floor mounted equipment weighing over 400 lbs. and suspended equipment and vessels of any weight shall be protected by properly sized anchor bolts or hanger rods and bracing and, if required, by additional seismic restraints as described above for isolated equipment.
- E. All non-isolated piping and ductwork shall be protected in accordance with the SMACNA Guidelines. At the Contractor's option, for ease of installation, cable restraint system may be used. Installations not addressed in the SMACNA Guidelines shall be designed by a registered professional engineer who designed the seismic bracing for the suspended piping and ductwork.
- F. Isolator Types: Where equipment isolators are not provided by other sections of the specification or shown on Drawings, provide factory fabricated isolator types sized by the manufacturer for the appropriate loading. Model numbers of Mason Industries products are listed below. Products of other manufacturers will be acceptable provided they comply with all of the requirements of this specification and the Drawings. Manufacturers: Mason Industries, M.W. Sausse, Kinetics or approved equal.

1. Floor Mounted Pumps: 2" free-standing type housed single coil spring with separate seismic snubbers. Mount on concrete filled inertia base with weight not less than that equaling the equipment weight. Mason Industries #BMK base with #SLF springs and #Z-1225 snubbers.

G. Submittals:

1. Confirmation of responsible design party (Shop Drawings received without this information will be rejected without review. Architect will be informed of potential delay of project.)
 - a. The seismic manufacturer's representative or engineer responsible for preparing the specified seismic submittal package shall send the following documentation of qualification:
 - i. The name and professional engineer's license number of the structural engineer who will be responsible for preparing, designing, and stamping the seismic shop drawing information.
2. Shop Drawings submittal
 - a. Stamped seismic restraint calculations.
 - b. The type, size and deflection of each isolator proposed.
 - c. Details for all the isolators with snubbers proposed and seismic bracing.
 - d. Details for steel frames to be used in conjunction with the isolation and seismic restraint of the items.
 - e. Clearly outlined procedures for installing and adjusting the isolators, seismic restraints and snubbers.

2.4 PIPE PORTALS

- A. Where pipe portals are not provided by other sections of Specification, provide prefabricated insulated pipe portals as required for piping penetrating through the roof where shown on plans. Field built pipe portals are acceptable alternatives - provide detail of construction for review.
- B. Standard pipe portals, unless otherwise noted, shall be constructed as follows:
 1. Curb shall be constructed of heavy gauge galvanized steel with continuous welds on shell seams.
 2. Insulation to be 1-½" thick, 3 lb density rigid fiberglass.
 3. Curb to have a raised 3" (minimum), 45° cant.
 4. Curb to have 1-1/2" x 1-1/2" wood nailer (minimum).
 5. Curb height to be 8" (minimum) above roof deck.
 6. Cant shall be raised to match roof insulation thickness.
 7. Cover or flashing to be constructed of galvanized steel or other suitable material to provide sturdy weather tight closure. Provide collars and rubber nipples with draw bands of sizes required by piping. Size curb, cover and nipples per manufacturer's recommendations.
 8. Manufacturer: Roof Products Systems or Pate.

2.5 ACCESS PANELS AND ACCESS DOORS

- A. Provide all access doors and panels to serve equipment under this work, including those which must be installed, in finished architectural surfaces. Frame of 16-gauge steel, door of 20 gauge steel. 1" flange width, continuous piano hinge, key operated, prime coated. Refer to Architectural Specifications for the required product Specification for each surface. Contractor is to submit schedule of access panels for approval. Exact size, number and location of access panels is not shown on Plans. Access doors shall be of a size to permit removal of equipment for servicing. Access door shall have same rating as the wall or ceiling in which it is mounted. Provide access panel for each trap primer or concealed valve. Use no panel smaller than 12" x 12" for simple manual access, or smaller than 24" x 24" where personnel must pass through. Provide cylinder lock for access door serving mixing or critical valves in public areas.
- B. Included under this work is the responsibility for verifying the exact location and type of each access panel or door required to serve equipment under this work and in the proper sequence to keep in tune with construction and with prior approval of the Architect. Access doors in fire rated partitions and ceilings shall carry all label ratings as required to maintain the rating of the rated assembly.
- C. Acceptable Manufacturers: Milcor, Karp, Nystrom, or Elmdor/Stoneman.
- D. Submit markup of architectural plans showing size and location of access panels required for equipment access for approval by Architect.

2.6 IDENTIFICATION MARKERS

- A. Mechanical Identification Materials: Provide products of categories and types required for each application as referenced in other DIVISION 22 Sections. Where more than single type is specified for application, selection is installer's option, but provide single selection for each product category. Stencils are not acceptable.
- B. Plastic Pipe Markers:
 - 1. Snap-On Type: Provide pre-printed, semi-rigid snap-on, color coded pipe markers, complying with ANSI A13.1.
 - 2. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers, complying with ANSI A13.1. Secure both ends of markers with color coded adhesive vinyl tape.
 - 3. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
 - 4. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.
- C. Underground-Type Plastic Line Markers: Provide 6" wide x 4 mils thick multi-ply tape, consisting of solid metallic foil core between 2 layers of plastic tape. Markers to be permanent, bright colored, continuous printed, intended for direct burial service.
- D. Valve Tags:
 - 1. Brass Valve Tags: Provide 1 1/2" diameter 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Fill tag engraving with black enamel.

2. Plastic Laminate Valve Tags: Provide 3/32" thick engraved plastic laminate valve tags, with piping system abbreviations in 1/4" high letters and sequenced valve number 1/2" high, and with 5/32" hole for fasteners.
 3. Valve Tag Fasteners: Provide solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
 4. Access Panel Markers: Provide 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.
 5. Non-potable Water Tags: 1/16" thick, engraved, plastic tags as indicated on Drawings.
- E. Plastic Equipment Signs:
1. Provide 4-1/2" x 6" plastic laminate sign, ANSI A.13 color coded with engraved white core lettering.
 2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
 3. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters, such as pressure drop, entering and leaving conditions, rpm, etc.
- F. Acceptable Manufacturers: Craftmark, Seton, Brady, Marking Services, Inc., or Brimar.

2.7 ELECTRICAL

- A. General:
1. All electrical material, equipment, and apparatus specified herein shall conform to the requirements of DIVISION 26.
 2. Provide all motors for equipment specified herein. Provide motor starters, controllers, and other electrical apparatus and wiring which are required for the operation of the equipment specified herein.
 3. Set and align all motors and drives in equipment specified herein.
 4. Provide expanded metal or solid sheet metal guards on all V-belt drives to totally enclose the drive on all sides. Provide holes for tachometer readings. Support guards separately from rotating equipment.
 5. Provide for all rotating shafts, couplings, etc., a solid sheet metal, inverted "U" cover over the entire length of the exposed shaft and support separately from rotating equipment. Cover shall extend to below the bottom of the shaft and coupling, and shall meet the requirements of the State Industrial Safety Regulations.

6. Specific electrical requirements (i.e., horsepower and electrical characteristics) for plumbing equipment are scheduled on the Drawings.
- B. Quality Assurance:
1. Electrical components and materials shall be UL or ETL listed/labeled as suitable for location and use - no exceptions.
- C. Motors:
1. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment Specifications.
 2. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
 3. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. Unless otherwise noted on plans, all motors ½ HP or larger shall be rated for 208 or 460 volt, 3-phase, operation. Unless otherwise noted on plans, all motors less than 1/2 HP shall be rated for 120 volt, single phase operation.
 4. Temperature Rating: Motor meets class B rise with class F insulation.
 5. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.
 6. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
 - a. Frames: NEMA Standard No. 48 or 56; use driven equipment manufacturer's standards to suit specific application.
 - b. VFD driven motors. To be provided rated for inverter duty (NEMA Standard MG-1, Part 31) and equipped with a shaft grounding device or as an insulated bearing motor.
 - c. Bearings:
 - i. Ball or roller bearings with inner and outer shaft seals.
 - ii. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
 - iii. Designed to resist thrust loading where belt drives or other drives product lateral or axial thrust in motor.
 - iv. For fractional horsepower, light duty motors, sleeve type bearings are permitted.
 - v. Enclosure Type:
 - a) Open drip-proof (ODP) motors for indoor use in clean air environments.
 - b) Totally enclosed fan cooled (TEFC) motors for outdoor use and indoor application in dirty environments.
 - c) Totally enclosed air over (TEAO) motors for motors in the airstream of cooling towers and fluid coolers.
 - d) Guarded drip-proof motors where exposed to contact by employees or building occupants.
 - e) Weather protected Type I for outdoor use, Type II where not housed.

- d. Overload Protection: Built-in thermal overload protection where external overload protection is not provided and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
 - e. Noise Rating: "Quiet."
 - f. Efficiency:
 - i. Motors shall have a minimum efficiency per governing State or Federal codes, whichever is higher.
 - ii. Motors shall meet the NEMA premium efficiency standard.
 - iii. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
- D. Starters and Electrical Devices:
- 1. Motor Starter Characteristics:
 - a. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs.
 - b. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
 - 2. Manual switches shall have pilot lights and all required switch positions for multi-speed motors. Overload Protection: Melting alloy or bi-metallic type thermal overload relays, sized according to actual operating current (field measured).
 - 3. Magnetic Starters:
 - a. Heavy duty, oil resistant, hand-off-auto (HOA), or as indicated, and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
 - b. Trip-free thermal overload relays, each phase, sized according to actual operating current (field measured).
 - c. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of DIVISION 23.
 - d. Built-in primary and secondary fused control circuit transformer, supplied from load side of equipment disconnect.
 - e. Externally operated manual reset.
 - f. Under-voltage release or protection for all motors over 20 hp.
 - 4. Motor Connections: Liquid tight, flexible conduit, except where plug-in electrical cords are specifically indicated.
- E. Low Voltage Control Wiring:
- 1. General: 14 gauge, Type THHN, color coded, installed in conduit.
 - 2. Manufacturer: General Cable Corp., Alcan Cable, American Insulated Wire Corp., Senator Wire and Cable Co., or Southwire Co.

F. Disconnect Switches:

1. Fusible Switches: For equipment 1/2 HP or larger, provide fused, each phase; heavy duty; horsepower rated; spring loaded quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated.
2. Non-Fusible Switches: For equipment less than 1/2 horsepower, switch shall be horsepower rated; toggle switch type with thermal overload quantity of poles and voltage rating as required.

PART 3 - EXECUTION

3.1 GENERAL

- A. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.
- B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal or otherwise irregular work, unless so indicated on Drawings or approved by Architect.

3.2 MANUFACTURER'S DIRECTIONS

- A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.

3.3 INSTALLATION

- A. Coordinate the work between the various Plumbing Sections and with the work specified under other Divisions. If any cooperative work must be altered due to lack of proper supervision or failure to make proper and timely provisions, the alternations shall be made to the satisfaction of the Engineer and at the Contractor's cost.
- B. Inspect all material, equipment, and apparatus upon delivery and do not install any damaged or defected materials.

3.4 SUPPORTS AND HANGERS

- A. Prior to installation of hangers, supports, anchors, and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives, (if any), installers of other work with requirements specified.
- B. Installation of Building Attachments: Install building attachments at required locations within concrete or on structural steel for proper piping support. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed. Fasten insert securely to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through opening at top of inserts.
- C. Proceed with installation of hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to, proper placement of inserts, anchors, and other building structural attachments.

- D. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- E. Install hangers within 12 inches of every change in piping direction, end of pipe run or concentrated load, and within 36 inches of every major piece of equipment. Hangers shall be installed on both sides of flexible connections. Where flexible connection connects directly to a piece of equipment only one hanger is required.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- G. Support gas independently of other piping.
- H. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- I. Hanger Spacing in accordance with following minimum schedules (other spacings and rod sizes may be used in accordance with the SMACNA Seismic Restraint Manual using a safety factor of five):

1. Steel Pipe (Water Filled):

<u>Pipe Size</u>	<u>Max. Hanger Spacing</u>	<u>Rod Size</u>
1/2" to 1 1/4"	5 feet	3/8"
1 1/2" to 2"	7 feet	3/8"
2 1/2" to 3"	10 feet	1/2"
4" and larger	12 feet	5/8"

2. Steel Pipe (Gas/Air Filled):

<u>Pipe Size</u>	<u>Max. Hanger Spacing</u>	<u>Rod Size</u>
1/2" to 1 1/4"	6 feet	3/8"
1 1/2" and larger	10 feet	1/2"

3. Copper Pipe:

<u>Pipe Size</u>	<u>Max. Hanger Spacing</u>	<u>Rod Size</u>
1/2" to 2"	6 feet	3/8"
2 1/2" and larger	8 feet	1/2"

4. Slope all piping as specified and as indicated, true to line and grade, and free of traps and air pockets. Unless indicated otherwise, slope piping in the direction of flow as follows:

<u>Service</u>	<u>Inclination</u>	<u>Slope</u>
Domestic Water	Down	1" per 100'
Heating Water	Up	1" per 40'
Steam	Down	1" per 40'
Soil and Waste	Down	1/4" per foot (1/8" per foot)
Storm Water	Down	1/4" per foot (1/8" per foot)
Sanitary Vent	Up (towards roof terminal)	1/4" per foot (1/8" per foot)

5. Slope all compressed air branch piping down toward main risers at 1" per 10'.
 6. Provide eccentric reducers in horizontal piping for all sizing changes:
 7. Provide drain valves and hose adapters at all low points in piping.
 8. Provide vents at all high points in water piping.
- J. Provisions for Movement:
1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connecting equipment.
 3. Insulated Piping: Comply with the following installation requirements:
 - a. Clamps: Attach clamps, including spacers, (if any), to piping with clamps projecting through insulation.
 - b. Shields: Where low compressive strength insulation or vapor barriers are indicated on cold water piping, install shields or inserts.
 - c. Saddles: Where insulation without vapor barrier is indicated install protection saddles.
- K. Installation of Anchors:
1. Install anchors at proper locations to prevent excessive stresses and to prevent transfer of loading and stresses to connected equipment.
 2. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure.
 3. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
 4. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends.
- L. Equipment Supports:
1. Provide all concrete bases, unless otherwise furnished as work of DIVISION 3. Furnish to DIVISION 3 Contractor scaled layouts of all required bases, with dimensions of bases, and location to column centerlines. Furnish templates, anchor bolts, and accessories necessary for base construction.
 2. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks.
- M. Adjusting:
1. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
 2. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

3. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.5 ROOF CURBS, EQUIPMENT RAILS, PIPE PORTALS

- A. Install per manufacturer's instructions.
- B. Coordinate with other trades so units are installed when roofing is being installed.
- C. Verify roof insulation thickness and adjust raise of cant to match.

3.6 VIBRATION CONTROL ISOLATORS

- A. Comply with manufacturer's recommendations for selection and application of vibration isolation materials and units except as otherwise indicated. Comply with minimum static deflections recommended by ASHRAE, of vibration isolation materials and units where not otherwise indicated.
- B. Comply with manufacturer's instructions for installation and load application to vibration control materials and units except as otherwise indicated. Adjust to ensure that units have equal deflection, do not bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices intended for temporary support during installation.
- C. Install units between substrate and equipment as required for secure operation and to prevent displacement by normal forces, and as indicated.
- D. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where substrate is not level.
- E. Flexible Pipe Connectors: Install on equipment side of shutoff valves.
- F. Upon completion of vibration control work, prepare report showing measured equipment deflections for each major item of equipment as indicated. Clean each vibration control unit, and verify that each is working freely, and that there is no dirt or debris in immediate vicinity of unit that could possibly short-circuit unit isolation.

3.7 ELECTRICAL REQUIREMENTS

- A. Plumbing Contractor shall coordinate with DIVISION 26 work to provide complete systems as required to operate all mechanical devices installed under this Division of work.
- B. Installation of Electrical Connections: Furnish, install, and wire (except as may be otherwise indicated) all plumbing, motors and controls in accordance with the following schedule and in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC, and NECA's "Standard of Installation" to ensure that products fulfill requirements. Carefully coordinate with work performed under the Plumbing Division of these Specifications.
- C. DIVISION 22 has responsibilities for electrically powered or controlled plumbing equipment which is specified in DIVISION 22 Specifications or scheduled on DIVISION 22 Drawings. The specific division of responsibilities between DIVISION 22 and DIVISION 26 for furnishing or wiring this equipment is as follows:
 1. DIVISION 22 Plumbing Responsibilities:
 - a. MOTORS: Furnish and install all motors necessary for plumbing equipment.

- b. **MAGNETIC STARTERS:** Furnish all magnetic starters whether manually or automatically controlled which are necessary for mechanical equipment. Furnish these starters with all control relays or transformers necessary to interface with plumbing controls. If the starter is factory installed on a piece of DIVISION 22 equipment, also furnish and install the power wiring between starter and motor.
 - c. **VARIABLE FREQUENCY DRIVES:** Provide all VFD's associated with plumbing equipment. If the drive is installed on a piece of factory assembled equipment the wiring between motor and drive is to be provided as part of the factory equipment.
 - d. **DISCONNECTS:** Provide the disconnects which are part of factory wired DIVISION 22 plumbing equipment. Factory wiring to include wiring between motor and disconnect or combination starter/disconnect.
 - e. **CONTROLS:** DIVISION 22 Contractor (including the temperature controls installer) is responsible for the following equipment in its entirety. This equipment includes but is not limited to the following:
 - i. Control relays necessary for controlling DIVISION 22 equipment.
 - ii. Control transformers necessary for providing power to controls for DIVISION 22 equipment.
 - iii. Low or non-load voltage control components.
 - iv. Non-life safety related valve.
 - v. Float switches.
 - vi. Solenoid valves, EP and PE switches.
- D. DIVISION 26 has responsibilities for electrically powered or controlled equipment which is specified in DIVISION 22 Specifications or scheduled on DIVISION 22 Drawings. The specific division of responsibilities between DIVISION 22 and DIVISION 26 for furnishing or wiring this equipment is as follows:
1. DIVISION 26 – ELECTRICAL responsibilities:
 - a. **Motors:** Provide the power wiring for the motors.
 - b. **Magnetic Starters:** Except where magnetic starters are factory installed on DIVISION 22 factory assembled equipment, DIVISION 26 is to install magnetic starters furnished by DIVISION 22 and install the necessary power wiring to the starter and from the starter to the motor. In the case of factory installed starters, DIVISION 26 is to install the necessary power wiring to the starter.
 - c. **Variable Frequency Drives:** Physically mount all VFD's, which are not specified to be installed on DIVISION 22 factory assembled equipment. Provide the necessary power wiring to the VFD and from the VFD to the motor except in the case of factory installed VFD's where wiring between the motor and VFD is to be by DIVISION 22. Where disconnects are installed between a VFD and a motor provide the interlocking wiring between the disconnect and VFD to insure that the drive is shutdown simultaneously with motor.
 - d. **Disconnects:** Provide all disconnects necessary for DIVISION 22 mechanical equipment which are not provided as part of factory wired DIVISION 22 equipment. Provide power

wiring to all disconnects. In addition provide power wiring between motor and disconnect when the disconnect is not factory installed. See also Variable Frequency Drive above for special wiring requirements.

- e. Controls: DIVISION 26 Contractor is responsible for providing power to control panels and control circuit outlets.
 - 2. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
 - 3. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
 - 4. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner, or Architect/Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
 - 5. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
 - 6. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- E. Motors and Motor Control Equipment: Conform to the standards of the NEMA. Equip motors with magnetic or manual line starters with overload protection. Motor starters and line voltage controls shall be installed under Electrical Section but located and coordinated as required under this Section of the work. Starters shall be combination type with non-fusible disconnect switches. All single phase fractional horsepower motors shall have built-in overload protection.

3.8 PAINTING

- A. All painting shall be provided under this Division work, unless otherwise specified under DIVISION 9: Painting. Painting schemes shall comply with ANSI A13.1. Paint all exposed materials such as piping, equipment, insulation, steel, etc. Exposed gas piping inside and outside the building shall be painted with two coats of "Rust-O-Leum" Yellow. Exposed copper indirect waste piping serving food service equipment shall be painted metallic chrome.
- B. All exposed work under DIVISION 22 shall receive either a factory finish or a field prime coat finish, except:
 - 1. Exposed copper piping.
 - 2. Aluminum jacketed outdoor insulated piping.

3.9 IDENTIFICATION MARKERS

- A. General: Where identification is to be applied to surfaces which require insulation, painting, or other covering or finish, including valve tags in finished mechanical spaces, install identification after

completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. Piping System Identification:

1. Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.
2. Locate pipe markers as follows:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short take-offs for fixtures; mark each pipe at branch, where there could be question of flow pattern.
 - c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
 - d. At access doors, manholes, and similar access points which permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced horizontally at maximum spacing of 20' along each piping run, with minimum of one in each room. Vertically spaced at each story transversed.

C. Underground Piping Identification: During backfilling/topsoiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

D. Plumbing Equipment Identification: Locate engraved plastic laminate signs on or near each major item of plumbing equipment and each operational device. Provide signs for the following:

1. Main control and operating valves, including safety devices.
2. Meters, gauges, thermometers, and similar units.
3. Pumps, compressors and similar motor-driven units.
4. Hot water system mixing valves and similar equipment.
5. Boilers, heat exchangers and similar equipment.
6. Tanks and pressure vessels.
7. Strainers, filters, treatment systems and similar equipment.

E. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations. Equipment signs shall include an identification of the area or other equipment served by the equipment being labeled.

F. Gas pressure regulators shall have metal tags attached stating, "Warning: 2 lbs. upstream natural gas pressure. Do not remove."

3.10 VIBRATION AND DYNAMIC BALANCING

- A. Vibration tolerances shall be as specified by the "International Research and Development Corporation", Worthington, Ohio, measured by the displacement, peak to peak, as follows:
 - 1. Pump and Electric Motors: Below severity chart labeled "SLIGHTLY ROUGH", maximum vibration velocity of 0.157 in/sec, peak.
 - 2. Compressors: Same as pumps.
- B. Correction shall be made to all equipment which exceeds vibration tolerances specified above. Final vibration levels shall be reported as described above.

3.11 TESTING

- A. Provide all tests specified hereinafter and as otherwise required. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing, that the specified tests have been performed and that the installation complies with the specified requirements and provide a report of the test observations signed by qualified inspector.

END SECTION 22 05 00

SECTION 23 05 01 PLUMBING

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, and SECTION 22 05 00 - BASIC MATERIALS AND METHODS, and other Sections in DIVISION 22 specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 22 05 00 - BASIC MATERIALS AND METHODS
- B. SECTION 23 07 00 - HVAC INSULATION
- C. SECTION 22 21 13 - PLUMBING PIPING, VALVES AND SPECIALTIES
- D. SECTION 22 40 00 - PLUMBING FIXTURES
- E. SECTION 22 11 23 - PLUMBING EQUIPMENT

1.3 SCOPE

- A. All work includes removing and modifying existing and providing new plumbing. Systems as specified under this section shall include but not necessarily be limited to the following:
 - 1. Connection to utilities at five (5) feet from the building. Coordinate with the Civil Engineering Plans and/or DIVISION 2 work.
 - 2. Connection of all waste, vent, and water piping to all plumbing fixtures, drinking fountains, sinks, electric water coolers, drains and mechanical equipment.
 - 3. Provide for future expansion as indicated.
 - 4. Connect to new expansion tank and domestic hot water heaters.
 - 5. Connect hot and/or cold water to hose bibbs and wall hydrants. Provide individual shut-off valves at each location.
 - 6. Provide traps on all floor drains with trap primer where specified. Pipe to trap shall be ½" minimum.
 - 7. 160°F hot water shall be provided to laundry, 120°F to kitchen areas. Mixing valves shall be provided to reduce to desired temperatures within each service area.
 - 8. 105°F hot water shall be mixed at point of use for service to public fixtures including lavatories.
 - 9. Domestic water heating plant shall be propane supply.
 - 10. Provide domestic hot water recirculation system. Each branch line to be set at one (1) gpm. Provide individual shut-off valve, check valve and balance valve and ball valve with memory stop at each location.
 - 11. Provide floor drainage in core toilets, mechanical rooms and equipment rooms.
 - 12. Provide gas shut-off and dirtleg assembly at each connection, as detailed on drawings.

13. Temporary Water Service: As directed by the General Contractor, the plumber shall provide a temporary metered water service and temporary water risers with four (4) hose bibbs installed at each level as the building proceeds upwards to the roof.

1.4 SUBMITTALS

- A. Prior to construction submit for approval all materials and equipment in accordance with DIVISION 1. Submit manufacturer's data, installation instructions, and maintenance and operating instructions for all components of this section including, but not limited to, the following:
 1. Plumbing specialties.
 2. Trap primers.
 3. Cleanouts.
 4. Drains
 5. Roof flashing
 6. Wall hydrants and hose bibbs
 7. Mixing valves
 8. Backwater valve
- B. DELIVERY, STORAGE, AND HANDLING
- C. Deliver products to the site in containers with manufacturer's stamp or label affixed.
- D. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products - remove from project site.

1.5 WARRANTY

- A. Provide one-year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials and equipment under this Division of the Specifications shall be new, of best grade and as listed in printed catalogs of the manufacturer.
- B. All manufactured materials shall be delivered and stored in their original containers. Equipment shall be clearly marked or stamped with the manufacturer's name and rating.
- C. The following products to be included as part of this work but specified under SECTION 22 05 00 - BASIC MATERIALS AND METHODS and SECTION 22 21 13 - PLUMBING PIPING, VALVES AND SPECIALTIES:
 1. Piping.
 2. Valves.
 3. Hangers and supports.
 4. Escutcheon plates, flashings, and sleeves.
 5. Identification markers and signs.

- 6. Anchors and alignment guides to comply with seismic requirements as indicated on structural plans.
- 7. Excavation and backfill.
- 8. Pressure and temperature gauges.
- 9. Access Panels.
- D. Plumbing Fixtures: Refer to SECTION 22 40 00 - PLUMBING FIXTURES.
- E. Plumbing Equipment: Refer to SECTION 22 11 23 - PLUMBING EQUIPMENT.
- F. Products made of, or containing, lead, asbestos, mercury, or other known toxic or hazardous materials are not acceptable for installation under this Section. Any such products installed as part of the work of this Section shall be removed and replaced and all costs for removal and replacement shall be borne solely by the Contractor(s).

2.2 VALVES: DOMESTIC WATER AND PROPANE (SEE SECTION 22 21 13 – PLUMBING PIPING, VALVES AND SPECIALITIES)

2.3 CLEANOUTS

- A. Acceptable Manufacturers: J. R. Smith, Zurn, Wade, Sioux Chief and Josam.
- B. Cleanout Plugs: Bronze, taper thread countersunk head.
- C. Floor Cleanouts: Service weight cast-iron body and frame, flange with flashing clamp, adjustable cast-iron collar, caulk inside, Ty-seal or No-hub joints, neoprene plug gasket seal.
 - 1. Carpeted Areas: Zurn ZN-1400-KC-VP-BP-CM or J. R. Smith 4028 C - F - C - Y - U
 - 2. Tiled Areas: Zurn ZN-1400-X-KC-VP-BP or J.R. Smith 4148 - F - C - U
 - 3. Unfinished Areas: Zurn ZN-1400-HD-KC-VP-BP or J.R. Smith 4108 C - F - C - U
 - 4. Yard Areas: Zurn Z 1474-IN-VP or J.R. Smith 4258 - C - U
- D. Cleanout Tee: Cast iron cleanout tee with countersunk brass plug, neoprene plug gasket seal and smooth stainless steel cover.
 - 1. Manufacturer: Zurn Z-1446-BP or J. R. Smith 4532 S (Y)

2.4 ROOF FLASHING

- A. Flashing: Unless indicated otherwise on the drawings flashings for pipes through the roof shall be galvanized sheet metal, 24 gauge minimum or sheet copper, 8 oz. per sq. ft. minimum with seams and joints lapped and soldered watertight. Coordinate with Architectural Sections for flashings and roofing.
- B. Vent Pipes: Provide caulk type, vandal proof hood with Allen head vandal proof screws for all vent pipes through roof or preformed vinyl/galvanized steel assembly.

2.5 WATER HAMMER ARRESTORS

- A. Piston Type: Hard drawn copper construction, mirror finished internal surfaces; machine finished brass piston, air charged, 250 psi rated, tested and certified per PDI WH-201 and ASSE 1015.
 - 1. Manufacturer: Watts Series 15, Precision Plumbing series SC, or Sioux Chief.

2.6 ANTI-CONTAMINATION WALL HYDRANTS AND HOSE BIBBS

- A. Anti-contamination Hose Bibbs, HB-1: Bronze body construction, polished chrome plated finish, renewable composition disc, wheel handle, ½" NPT inlet, ¾" threaded hose end, vacuum breaker/backflow preventor, solder joint, ANSI 1011.
 - 1. Manufacturer: Woodford series 24P or Zurn Z1341.
- B. Anti-contamination Hose Bibbs: Toilet Rooms, HB-2: Stainless steel recessed hose box with door and lock, cast bronze valves with integral stops, ¾"H & CW outlet with vacuum breakers.
 - 1. Manufacturer: Acorn 8000 or Willoughby HB-2.
- C. Anti-Contamination Wall Hydrant, WH-1: Exterior, box-type, freezeproof, cast-bronze construction, chrome plated finish, loose key, bronze casing, length to suit wall thickness, vacuum breaker/backflow preventor, ¾" inlet, ¾" threaded hose end, solder joint.
 - 1. Manufacturer: Woodford series B 67C, or Zurn Z-1320-C.
- D. Anti-Contamination wall hydrant, WH-2: Exterior, freezeproof, cast bronze construction, chrome plated finish/loose-key, bronze casing, length to suit wall thickness, vacuum breaker/backflow preventor, ¾" inlet, ¾" outlet with threaded end, solder joint.
 - 1. Manufacturer: Woodford Series 65C.
- E. Washer Box: W-1:
 - 1. Unit: 10 ¾" x 9" x 3 5/8" steel wall box, (9" x 14" x 3 5/8"). ½" brass sweat connection with hose bibbs, 2" drain outlet (20 amp duplex outlets, 30 amp dryer outlet).
 - 2. Mounting Height: 42" above finished floor.
 - 3. Manufacturer: Guy Gray BB200TS (BBED 200TS)
- F. Ice Maker Hook-up, IM-1: 10 ¾" x 9" x 3 5/8" steel wall box, ½" sweat connection with ½" x ¼" angle valve with compression fitting.
 - 1. Manufacturer: Guy Gray BIM875

2.7 DRAINS

- A. General: Provide drains of type and size as indicated on drawings, including features, as specified herein.
 - 1. Acceptable Manufacturers: J.R. Smith, Zurn, Wade, Sioux Chief, Josam and Watts.
- B. Area Drain AD-1: Enamel coated cast iron body with flange, clamping collar, seepage openings, adjustable 8" square top, sediment bucket, bottom outlet, caulk inside or Ty-seal, satin bronze finish, vandal proofed.
 - 1. Manufacturer: Zurn Z-525-T-VP-S or J.R. Smith 2310 - U - FBS - C(Y).
- C. Area Drain AD-2: All welded steel construction, hubbed outlet, outside trap seal, tamper proof (8) screws. 19"x 19"x 21", exterior coating, enamel coated, slotted grate, Interior removable screen filter, asphalt interior.
 - 1. Manufacturer: Rockford separator SDE-25.

- D. Floor Drain, FD-1 - Finished Areas: Enamel coated cast iron body with flange, integral reversible clamping collar, seepage openings, adjustable round satin nickel bronze strainer, sediment bucket, bottom outlet, caulk inside or Ty-Seal or no-hub joint. Provide trap primer.
 - 1. Manufacturer: Zurn ZN-415-5B-Y-P or J.R. Smith 2010 - A - C(Y).
- E. Floor Drain, FD-2 - Mechanical Rooms: Enamel coated cast iron body with flange, clamping collar, seepage openings, 8-1/2" diameter adjustable cast iron bar strainer, sediment bucket, bottom outlet, caulk inside or Ty-Seal or no-hub joint. Provide trap primer.
 - 1. Manufacturer: Zurn Z-520-Y-P or J.R. Smith 2350 C(Y).
- F. Floor Drain, FD-3 Mechanical Rooms: 18" x 18" x 18" custom fabricated 10 gauge steel basin with slotted grate, 4" outlet, asphalt coated exterior. Provide trap primer tap and 4" outlet.
 - 1. Manufacturer: Lynch Company.
- G. Floor Sink, FS-1: Enamel coated cast iron body with seepage flange, acid resistant interior surfaces, aluminum dome strainer, 12" x 12" x 6", half grate, bottom outlet, caulk inside, Ty-Seal or no-hub joint. Provide trap primer.
 - 1. Manufacturer: Commercial Enameling series 906-1 or Zurn-ZFD-2375-K-H-Y.
- H. Floor Sink, FS-2: Enamel coated cast iron body with seepage flange, acid resistant interior surfaces, aluminum dome strainer, 12" x 12" x 10", half grate, bottom outlet, caulk inside, Ty-Seal or no-hub joint. Provide trap primer and sediment bucket.
 - 1. Manufacturer: Commercial Enameling series 906-1 sediment bucket #1001 or Zurn-ZFD-2377-K-H-Y.
- I. Trench Drain, Type 1, TD-1: 4" wide fiberglass channel construction, 5" wide stainless steel frame with perforated steel grate, bottom outlet & end caps. Provide with catch basin.
 - 1. Manufacturer: ACO –NW 100-465 or Zurn 804-CG.
- J. Trench Drain, Type 2, TD-2: Roadway: 8" wide fiberglass channel construction with 0.75 slope, 10" wide dura coated steel frame and slotted grate, bottom outlet, end caps. Provide with matching catch basin.
 - 1. Manufacturer: ACOFG 200-461 or Zurn.

2.8 TRAP PRIMER

- A. Flow activated trap primer, cast bronze construction, vacuum breaker ports, NPT inlet and outlet connections, for use up to four (4) drains. Install in accessible location or provide access panel. PPP PRO1-500 Prime-Pro, PPP Oregon #1, Sioux Chief PrimePerfect, or equal.
- B. For Multiple Units or Kitchen Areas or remote locations: Coordinate 120 volt electrical service with DIVISION 26. PPP Prime Time or Sioux Chief electronic trap primer Series PT, or equal.
- C. Alternate for single trap application adjacent to a flush valve toilet: One piece, chrome plated flush valve connection with vacuum breaker, 3/8" elbow, flex-bend tube connection, diverter. Sloan VBF-72A or equal.

2.9 MIXING VALVES ASSEMBLY

- A. Mixing Valve: 300 psi, Brass construction, thermostatic controller with check stops. Refer to drawings for schedule of each valve. Use high/low type for uses over 20 gpm.

- B. Manufacturer: Holby, Lawler, Symmons or Leonard.

PART 3 - EXECUTION

3.1 GENERAL

- A. This system to be installed by an experienced firm regularly engaged in the installation of plumbing systems as specified by the requirements of the Specifications.
- B. Install all items specified in this section of the Specification under the full purview of local and state governing agencies.
- C. Refer to SECTION 22 05 00 - BASIC MATERIALS AND METHODS for installation of piping, valves and other requirements.

3.2 PERFORMANCE OF WORK

- A. Examine areas, physical conditions and phasing requirements under which materials are to be installed. Layout the system to suit the different types of construction and equipment as indicated on the drawings.
- B. Work shall start immediately after authorization has been given to proceed so that the overall progress of the construction is not delayed. No foundry items to be installed until submittals have been approved.
- C. Coordinate with other trades as necessary to properly interface components of the plumbing system.
- D. Follow manufacturer's directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the drawings or covered in these Specifications.
- E. The omission from the drawings or Specifications of any details of construction, installation, materials, or essential specialties shall not relieve the Contractor from furnishing the same in place for a complete system.

3.3 PIPING INSTALLATION

- A. The word "piping" shall mean all pipes, fittings, nipples, valves and all accessories connected thereto.
- B. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts flues, conduits and work of other trades and close to ceiling or other construction as practical, free of unnecessary traps or bends.
- C. Run horizontal sanitary drainage at uniform pitch of not less than 1/8" per foot, unless otherwise indicated. Pitch horizontal vent piping downward from stack to fixtures.
- D. Run drainage piping as straight as possible with long radius turns. Offsets shall be made at an angle of 45° or less.
- E. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
- F. Piping connections to all equipment shall be made up with unions.
- G. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.

- H. Use reducers or increasers. Use no bushings.
- I. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageway.
- J. Vent pipes to terminate at least 6" above the roof. Provide vandal proof hood assembly.
- K. Cover, cap or otherwise protect open ends of all piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect water supply piping as specified.
- L. Exposed connections to equipment shall be installed with special care, showing no tool marks or threads at fittings and piping. No bowed or bend piping to be permitted.
- M. All ferrous to non-ferrous connections shall be made by means of dielectric fittings. Submit shop drawings for approval.
- N. Use extra heavy pipe for nipples, where unthreaded portion is less than 1½". Use no close nipples. Use only shoulder nipples.
- O. All piping shall be inspected for defects and flaws prior to installation. Remove any damaged piping from job site. Piping shall be thoroughly cleaned of dirt, debris or rust.
- P. Cleanouts to be provided at each change in direction greater than 135° or 100' maximum intervals on underground piping.
- Q. Cleanouts to be same size as pipe except cleanout plugs larger than 4" shall not be required.
- R. Cleanouts on concealed piping to be extended through and terminate flush with the finished wall or floor. Cover plates to be provided on all cleanout plugs in finished areas.
- S. The bodies of cleanout ferrules to conform in thickness to that required for pipe and fittings of the same metal.
- T. Route piping on roof on manufactured polypropylene pipe supports: Roof Top Blox RTB-#.

3.4 WATER HAMMER ARRESTERS

- A. Install as per PDI Standard WH-20 and equipment manufacturer's recommendation and as shown on working drawings. Provide before each quick closing valve (flush valve, solenoid valve, etc.) or bank of fixtures.
- B. Install at each plumbing fixture, bank of fixtures, equipment and as indicated.

3.5 TESTING AND DISINFECTING - PLUMBING SYSTEMS

- A. General: The Contractor to perform all field tests and provide all labor, equipment, and incidentals required for the tests. Owner to witness all field tests and conduct all field inspections. The Contractor to give the Owner ample notice of the dates and times scheduled for tests. Any deficiencies to be completely retested at no additional cost.
 1. Inspection: Inspection to continue during installation and testing. Perform a final inspection of the equipment prior to installation to determine conformity to the type, class, grade, size, capacity, and other characteristics specified herein or indicated. Correct or replace all rejected equipment prior to installation.
 2. Water Distribution Piping Test: Before fixtures are set, subject the entire hot and cold piping system to a hydrostatic pressure test of 150 pounds per square inch with water for not less than 8 hours in order to permit inspection of all joints with no evidence of leakage. Where a

portion of the water distribution piping is to be concealed before completion, test this portion separately as specified for the entire system.

3. Sanitary, Waste, and Vent Piping Test: Before the installation of any fixtures or drains, cap the ends of the system and fill all lines with water to the roof level and allow to stand for at least 30 minutes without leakage. Make tests within building with piping exposed. If the system is tested in sections, tightly lug each opening, except the highest opening of the section under test, and fill each section with water and test with at least a 10' head of water.
4. Sanitary Drainage Vent, and Fixture System Final Test: Give sanitary, drainage vent, and fixture systems an in-service test after complete installation. After all fixtures are installed, test the entire vent and sewer system and prove gas and water tight. Final test shall be with air. Before proceeding with test, fill all traps with water. Close all stacks and line openings during test, for a minimum period of 24 hours. If test reveals leakage of air at any point, repair and retest the system.
5. Disinfection of Water Distribution System: After pressure tests have been made thoroughly flush the entire domestic water distribution system with water until all entrained dirt and mud have been removed, and sterilize by chlorinating material. The chlorinating material shall be liquid chlorine. The chlorinating material shall provide a dosage of not less than 50 parts per million and shall be introduced into the system or part thereof in an approved manner. Retain the treated water in the pipe for 24 hours, or, fill the system or part thereof with a water-chlorine solution containing at least 200 parts per million of chlorine and allow to stand for three hours. Open and close all valves in the system being disinfected three times during the contact period. Then flush the system with clean potable water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period open and close all valves and faucets three times. From at least three divergent points in the system, take samples of water in properly sterilized containers for bacterial examination. Repeat the disinfecting until tests indicate that satisfactory bacteriological results have been obtained.
 - a. Taking of samples shall be witnessed by Architect or Owner's representative. Samples are to be taken and tested by an independent analytical testing laboratory. Written reports shall be supplied to Architect for approval.

3.6 OPERATING TESTING AND CERTIFICATION - PLUMBING SYSTEMS

- A. Upon completion and disinfection, and prior to acceptance of the installation, the Contractor to subject the plumbing system to operating tests to demonstrate satisfactory, functional, and operating efficiency. Such operating tests to include the following information in a report with conclusions as to the adequacy of the system.
 1. Time, date, and duration of tests.
 2. Water pressures at most remote location.
 3. Operation of all valves and hydrants.
 4. Operation of all floor drains by flooding with water.
 5. Quality of domestic water.
 6. Read all indicating instruments at half-hour intervals unless otherwise directed. Supply four copies of the test report to the Owner.

3.7 CLEANING EQUIPMENT AND MATERIALS

- A. In addition to the requirements of SECTION 22 05 00 - BASIC MATERIALS AND METHODS, provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care to be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors, and similar equipment.
- B. All piping, finished surfaces, and equipment to have all grease, adhesive labels, and foreign materials removed.
- C. All piping to be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, flush valves, and similar items shall be thoroughly cleaned. Remove and thoroughly clean and reinstall all liquid strainer screens after the system has been in operation for ten days.
- D. When connections are to be made to existing systems, the Contractor is to do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.

3.8 OPERATION MANUALS, START-UP SERVICE, WARRANTIES, ACCEPTANCE AND GUARANTEES

- A. General: Refer to SECTION 22 05 00 - BASIC MATERIALS AND METHODS for details.

END SECTION 22 05 01

SECTION 22 05 04 PLUMBING SITE UTILITIES

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this Section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, and SECTION 22 05 00 - BASIC MATERIALS AND METHODS, and other Sections in DIVISION 22 specified herein.

1.2 SCOPE

- A. Provide all labor, materials and equipment required to complete the mechanical site utility work of the Contract Documents. Verify all existing utilities and exact locations prior to installation of new piping and provide all necessary trim and fittings for required connections. All work to be furnished and installed under this Section shall include, but not necessarily be limited to, providing the following:
 - 1. Domestic and utility water piping.
 - 2. Sanitary sewer piping.
 - 3. Gas piping.
 - 4. Piping accessories.
 - 5. Valves and valve boxes.
 - 6. Thrust blocks.
 - 7. Excavation, trenching and backfill.
 - 8. Cleaning and testing of piping.
 - 9. Disinfection of domestic cold water piping.
 - 10. Connection of site utility services to building piping system of buildings, to existing site utilities and to site utilities specified under other divisions.

1.3 RELATED WORK IN OTHER SECTIONS

- A. DIVISION 2 and DIVISION 3 Sections for Trench Excavation and Backfill, Asphalt Concrete Paving, and Cast-In-Place Concrete.
- B. SECTION 22 05 00- BASIC MATERIALS AND METHODS.
- C. SECTION 22 07 00 - PLUMBING INSULATION.

1.4 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect materials before, during, and after installation and to protect the installed work and materials of all other trades.
- B. The general arrangement and locations of piping are shown on the Drawings. Changes may be necessary to accommodate work. Should it be necessary to deviate from arrangement or location indicated in order to meet existing conditions or due to interference with work of other trades, such deviations as offsets, rises and drops in piping that may be necessary, whether shown or not, shall be made without extra expense. Accuracy of data given herein and on the Drawings is not

guaranteed. The Drawings and Specifications are for assistance and guidance, and exact locations, distances, and elevations will be governed by actual site conditions.

- C. All work shall be in accordance with the applicable codes listed in DIVISION 1. No extra charge will be paid for furnishing items required by the regulations but not specified herein or shown on the Drawings. Should there be any direct conflict between the Drawings and/or Specifications and the above rules and regulations, the rules and regulations shall take precedence.
- D. All work shall be completely coordinated, and all lines, grades, slopes and vertical and horizontal locations of pipes shall be exactly determined in the field and cleared with the Owner's Representative before the installation of these items is begun. No extra compensation shall be made for failure to observe this clause.
- E. The Drawings and Specifications do not undertake to list every item that will be installed. When an item is necessary for the satisfactory operation of the system, it shall be furnished without extra cost. Work called for in the Specifications, but not on the Drawings, or vice versa, shall be done as though required by both. Lack of specific mention of any work necessary for proper completion of the work in the Specifications and/or Drawings, shall not lessen the Contractor's responsibility.
- F. Obtain Owner's Representative's approval prior to rerouting of existing services. Refer to DIVISION 1 - GENERAL REQUIREMENTS sections for alterations, shutdown and temporary construction for existing services.
- G. Pipe spaces provided in the design shall be utilized and the work shall be kept within the spaces established on the Drawings.
- H. Manufacturers' directions shall be followed in all cases where manufacturers of articles used in this Contract furnish directions covering points not shown on the Drawings or specified herein. Manufacturers' directions do not take precedence over the Drawings and Specifications. Where manufacturers' directions are in conflict with the Drawings and Specifications, submit these conflicts to the Engineer and receive clarification before installing the work.
- I. Do not permit or cause any work to be covered or enclosed until it has been inspected, tested, and approved. Should any of the work be enclosed or covered before inspection and test, Contractor shall, at his/her own expense, uncover the work; and, after it has been inspected, tested and approved, make all repairs with such materials as may be required. Restore all work to its original and proper condition.
- J. Be responsible for damage to any of this work before acceptance. Securely cover all openings, both before and after setting into place, to prevent obstructions in the pipes and breakage.
- K. Repair all damage to the premises occasioned by the work. All damage to any part of the premises caused by leaks or breaks in the pipe installed under this Section of the work for a period of one (1) year after date of final acceptance of the work, shall be repaired.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of piping system, boxes and accessories.
- B. Maintenance Data: Submit maintenance data and replacement material lists. Include this data in maintenance manual.
- C. Product Samples: Provide one 12" long sample of each proposed type of pipe.
- D. Submit thrust block calculations and Drawings for approval.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site in containers with manufacturer's stamp or label affixed.
- B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged components - remove from project site.

PART 2 - PRODUCTS

2.1 PIPING

- A. Sanitary Sewer Drain Piping:
 - 1. Underground Beyond Five Feet of Building: Piping shall be AWWA, Class 900 PVC, SDR-14 or SDR-18, blue finish with ANSI B16.5 flanges, AWWA C-110 ductile iron, double field wrapped with 2", 20 mil vinyl tape or ASTM D2466 PVC sockets.
 - 2. Wall Foundation Drain Line:
 - a. Type: ASTM F405 corrugated perforated polyethylene tubing and fittings, with fabric sleeve.
 - b. Manufacturer: Advanced Drainage Systems, Inc., (800) 742-1933, Type ADS "Drain Guard," or equal.
 - c. Piping: Non-perforated polyvinyl chloride pipe (PVC), ASTM D1785, PVC 1120-1220, Schedule 40, pipes and fittings.
- B. Domestic Water and Utility Water Main Piping:
 - 1. Class 52 ductile iron, ANSI A21.51, AWWA C1510-70, 150 psi, white cement lined, factory encased with 8 mil polyethylene tube or sheet. PVC pressure piping conforming to AWWA-C907 and CSA B137.
 - 2. Water line fittings shall be ductile iron, mechanical joint, 250 psi water pressure, conforming to ANSI Standard A21.10, mechanical joint or flanged. Fittings shall be double field wrap with 2", 20 mil vinyl tape, 50% overlap. PVC fittings conforming to AWWA-C907.
- C. Underground Gas Piping:
 - 1. Polyethylene, Grade 23, Type II, ASTM 2513, plain ends, heat fused joints, orange finish.

2.2 VALVES

- A. Refer to SECTION 22 21 13 - PLUMBING PIPING, VALVES AND SPECIALITIES for valves.
- B. All valves shall be designed for Class 150 pipe systems, and shall open by turning the stem counterclockwise.
 - 1. Buried Butterfly Valves: Valves shall be mechanical joint, rubber-seated butterfly valves conforming to AWWA Standard C504 Class 150B. Buried valves shall be equipped with a 2" square operating nut and shall be Henry Pratt Co. "Groundhog," BIF "Model 56," ITT Grinnell, or equal. Buried valves shall be bituminous coated and shall be provided with an extension stem equipped with a 2" square operating nut. Extension stem shall extend to within 18" of top of valve box.

2.3 TAPPING SLEEVE AND TAPPING VALVE

- A. Cast iron mechanical joint type sleeve, sized specifically for actual O.D. and piping material, Koppel, Mueller, or Clow.

2.4 VALVE BOXES

- A. Cast iron valve boxes for shutoff valves buried in ground shall be complete with bell bottoms, extension piece, top and cover. Boxes shall be suitable for the types of valves with which they are used. All valve boxes shall have a concrete collar flush with grade.
- B. Lids shall have the applicable letters embossed upon the top surface. Tagging shall match existing lids.
- C. Manufacturer: Tyler, ITT Grinnell, Mueller or Kennedy.

2.5 TRACER WIRE

- A. Provide #10 bare copper trace wire installed parallel to piping and attached to valves.

2.6 THRUST BLOCKS

- A. Provide 2,000 psi concrete thrust blocks at changes in pipe direction, changes in pipe sizes, dead-end stops and at valves.
- B. Calculate area of undisturbed earth of thrust block based on soils report 2000 psi and 150 psi water test pressure.
- C. Concrete and reinforcing steel shall be as specified in DIVISION 3 and DIVISION 5. All concrete shall be Class A, unless specified otherwise.
- D. Miscellaneous nuts and bolts shall be stainless steel.

2.7 RODS AND CLAMPS

- A. Socket clamps shall be stainless steel, four bolt type, equipped with stainless steel socket clamp washers and nuts Grinnell Fig. 595 and 594, Elcen Fig. 37 and 37X.
- B. Rods shall be stainless steel, $\frac{3}{4}$ " diameter.

2.8 TEST CONNECTIONS

- A. Saddles shall be of malleable or ductile iron, with neoprene gasket and $\frac{3}{4}$ " N.P.T. female pipe connection, Smith Blair No. 311, Rockwell International No. 331.
- B. Valves shall be $\frac{3}{4}$ " - 300# bronze globe with composition disc.

NOTE: When all tests have been completed, valve and pipe nipple shall be removed from the saddle and a forged steel pipe plug shall be inserted.

2.9 CLEANOUTS

- A. Cleanouts shall be Wade, Ancon, Smith or Zurn, extra heavy duty type with adjustable housing and vandal proof cover.
- B. Cleanouts shall be set in concrete pad, 18"x18"x8" deep.

2.10 CATCH BASIN

- A. CB-1 (SD System): 24" square x 30" deep, 10 gauge steel basin with 28" x 28" slotted grate, highway construction grade only, bicycle proof. Coat exterior twice with oil base bitumastic. Lynch or Santa Rosa.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Have on hand all installation manuals, brochures, and procedures for the equipment and materials concerned.
 - 1. Follow manufacturer's instructions, where such are provided, in all cases that cover points not shown on the Drawings or specified herein.
 - 2. Manufacturer's instructions do not take precedence over the Drawings and Specifications.
 - 3. Where manufacturer's instructions are in conflict with the Drawings and Specifications; submit the conflicting instructions to the Owner's Representative for clarification before performing the work.
 - 4. Use fittings to make all changes in direction and size unless otherwise shown on the Drawings.
 - 5. Maintain factory plastic end covers on the pipe during storage. Caps shall be removed upon installation of pipe to insure cleanliness.

3.2 TRENCH, EXCAVATION AND BACKFILL

- A. Conform to requirements of DIVISION 2.
- B. Install all utilities with a minimum 36" cover over the crown of the pipe.
- C. Provide all necessary shoring, sheeting, pumping as part of work of this division.
- D. Dig trenches straight, true to line and grade with bottoms smoothed of any rock points. Excavate 3" below grade of pipe, fittings, hubs, couplings, etc., using templates to fit outside periphery of lower third of piping.
- E. Excavations for trench may be by machine or by hand with special care used around buried utilities and trees shown on Contract Drawings.
- F. All excavations shall be carefully done to avoid "over-digging" and backfilling the bottom of trench before pipe is installed in the trench.
- G. Before placement of pipe, a sand bed shall be prepared in the following manner:
 - 1. Trench shall be backfilled with sand to a minimum depth of 6".
 - 2. Sand shall be compacted sufficiently to prevent settlement of pipe.
 - 3. Loose sand shall be removed at mechanical joints so that the barrel of the pipe will be firmly supported on compacted sand.
- H. Trench width and special instructions necessary to correctly install pipe and fittings shall be as recommended by the pipe manufacturer.

- I. Special preparation shall be taken to keep the inside of the piping clean of all debris, especially sand and dirt, during installation and testing. Maintain factory covers on open ends of pipe until lowered into trench.
- J. After testing and acceptance, the trench shall be backfilled with native backfill for the first 10" depth, then wetted and hand tamped, refilled with the native backfill to approximately 12" over top of pipe, wetted again and hand tamped firm. Mechanical tamping of rock-free soil shall be carefully done to achieve a minimum of 90% compaction at depth of 12" and below, and to 95% for top 12" depth.
- K. Provide precast monument set flush with surface in paved area to locate branch connection.

3.3 CONCRETE

- A. Conform to requirements of DIVISION 3.
- B. Install thrust blocks and anchors as per manufacturer's recommendations.
- C. Provide concrete thrust blocks for piping. Concrete thrust blocks shall be poured and set before pressure testing.
- D. Concrete thrust blocks shall be installed at all fittings and at all changes of direction whether shown on drawing or not.
- E. Thrust blocks shall be formed on the sides to establish a definite shape and limit on height and width subject to approval before ordering concrete. Make-shift and ill-fitting forms will not be accepted. Forms shall be removed before backfilling.
- F. Thrust blocks shall be allowed to cure a minimum of 3 days before water pressure is applied to any part of the system and before forms are removed.

3.4 CONDUIT AND CABLES

- A. Conform to requirements of DIVISION 26.

3.5 WELDED PIPING

- A. Conform to welding procedures per recommendations of American Welding Society.

3.6 WALL DRAIN LINE

- A. Do not install prior to acceptance of wall work and waterproofing under another section.
- B. Drainage Pipe: Install and connect drain line, as per Drawings.
- C. Drainage Fabric: Install continuously along wall where soil is retained, per manufacturer's Specifications.

3.7 UNDERGROUND PIPING INSTALLATION

- A. Lay piping on a bed of the specified sand, at least 6" thick, or firm undisturbed earth. Remove loose rock, clods, and debris from the trench before placing bedding sand, and before laying any pipe.
 - 1. The pipe shall be made up with the pipe barrel bearing evenly along its full length on the sand bed on the bottom of the trench.
 - 2. In the case of steel or other rigid joint piping, excavate holes under joints and connections for access for making up, welding, testing, and wrapping joints.

- B. Thoroughly cleanout each section of pipe and fitting before lowering into the trench. Clean each pipe or fitting by swabbing-out, brushing-out, blowing-out with compressed air, washing-out with water, or by any combination of these methods necessary to remove all foreign matter.
- C. If cleaned pipe sections and fittings cannot be placed in the trench without getting dirt into the open ends, tie tightly woven canvas or other type of approved cover over the ends of the pipes and fittings until they have been lowered into position in the trench. After removal of the covers in the trench, completely remove foreign matter from the pipe ends and fittings.
- D. Do not lower any pipe or fitting into a trench that contains water.
 - 1. Pump water from wet trenches, and keep the trenches dry until the joints have been completed and the open ends of the pipes have been closed with watertight plugs or bulkheads.
 - 2. Whenever pipe laying is discontinued on any job for short periods or whenever work is stopped at the end of the day, close the open ends of the pipe with watertight plugs or bulkheads. Do not remove the plug or bulkhead unless the trench is dry.
 - 3. Keep the trench dry at all times.
- E. Assemble lengths of PVC that are joined by couplings, Tyton type push-on joints, Ring-Tite or Fluid-Tite, or equal, such that centerline of two pipes being joined do not form an angle exceeding 2° in any plane. In addition, the angle formed in the vertical plane shall not exceed 1½°.

3.8 CONNECTIONS TO EXISTING UTILITY MAINS

- A. Under no circumstances shall existing lines or utilities be interrupted without prior approval of the Owner's Representative. Submit the request for this approval to the Owner's Representative in accordance with DIVISION 1, and also state the maximum duration of shutdown.
- B. Schedule all outages for utility tie-in work well in advance, and give written notice to the Owner's Representative in accordance with DIVISION 1.
- C. In preparation for tie-ins to the utility systems, the Owner will drain and/or blow the existing piping prior to start of tie-in work by the Contractor. In all cases, the Owner will close the appropriate valves to isolate the area of work. The Contractor shall be responsible for refilling the system.

3.9 FLUSHING

- A. The entire new piping system shall be thoroughly flushed out until reasonably clean in the opinion of the Owner's Representative.
- B. All tests shall be conducted at such times as directed by and in the presence of the Owner's Representative.

3.10 PIPE TESTING

- A. Sanitary sewer piping shall be tested under minimum 15 feet hydrostatic head for 4 hours and proven watertight.
- B. Domestic water piping shall be hydrostatically tested under 150 psig pressure for four hours and proven watertight. Provide all instruments, facilities, and labor to conduct testing and placing in operation.
- C. Piping shall be tested in whole or in sections. Testing under this section of the work shall be done before final connections to building piping and existing utility piping is made, with the provision that

subsequent leaks, if developed, at these conditions shall be corrected under this section of the work.

- D. Any part of any piping system, including all accessories, that shows failure during testing shall immediately be repaired or replaced with new materials. The system shall be completely retested after repair or replacement. This procedure shall be repeated, if necessary, until all parts of all systems withstand the specified tests. All retesting costs shall be part of the Contract.
- E. Tests shall be witnessed by the Owner's Representative; at least 48 hours notice of tests shall be given.

3.11 CLOSING OF UNINSPECTED WORK

- A. No work shall be covered up or enclosed until the opportunity to inspect and test same has been afforded to the Owner's Representative and the Owner's Representative has authorized the Contractor to cover or enclose the work.
- B. Any work enclosed or covered in the absence of the Owner's Representative's authorization shall be uncovered. All expense to comply shall be borne by the Contractor.

END SECTION 22 05 04

SECTION 22 05 33 HEAT TRACING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Furnish and install a complete UL listed system of heaters, components, and controls to prevent pipe lines from freezing including:
 - 1. Chemical supply and return piping.
 - 2. All other piping lines exposed to freezing.
 - 3. Exterior domestic water piping.
 - 4. All miscellaneous drain and air bleed lines, etc. that are associated with the above piping systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 22 05 00 - BASIC MATERIALS AND METHODS
- B. SECTION 22 07 00 - PLUMBING INSULATION
- C. SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
- D. SECTION 26 27 26 - WIRING DEVICES

1.3 QUALITY ASSURANCE

- A. The manufacturer shall have over three years experience with self-regulating heating cables in the domestic hot water temperature maintenance application and be regularly engaged in the production of such equipment and be capable of providing complete catalog information on such products.
- B. The heating cable and components must have a UL System Listing. The UL Listing must have been in effect for three years at the time of quote submission.
- C. The heating cable and components must be Factory Mutual approved for installation in applications as shown in the construction documents.
- D. The heating cable and components must comply with ANSI Standard 515 "Recommended Practice for the Testing, Design, Installation, and Maintenance of Electrical Resistance Heat Tracing for Industrial Applications".

1.4 SUBMITTALS

- A. Prior to construction submit for approval all materials and equipment. Submit manufacturer's data, installation instructions, and maintenance and operating instructions for all components of this section including, but not limited to, the following:
 - 1. Catalog cut of all proposed components, including but not limited to
 - a. Heat Trace Controller
 - b. Heat Trace Cable.
 - c. Power Connections.
 - d. Splice Connections.

- e. Tee Connections.
- f. Lighted End Seals.
- 2. Installation manual for each component.
- 3. Shop drawing of proposed installation showing number of heat trace circuits, watts/foot cable type for each circuit and components used.
- 4. Forms for factory recommended Electrical Testing and Commissioning Documentation for the system.
- 5. Spare Parts List.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site. Deliver products to the site in containers with manufacturer's stamp or label affixed.
- B. Store/protect products safely. Protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products - remove from project site.

1.6 WARRANTY

- A. Provide one year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

1.7 DIVISION OF RESPONSIBILITY

- A. DIVISION 22: The Plumbing Contractor shall purchase all heat trace components as noted herein to provide a complete system. Heat trace cabling, associated fittings and accessories and heat trace signage shall be installed as part of the mechanical contractor's scope of work including hiring an electrical contractor if the installation of the cabling needs to be performed by electricians. The mechanical contractor shall be responsible to perform all coordination with the electrical contractor in terms of scheduling, installation of equipment, etc.
- B. DIVISION 26: Above ground and underground branch circuit wiring to the heat trace power connection J-boxes from the heat trace controller/contactor panel(s) and incoming power to the controllers/contactors shall be installed and connected by DIVISION 26. All testing and commissioning shall be done by DIVISION 26.

PART 2 - PRODUCTS

2.1 ELECTRIC HEAT TRACING SYSTEM

- A. Cable: The self-regulating heater shall consist of two (2) 16 AWG nickel coated, copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed over itself without over-heating and to be cut to length in the field. To provide a good ground path where none exists and to enhance the heater's ruggedness, the heater shall have an outer braid of tinned copper and an outer jacket of modified polyolefin.
- B. Self-regulating: In order to provide energy conservation and to prevent overheating, the heater shall have a self-regulating factor of at least 90%. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heater output going from 40° F pipe temperature operation to 150° F pipe temperature operation.

- C. Single or dual circuit heat-trace controllers, quantity as required for the length of heat trace cable required.\

2.2 WATTAGE/VOLTAGE

- A. The heater cable shall operate on line voltage of 120, 208, 220, 240, or 277 volts without the use of transformers. See floor plan and schedules for voltage.
- B. The heater cable shall be installed according to the table below. The required heater output rating is in watts per foot at 50° F. Heater selection based on 1.5" fiberglass insulation on metal piping. Increase to next size wattage rating if less insulation is shown to be required or 208V is used due to its required derating from its base rating of 240V.

PIPE SIZE	MIN. AMBIENT -10°F	TEMPERATURES -20°F
3" or less	5 watt	5 watt
4"	5 watt	8 watt

- C. The maximum heater cable lengths per circuit breaker, size noted, shall be installed according to the table below: If a required heat trace cable circuit length exceeds the values below then divide the cable length into equal parts. Inform electrical contractor the required number of output circuits/ connection points. This chart is based on Raychem BTV cable.

Cable	Breaker Size	Start up Temp	Voltage	Max Length per Breaker
5BTV	30A	0°F	208, 2 pole	495'

2.3 GROUND FAULT EQUIPMENT PROTECTION

- A. Where individual heat trace circuits are shown not connected to a control panel that includes 30mA ground fault circuit breakers (GFEPD) AND if not shown in the DIVISION 26 panel schedules or if other sizes are required, then provide as part of this DIVISION 23 scope of work.
- B. Heat trace controllers have integral ground fault protection.

2.4 MANUFACTURER

- A. The heat tracing system shall be manufactured by Raychem Corporation only: provide the above-insulation installed components as listed below:
 - 1. Ordinary Area Location Electrical Components:
 - a. Heat Trace Controller: DigiTrace 910 controller in an 8" x 10" FRP enclosure with window. 2-pole 30 A EMR. Controls a single circuit with a 2-pole electromechanical relay.
 - b. Heat Race Controller: Where two circuits are required provide DigitTrace 920 with same specs as above unit.
 - c. Power connection kit with J-box and LED light end seals: Rayclic-P Series, if two cables are required than use the dual exit fitting. RayClic-LE – lighted end seal
 - d. Industrial Heating Cable: Tyco Raychem BTV-C-CR or equal by Nelson
 - e. Commercial Heating Cable: Tyco Raychem XL-Trace-CR or equal by Nelson
 - f. Fiberglass installation tape: GT-66 for installation above 40° F.

- g. Aluminum tape for use on plastic piping.
- B. Signage:
 - 1. Heat Traced signs: Industry standard, self-sticking type with white letters "HEAT TRACED", on a green background. Brady #B-946. Call Hanson Supply Company.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cable Installation:
 - 1. Apply the heater linearly on the pipe after piping has been successfully pressure tested. Do not spiral wrap except at valves and heat sinks. Installation shall be as detailed in the manufacturer's installation instructions.
 - 2. Secure the heater to piping with fiberglass tape at one foot intervals per the detail on the drawings. Do NOT use metal attachments, tie wire, or hose clamps to secure cable to the pipe. Verify correct fiberglass tape selection based on ambient temperatures.
 - 3. Lighted End Seal: Mount J-box at the free end of every heating cable.
 - 4. Cable Slack: When determining length of heating cable make allowances for extra cable around heat sinks such as supports and valves and for service loops at connections. Leave 18 inches of heating cable at the power connection, at all sides of splices and tees, and at the end seal to provide for service loops; except on pipes smaller than 1 inch, where 9 inches shall be provided.
 - 5. Sealing: Seal all joints with sealing compound. All places where valves stems, conduits, connection enclosures, and other components that penetrate through the insulation jacketing must be sealed with a suitable sealing compound to keep water out. Ensure that the edges of these clearance holes and cable transitions do not rub on the cable and cause mechanical damage.
- B. Electrical Connections:
 - 1. The mechanical contractor shall use the following table to determine the required amount of heat trace cabling required.
 - 2. Re-use of a grommet, or use of the wrong grommet, can cause leaks, cracked components, shock or fire. Use a new grommet whenever the cable has been pulled out of the termination. Verify that the proper grommets are used by checking the installation instructions supplied with the connection kit being installed. Connection kits should be mounted on top of the pipe when practical.
 - 3. Electrical branch circuit conduit leading to power connection kits must be sloped away from kit to avoid condensation entry into the heating system. Use one single entry kit per circuit. Install conduit drain on branch circuit conduit.
 - 4. Heat Trace controller RTD Sensor has a 10'-0" lead length, its location of sensor is greater than 10'-0" away from the controller than provide a 3-conductor, #16 AWG, shielded cable in EMT conduit to extend the sensor wiring.

5. All hot and neutral conductors downstream of controller serving heat trace cabling shall use cross-linked polyethylene insulated copper conductors with dielectric constant of 3 one-way circuit length exceeds 50'; 600V type XLP typical. This is to limit ground fault leakage.
 6. Mount controller RTD temperature sensor outside on wall in the shade of the overhang in the location shown.
- C. Signage: Apply "HEAT TRACED" signs to the outside of the thermal insulation on alternate side every 10 feet and at all changes in direction. Use 2" high letters on pipes greater than 3" outside diameter including insulation. Use 3/4" high letters on pipes smaller than 2 ½" outside diameter.

3.2 TESTING AND COMMISSIONING

- A. Before cable installation (on roll), after cable installation and again after the installation of the thermal insulation, subject heat trace cable to testing using three voltages – 500, 1000 and 2500 VDC megger as discussed in ANSI IEEE Standard 141. A clean dry, properly installed circuit should measure thousands of megohms, regardless of the heating cable length or measuring voltage (0-2500VDC). The following criteria are provided to assist in determining the acceptability of an installation where optimum conditions may apply:
1. All insulation resistance values should be greater than 1000 megohms.
 2. Insulation resistance values should not vary more than 25 percent as a function of measuring voltage for Test A and Test B.
- B. DIVISION 26 shall test for both heating cable bus wires to verify the connection of any splices of tees.
- C. Document all tests on Engineer provided test forms, if provided or manufacturer's forms if not provided. Completed forms shall be submitted to Engineer after initial installation test is complete and after final testing. All forms shall be included in the Operation & Maintenance (O&M) manuals.

3.3 INSPECTIONS

- A. The Mechanical and Electrical Contractor are responsible to notify the Electrical Engineer one week prior to installation of insulation in order to inspect the system. At the time of the inspection the electrical contractor shall have written documentation of the megger tests on the Engineer provided forms. Ladders, man lifts or scaffolding shall be provided by the mechanical contractor to allow for inspection of all heat tracing components.
- B. The Mechanical Contractor is responsible to notify the electrical engineer as soon as possible after installation of insulation and sealing of all joints is 100% complete in order to inspect the system. Ladders, man lifts or scaffolding shall be provided by the mechanical contractor to allow for inspection of all heat tracing components.

3.4 COORDINATION

- A. Mechanical Contractor is responsible to coordinate installation of heat tracing with Electrical Contractor and all subcontractors.

END SECTION 22 05 33

TESTING AND COMMISSIONING INSPECTION RECORD
 COPY AND FILL OUT THIS FORM FOR EACH HEAT TRACE CABLE CIRCUIT

CIRCUIT NUMBER:	
HEATING CABLE TYPE:	
CIRCUIT LENGTH:	

Inspection date:					
Visual inspection inside connection boxes for signs of overheating, corrosion, moisture, loose connections, and other problems.*					
Proper electrical connection, ground, and bus wires insulated over full length.*					
Damaged or wet thermal insulation; damaged, missing, or cracked lagging or weatherproofing; gaps in caulking.					
End seal, covered splices, and tees properly labeled on insulation cladding.*					
Thermostats checked for moisture, corrosion, set point, switch operation, capillary damage, and protection.					
Megohmmeter test Ohms					
Test A 500 V					
1000 V					
2500 V					
Test B* 500 V					
1000 V					
2500 V					
Power check					
Circuit voltage Panel					
Circuit end*					
Circuit amps after 10 min.					
Pipe temperature (°F)					
Power = Volts x amps/ft					

* Commissioning testing only.

SECTION 22 07 00 PLUMBING INSULATION

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, and SECTION 22 05 00 - BASIC MATERIALS AND METHODS, and other Sections in DIVISION 22 specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this Section shall include, but not necessarily be limited to, providing insulation for the following:
1. Piping Services:
 - a. Domestic hot water supply and return.
 - b. Domestic cold water, unless otherwise noted on drawings.
 - c. Irrigation water, unless otherwise noted on drawings.
 - d. Drains from electric water coolers to first connection.
 - e. Cooling coil condensate drainage.
 - f. All heat traced piping.
 - g. All valves and fittings for systems listed above.
 2. Types of plumbing piping insulation specified in this Section include the following:
 - a. Pipe insulation: Fiberglass.
 - b. Pipe insulation: Flexible elastomeric closed cell foam.
 3. Insulation jackets:
 - a. Interior application
 - b. Exterior application
 - c. Removable covers
 4. Types of plumbing equipment insulation specified in this Section include the following :
 - a. Equipment insulation: Fiberglass blanket
 - b. Equipment insulation: Fiberglass board
 - c. Equipment insulation: Cellular glass.
 - d. Equipment insulation: Flexible elastomeric closed cell foam.
 5. Insulation accessories.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 22 05 00 - BASIC MATERIALS AND METHODS.
B. SECTION 22 05 01 - PLUMBING.

1.4 DEFINITIONS

- A. Ambient: The air temperature to be maintained in a conditioned room. Typically between 70°F and 78°F.
- B. Insert: Spacer placed between the pipe support system and the piping to allow for the space required for insulation.
- C. Insulation Group (IG): Definition of Insulation Materials and Operating Temperatures.
- D. Insulation Shield: Buffer material placed between the pipe support system and the insulation to prevent the insulation material from crushing.
- E. Jacket: Protective covering over the pipe insulation; may be factory applied such as “all service jacket” or field applied to provide additional protection; of such materials as canvas, PVC, aluminum or stainless steel.
- F. Piping Insulation: Thermal insulation applied to prevent heat transmission to or from a piping system.
- G. Vapor Barrier Jacket: Insulation jacket material that impedes the transmission of water vapor.
- H. Freezing Climate: Where outdoor design temperature is less than 33° F, as stated in ASHRAE fundamentals under 99% column for winter design conditions.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Provide products conforming to the requirements of the following:
 - 1. American Society for Testing and Materials (ASTM): Manufacture and test insulation in accordance with the ASTM Standards, including:
 - a. B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - b. C165 - Recommended Practice for Measuring Compressive Properties of Thermal Insulation.
 - c. C167 - Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.
 - d. C177 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission.
 - e. Properties by Means of the Guarded-Hot-Plate Apparatus.
 - f. C195 - Specification for Mineral Fiber Thermal Insulating Cement.
 - g. C196 - Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement.
 - h. C302 - Test Method for Density of Preformed Pipe-Covering-Type Thermal Insulation.
 - i. C303 - Test Method for Density of Preformed Block-Type Thermal Insulation.
 - j. C305 - Test for Thermal Conductivity of Pipe Insulation.
 - k. C356 - Test for Linear Shrinkage of Preformed High-Temperature Thermal Insulation.
 - l. C411 - Test for Hot-Surface Performance of High Temperature Thermal Insulation.
 - m. C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

- n. C449 - Specification of Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - o. C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - p. C533 - Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - q. C534 - Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - r. C547 - Specification for Mineral Fiber Preformed Pipe Insulation.
 - s. C552 - Specification for Cellular Glass Block and Pipe Thermal Insulation.
 - t. C553 - Specification for Mineral Fiber Blanket-Type Pipe Insulation (Industrial Type).
 - u. C592 - Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered).
 - v. C612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
 - w. C916 - Standard Specification for Adhesives for Duct Thermal Insulation.
 - x. C921 - Practice for Determining Properties of Jacketing Materials for Thermal Insulation.
 - y. C1104 - Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
 - z. C1071 - Standard Specification for Thermal and Acoustical Insulation.
 - aa. C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings..
 - bb. E84 - Test Method for Surface Burning Characteristics of Building Materials.
 - cc. E119 - Test for Fire Resistance.
 - dd. G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
 - ee. G22 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria.
2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Provide and install pipe and duct insulation in accordance with the following ASHRAE Standard:
 - a. 90 Energy Conservation in New Building Design.
 3. National Fire Protection Association (NFPA): Manufacture insulation in accordance with the following NFPA standards:
 - a. 255 Test Methods, Surface Burning Characteristics of Building Materials.
- B. Do not provide materials with flame proofing treatments subject to deterioration due to the effects of moisture or high humidity.

- C. Products Containing Prohibited Chemicals:
1. Products containing the following prohibited chemicals for use as flame retardants or for other purposes will not be acceptable:
 - a. Pentabrominated diphenyl ether (CAS#32534-81-9)
 - b. Octabrominated diphenyl ether (CAS#32536-52-0)
 - c. Decabrominated diphenyl ether (CAS#1163-19-50)
- D. Flame/Smoke Rating: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) Method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories, Inc., label or listing; or satisfactory certified test report from an approved testing laboratory to prove the fire hazard ratings for materials proposed for use do not exceed those specified.
- E. Corrosiveness: Provide insulation such that when tested in accordance with the following test, the steel plate in contact with the insulation shows no greater corrosion than sterile cotton in contact with a steel plate for comparison.
1. Test Specimen: Two specimens shall be used, each measuring 1" by 4" by approximately ½" thick.
 2. Apparatus: Provide a humidity test chamber in which two polished-steel test plates, 1" wide, 4" long and 0.020" thick, shall be placed. Plates shall be clear finish, cold-rolled strip steel, American quality, quarter hard, temper No. 3, weighing 0.85 lb/sq. ft.
 3. Procedure: The steel test plates shall be rinsed with cp benzol until their surfaces are free from oil and grease and allowed to dry. One piece of cold-rolled steel shall be placed between the two insulation specimens and secured with tape or twine. The test specimen and uncovered plate shall be suspended vertically in an atmosphere having a relative humidity of 95% (plus or minus 3%), and a temperature of 120°F (plus or minus 3°F), for 96 hours, and then be examined for corrosion.
- F. Insulation thickness shall be the greater standard of that specified here or the State energy conservation requirements.

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation. Also furnish necessary test data certified by an independent testing laboratory. Submit samples.
- B. Provide a statement with the submittal indicating that no product submitted contains an amount equal to or greater than 0.10% by mass of the following chemicals:
1. Pentabrominated diphenyl ether (CAS#32534-81-9)
 2. Octabrominated diphenyl ether (CAS#32536-52-0)
 3. Decabrominated diphenyl ether (CAS#1163-19-50)
- C. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product in maintenance manual.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coating to the site in containers with manufacturer's stamp or label affixed showing fire hazard indexes of products.
- B. Store and protect insulation against dirt, water, chemical, and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Johns Manville, Owens-Corning, Knauf, Armstrong, Pittsburgh-Corning, Trymer, IIG, Certainteed, Halstead, Rubatex, 3M FireMaster, Pabco, Reflectix, or approved equal. Manufacturer and insulation types listed below indicate a minimum acceptable level of quality required for each classification.

2.2 PIPE INSULATIONS

- A. Type PI-A: Glass Fiber: Molded fibrous glass pipe insulation shall comply with the requirements of ASTM C 547 and meet ASTM C 585 for sizes required in the particular system. For all fluid distribution temperatures below 45°F the system shall be of a wicking type.
 - 1. Fiberglass, Non-Wicking:
 - a. Manufacturers:
 - i. Johns Manville Micro-Lok HP meeting ASTM C547; or FSK faced Micro-Flex (pipe sizes larger than 18")
 - ii. Knauf
 - iii. einsulation
 - b. Applications: Insulation of piping up to 18" in diameter and 3" thick insulation.
 - c. 'K' Value: 0.23 at 75°F.
 - d. Maximum Service Temperature: 850°F.
 - e. Vapor Retarder Jacket: AP-T PLUS white kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or AP jacket with outward clinch expanding staples or vapor barrier mastic as needed.
- B. Type PI-B: Flexible Elastomeric Closed Cell Thermal Insulation: Armacel AP Armaflex, Rubatex K-Flex ECO, Aeroflex Aerocel, closed-cell, halogen free, elastomeric insulation. Comply with ASTM-C177, ASTM E 84 and UL 181.
 - 1. 'K' Value: 0.27 at 75°F.
 - 2. Density: 3.0 to 6.0 lbs./cu.ft.
 - 3. Maximum Service Temperature: 260°F.
 - 4. Seal all seams and joints with contact adhesive.
- C. Type PI-C: Cellular Glass- Pittsburgh-Corning Foamglas Meeting ASTM C522: Cellular Glass Thermal Insulation:
 - 1. 'K' Value: 0.35 at 75°F.

2. Density: 8.0 lbs./cu. ft.
 3. Maximum Service Temperature: 900°F.
 4. Provide with Pittsburg Corning Pittwrap jacketing.
- D. Field Applied Jackets (For Interior Applications):
1. All longitudinal seams shall be located on bottom of pipes.
 2. PVC Plastic: Johns Manville Zeston 2000. One piece molded type fitting covers and jacketing material, gloss white. Connect with tacks and pressure sensitive color matching vinyl tape.
 3. Canvas Jacket: UL listed fabric, 6 oz/sq. yd. plain weave cotton, treated with dilute fire retardant lagging adhesive.
 4. Aluminum Jacket: 0.016" thick sheet, smooth finish, with longitudinal slip joints and 2" laps, die shaped fitting covers with factory attached protective liner.
 5. Secure aluminum jackets with 3/8" or 1/2" stainless steel bands on 12" centers.
- E. Field Applied Jackets (For Exterior Applications):
1. All longitudinal seams, on horizontal pipe runs, shall be installed on the bottom of pipes.
 2. Aluminum Jacket: 0.016" (minimum) thick sheet, smooth finish, with longitudinal slip joints and 2" laps, die shaped fitting covers with factory attached protective liner.
 3. Stainless Steel Jacket: Type 304 stainless steel, 0.010" minimum (smooth/corrugated) finish.
 4. Secure stainless steel or aluminum jackets with 3/8" or 1/2" stainless steel bands on 12" centers.
 5. Manufacturers: Pabco, Childers, RPR, or approved equal.
- F. Removable Covers:
1. Provide removable covers on pumps, backflow devices, valves greater than 2", flanges, strainers, etc., where periodic maintenance or removal of insulation may is required.
 2. Use of pre-molded fittings with PVC covers is acceptable, unless noted otherwise.
 - a. Cold systems: Provide PVC covers on elbows.
 - b. Cold systems: Provide Armaflex elastomeric foam for flanges, valves, pumps and strainers.
 - c. Hot systems: provide PVC covers on elbows and flanges.
 - d. Hot Systems: provide removable blanket covers on valves, pumps, and strainers.
 3. Removable- type silicon cloth fiberglass filled insulating blankets:
 - a. Mfg: Fit Tight Covers, GLT products, or equal custom fabrication by Insulation Contractor, 0-350°F service operating temperature:
 - i. Jacket: silicon impregnated fiberglass cloth
 - ii. Liner: silicon impregnated fiberglass cloth
 - iii. Liner reinforcement : sstl mesh cloth
 - iv. Insulation: 1" type E glass matt

- v. Fastening: 2" nomex Velcro
- vi. Fastening: 1" straps and stainless steel D-rings
- vii. Fastening: 12 gage stainless steel hooks and stainless steel wire
- viii. Thread: Kevlar/stainless steel thread

2.3 EQUIPMENT INSULATIONS

- A. Type EI-A: Flexible Fiberglass Blanket: Johns Manville Microlite Type 75 Flexible Blanket:
 - 1. 'K' Value: ASTM C518, 0.27 Btu•in./(hr•ft²•°F) at 75°F installed full thickness.
 - 2. Maximum Service Temperature: 250°F.
 - 3. Density: 0.75 lb/cu ft.
 - 4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.
- B. Type EI-B: Rigid Fiberglass Board: Johns Manville Spin-Glass 814:
 - 1. 'K' Value: ASTM C518, 0.23 Btu•in./(hr•ft²•°F) at 75°F.
 - 2. Maximum Service Temperature: 250°F.
 - 3. Density: 3.0 lb/cu ft.
 - 4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.
 - 5. Facing: 1" galvanized hexagonal wire mesh stitched on one face of insulation. (Optional.)
- C. Type EI-C: Cellular Glass: Pittsburgh-Corning Foamglas Meeting ASTM C552; Cellular Glass Thermal Insulation:
 - 1. 'K' Value: 0.35 at 75°F.
 - 2. Density: 8.0 lb/cu. ft.
 - 3. Maximum Service Temperature: 900°F.
- D. Type EI-D: Flexible Elastomeric Closed Cell Thermal Insulation: Armacel AP Armaflex, Rubatex K-Flex ECO, Aeroflex Aerocel, closed-cell, halogen free, elastomeric insulation. Comply with ASTM-C177, ASTM E 84 and UL 181.
 - 1. 'K' Value: 0.27 at 75°F.
 - 2. Density: 3.0 to 6.0 lbs./cu.ft.
 - 3. Maximum Service Temperature: 260°F.
 - 4. Seal all seams and joints with contact adhesive.
- E. Type EI-E: Hydrous Calcium Silicate Johns Manville, IIG Thermo-12/Gold Meeting ASTM C533; Rigid Molded Block; Asbestos-Free Coded Throughout Material Thickness and Maintained Throughout Temperature Range:
 - 1. 'K' Value: 0.40 at 300°F.

2. Maximum Service Temperature: 1,200°F.
3. Compressive Strength (block): Minimum of 200 psi to produce 5% compression, based on 1½" thickness.
4. Securement: Insulation shall be securely banded in place, tightly butted, joints staggered and secured with 16 gauge galvanized or stainless steel wire or ½" x .015" galvanized steel bands on 12" maximum centers for large areas.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that piping has been tested for leakage in accordance with specifications before applying insulation materials. All piping shall be inspected by Owner's Representative prior to installation of insulation. Any insulation applied prior to inspection shall be removed and new insulation applied at no additional cost to Owner. Notify Owner's Representative five (5) working days prior to insulation installation.
- B. Verify that all surfaces are clean, dry and free of foreign material.

3.2 INSTALLATION

- A. General:
 1. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
 2. Remove and replace any insulation that has become wet or damaged during the construction process.
 3. Continue insulation and vapor barrier at penetrations and supports, except where prohibited by code.
- B. Piping Insulation:
 1. Locate insulation and cover seams in least visible locations unless otherwise specified.
 2. Neatly finish insulation at supports, protrusions, and interruptions.
 3. Provide insulated dual temperature pipes and cold pipes conveying fluids below ambient temperature with vapor retardant jackets with self-sealing laps. Insulate complete system. No staples shall be used on pipes conveying fluids below ambient temperatures (cold systems).
 4. For insulated pipes conveying fluids above ambient temperature, secure jackets with self-sealing lap or outward clinched, expanded staples. Seal ends of insulation at equipment, flanges, and unions.
 5. Provide insert between support shield and piping on piping 1½" diameter or larger. Fabricate of Johns Manville Thermo-12, or other heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths:
 - a. 1½" to 2½" pipe size 10" long
 - b. 3" to 6" pipe size 12" long
 - c. 8" to 10" pipe size 16" long
 - d. 12" and over 22" long

6. Use of metal saddles is acceptable as specified in SECTION 22 05 00 - BASIC MATERIALS AND METHODS. Fill interior voids with segments of insulation matching adjoining pipe insulation.
 7. Use of pipe hangers designed as an insulation coupling is acceptable in lieu of saddles and other devices. Klo-Shure coupling or equal.
 8. For pipe exposed in mechanical equipment rooms or in finished spaces below 7 feet above finished floor, finish with Johns Manville Zeston 2000 PVC jacket and fitting covers.
 9. Where pumps, valves, strainers, etc., with insulation require periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.
 10. Cold systems: Provide Armaflex elastomeric foam for pumps and strainers.
 11. For exterior applications:
 - a. Provide weather protection jacket. Insulated pipe lengths, pumps, fittings, joints, and valves shall be covered with aluminum jacket or stainless steel jacket. Jacket seams shall be located on bottom side of horizontal piping. All lateral joints shall be caulked with a minimum 20-year silicone sealant (clear). All longitudinal joints, except those at the bottom of a horizontal pipe run, shall be caulked with a minimum 20-year silicone sealant (clear).
 - b. Apply weather-resistant protective finish such as WB Armaflex to flexible elastomeric insulation. Insulation seams shall be located on the bottom side of horizontal piping. All lateral and longitudinal joints to be sealed with low V.O.C., UV inhibitive adhesive, such as Armaflex 520 BLV adhesive.
 12. For underground installations, install per manufacturer's written instructions and recommendations.
 13. When maintenance or service access for equipment will result in foot traffic over floor mounted insulated piping the contractor is to fabricate a permanent removable walkway to prevent damage to the piping and insulation.
- C. Equipment Insulation:
1. See Piping Insulation above for additional requirements.
 2. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands, per manufacturer's recommendations.
 3. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retardant cement.
 4. Provide insulated dual temperature equipment or cold equipment containing fluids below ambient temperature with vapor retardant jackets.
 5. For insulated equipment containing fluids above ambient temperature, provide jacket with or without vapor barrier.
 6. Cover insulation with metal mesh and finish with heavy coat of insulating cement, mastic, or aluminum jacket as indicated in the drawings.

7. For equipment in mechanical equipment rooms or in finished spaces, finish with Johns Manville Zeston 2000 jacketing and fitting covers or aluminum or stainless steel jacketing.
8. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.
9. When equipment with insulation requires periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage. Use of lace-on type insulation blankets is acceptable.

3.3 PIPING INSULATION SCHEDULE

- A. All insulation thicknesses shall meet or exceed State Energy Code requirements as noted below. Increase thickness ½" if exposed to exterior ambient air. Minimum thermal resistance in range of 4.2 to 4.6 per inch of thickness. Insulation thicknesses are based on fiberglass insulation and may be adjusted for equivalent insulation values for materials with superior "K" factors.
- B. Insulation

SERVICE	PIPE SIZE (inches)	THICKNESS (inches)	REMARKS/MATERIAL OPTIONS
Domestic water	Up to 2 2 ½ and over	1 1-½	Type PI-A,B
Domestic hot water return	All Sizes	1	Type PI-A,B
Domestic cold water	All Sizes	1	Type PI-A,B
Heat-Traced liquid containing piping exposed to freezing	All Sizes	1-½	Type PI-A,B. Provide aluminum jacket and label "heat traced" along with service designator label
Plumbing vents within 10 feet of the exterior in freezing climates	All Sizes	1	Type PI-A,B
Misc. drains from electric water coolers, ice machines, etc.	All Sizes	1	Type PI-A,B
Cooling coil condensate drain pipes	All Sizes	1/2	Type BI-B
PEX domestic hot and cold water	All Sizes	1/2	Type PI-A,B. To meet ASTM E-84, required only where PEX tubing is installed exposed in a ceiling air plenum and tubes are within 18" of another tube.

C. TABLE 2: CODE MINIMUM PIPING INSULATION THICKNESS BASED ON FLUID TEMPERATURE AND PIPING SIZE.

1. California

Insulation Based on California T-24 Energy Code Table 123-A Minimum Pipe Insulation Thicknesses or Greater								
FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)					
			Runouts up to 2	1 and less	1-1/4-2	2-1/2-4	5-6	8 and larger
			INSULATION THICKNESS REQUIRED (in inches)					
Space heating systems (steam, steam condensate and hot water)								
Above 350	0.32-0.34	250	1.5	2.5	2.5	3.0	3.5	3.5
251-350	0.29-0.31	200	1.5	2.0	2.0	2.5	3.5	3.5
201-250	0.27-0.30	150	1.0	1.5	1.5	2.0	2.0	3.5
141-200	0.25-0.29	125	1.0	1.5	1.5	1.5	1.5	1.5
105-140	0.24-0.28	100	1.0	1.0	1.0	1.0	1.5	1.5
Service water-heating systems (recirculating sections, all piping in electric trace tape systems, and the first 8 feet of piping from the storage tank for nonrecirculating systems)								
Above 105	0.24-0.28	100	1.0	1.0	1.0	1.5	1.5	1.5
Space cooling systems (chilled water, refrigerant and brine)								
40-60	0.23-0.27	75	1.0	1.0	1.0	1.0	1.0	1.0
Below 40	0.23-0.27	75	1.0	1.0	1.5	1.5	1.5	1.5

END SECTION 22 07 00

SECTION 22 11 23 PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, and SECTION 22 05 00 - BASIC MATERIALS AND METHODS, and other Sections in DIVISION 22 specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this section shall include but not necessarily be limited to the following:
 - 1. Water heaters
 - 2. Expansion Tank
 - 3. Lint Trap
 - 4. Water meters

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 22 05 00 - BASIC MATERIALS AND METHODS
- B. SECTION 22 05 01 - PLUMBING
- C. SECTION 22 40 00 -PLUMBING FIXTURES
- D. SECTION 22 21 23 - PUMPS AND SPECIALTIES

1.4 SUBMITTALS

- A. Prior to construction submit for approval all materials and equipment in accordance with DIVISION 1. Submit manufacturer's data, colors, installation instructions, and maintenance and operating instructions for all components of this section including, but not limited to, the following:
 - 1. Water heaters
 - 2. Expansion Tank
 - 3. Lint Trap
 - 4. Water meters
 - 5. Electrical Work: Refer to DIVISION 22, SECTION 22 05 00 - BASIC MATERIALS AND METHODS for requirements.
- B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for electrical power supply wiring. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation. Differentiate between portions of wiring that are factory installed and portions that are to be field installed.
- D. Maintenance Data: Submit maintenance data and parts lists for each type and size of water heater, control, and accessory, including "trouble-shooting" maintenance guide. Include this data, product

data, shop drawings, and wiring diagrams in maintenance manual, in accordance with requirements of DIVISION 1.

- E. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.
- F. Start-up: Provide written report on start-up in accordance with SECTION 22 05 00 - BASIC MATERIALS AND METHODS.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver units to the site in containers with manufacturer's stamp or label affixed.
- B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products - remove from project site.

1.6 WARRANTY

- A. Provide one year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses to repair or replace products or systems.

PART 2 - PRODUCTS

2.1 HIGH EFFICIENCY CONDENSING HOT WATER HEATER - GAS

- A. Water heater shall be fully condensing with 94% thermal efficiency with closed combustion venting.
- B. Water heater shall be of a seamless glass lined steel tank construction and include a powered gas burner with electronic flame safeguard, intermittent ignition, automatic gas valve, and gas pressure regulator. Maximum supply gas pressure to heater 14" W.C. Heater shall have capacities as indicated on contract documents.
- C. Water heater shall be suitable for sealed combustion direct venting using a CPVC air intake pipe and CPVC exhaust pipe for a total distance of 50 equivalent feet of vent and 50 equivalent feet of intake. The heater shall be approved for 0" clearances to combustibles.
- D. Water heater controls shall include integrated solid state temperature and ignition control device with integral diagnostics, LED fault display capability and a digital display of temperature settings.
- E. Tank shall be foam insulated and equipped with an ASME rated temperature pressure relief valve. The water heater shall be UL listed and exceed the minimum efficiency requirements of ASHRAE/IES 90.1b-1992.
- F. Set water heater temperature supply temperature to 140°F (minimum).
- G. Route condensate to floor sink through neutralizer by JJM Boiler Works, Axiom Industries or equal.
- H. Manufacturer: A. O. Smith Cyclone BTH, Bock or Bradford White.

2.2 RELIEF VALVES

- A. Relief Valve: Watts vacuum relief valve, bronze body, silicone disc, threaded ends, installed on C.W. supply line only, refer to H.W. Heater Detail on contract drawings.
- B. Temperature and Pressure Relief Valve: Watts, bronze body construction, thermostat and test lever, temperature relief set at 210°F, and pressure relief set at 125 psi.
- C. Acceptable manufacturers: Watts, Kunkle, Keckley or Cash Acme.

2.3 EXPANSION TANK

- A. Furnish and install where shown on plans for domestic hot water system.
- B. ASME stamped and constructed vessel with the following:
 - 1. Tanks rated for 125 psi maximum working pressure.
 - 2. Black steel galvanized construction painted with "Hammertone" blue enamel.
 - 3. Stainless connection opening.
 - 4. Butyl diaphragm bonded to polypropylene liner.
 - 5. Pre-charged air chamber permanently sealed.
 - 6. Air valve.
- C. Manufacturer: Amtrol AST, Adamson, RECO or Watts.

2.4 WATER METERS

- A. Water meter shall have a mechanical drive with hermetically sealed registers; meter shall be equal to or exceed AWWA Standards and shall have an all bronze case. Provide water meters installed complete with gate valve on each side of meter and full line size bypass around meter. Provide flanges on valves and support stands or wall brackets for meter support. Units shall be approved for use by local water district. Hersey Products Inc #MHD, Niagra or Rockwell. Meter shall be rated 200 gpm at 50 psi inlet pressure.

2.5 LINT TRAP, LT-1:

- A. Lint Separator shall be Rockford Lint Separator as manufactured by the Rockford Sanitary Systems, Rockford, Illinois, and as noted on plans.
- B. Separator: Furnish and install Rockford Model RLS-135 all-welded steel separator with extension up to finished floor, 6", hubbed, inlet and outlet with vent connection, internal vent connection, visible double wall outside trap seal, anchor flange without clamping ring, epoxy coating, anodes, sediment basket, reinforced cover for light traffic, secured with stainless steel bolts, heavy duty leakproof gasket, enamel coating inside, and bituminous coating outside.
- C. Unit shall be installed in reinforced concrete vault as indicated on plans. Refer to Detail Sheet P6.3.

PART 3 - EXECUTION

3.1 GENERAL

- A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- C. Orient so controls and devices needing service and maintenance have adequate access.
- D. Connect water piping to units with shutoff valves and unions as indicated.

- E. Start-Up: Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls. Start-up to be by authorized manufacturer's representative or agent.

3.2 OPERATION MANUALS, START-UP SERVICE, WARRANTIES, ACCEPTANCE AND GUARANTEES

- A. General: Refer to SECTION 22 05 00 - BASIC MATERIALS AND METHODS for details.

END SECTION 22 11 23

SECTION 22 21 13 PLUMBING PIPING, VALVES AND SPECIALTIES

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, SECTION 22 05 00 - BASIC MATERIALS AND METHODS, and other Sections in DIVISION 22 specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this Section shall comply with all the requirements of DIVISION 1, and shall include, but not necessarily be limited to the following:
1. Pipe and Fittings
 - a. Sanitary waste and vent
 - b. Cold water
 - c. Hot water
 - d. Fuel gas
 - e. Valves
 - f. Water valves
 - g. Natural gas valves
 - h. Balancing valves
 - i. Backflow prevention valves
 - j. Pressure reducing valves
 - k. Gas pressure regulator valves
 - l. Thermostatic mixing valves
 - m. Thermometers and gauges
 2. Piping specialties
 - a. Pipe escutcheons
 - b. Strainers
 - c. Drip pans
 - d. Air vent
 - e. Dielectric unions
 - f. Unions
 - g. Flanges
 - h. Pipe sleeves
 - i. Sleeve seals
 - j. Valve boxes

- k. Pipe coating
- l. Gas connectors

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 22 05 00 - BASIC MATERIALS AND METHODS
- B. SECTION 22 05 01 - PLUMBING
- C. SECTION 22 40 00 - PLUMBING FIXTURES
- D. SECTION 22 11 23 - PLUMBING EQUIPMENT
- E. DIVISION 26 – ELECTRICAL

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications:
 - 1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
 - 2. Replacement parts shall be readily available and stocked in the USA.
- B. Codes and Standards:
 - 1. All work shall be in full accordance with all applicable codes, ordinances and code rulings.
 - 2. The Contractor shall furnish without any extra charge the labor and material required for compliance of codes.
 - 3. Perform all tests required by governing authorities and as required under all DIVISION 22 Sections. Provide written reports on all tests.
 - 4. Electrical devices and wiring shall confirm to the latest standards of NEC; all devices shall be UL listed and so identified.
 - 5. All plumbing work shall comply with the Americans with Disabilities Act (ADA).
 - 6. All excavation work must comply with all provisions of state laws including notification to all owners of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for all piping, valves and specialties indicating dimensions, valve CV, tolerances etc.
- B. Shop Drawings: Submit shop drawings indicating underground piping installation showing all fittings with inverts. Indicate all footings and grade beams.
- C. Maintenance Data: Submit maintenance instructions on accordance with requirements of DIVISION 1.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.

1. All pipe, pipe fittings and valves shall be manufactured in North America.

OR

2. Upon request, the engineer shall be furnished certification by the manufacturer, stating samples representing each lot have been tested and inspected as indicated in governing ASTM specifications have been met. Certification shall be accompanied by test reports as prepared in accordance with relevant ASTM sections governing Test Methods and Inspection. Tension Tests reports shall include breaking load, machined diameter of the test bars, and calculated tensile strength. Certification shall include the legal name and address of the manufacturer.
- B. Type M copper piping is not acceptable for any pressure water piping unless specifically noted otherwise.
- C. For all Grade B piping specified below grade provide a mill report with production identification numbers for piping submitted to permit tracking of pipe by mill and production lot.
- D. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words "or approved equal" shall be considered to be subsequent to all manufacturer's names used herein, unless specifically noted that substitutes are not allowed.

2.2 STANDARD PIPE AND FITTING

A. Propane Gas Pipe & Fitting (Above Grade)

1. Pipe: ASTM A53, Schedule 40 black steel.
 - a. Fittings: 150 lb. rating. ANSI B16.3, malleable iron threaded; ANSI B16.5, flanged; ANSI B16.9, steel.
 - b. Joints: 2" and smaller, threaded all piping inside the building 2-1/2" and larger, ANSI B16.25 bevelweld, ANSI B16.5 flanges, or ANSI B16.11 socket weld.
2. Flexible Pipe System: Corrugated stainless steel tubing (CSST) equal to Gastite[®] corrugated stainless steel tubing manufactured from ASTM A240, type 304 stainless steel with a minimum nominal wall thickness of 0.010". System shall comply with ANSI LC-1 "Standard for Fuel Gas Piping Using Corrugated Stainless Steel Tubing (CSST), and carrying listings by CSA International (Certification Number 1009875), ICC Evaluation Services (Report Number ESR-1031) and IAPMO Research & Testing (Certificate of Listing Number 3250). System to be fire rated for installation in plenum applications.
 - a. Fittings and joints: Corrugated stainless steel tube fittings and joints equal to Gastite[®] mechanical tube fittings manufactured from ASTM B16 type 360 brass whose design incorporates a double wall flare for gas-tight seal with Jacket Lock[™], mechanical capture of the jacket for enhanced tubing protection.

B. Propane Gas Piping (Below Grade)

1. Polyethylene, Grade 23, Type II, ASTM 2513, plain ends, heat fused joints, orange finish.

C. Trap Primer Piping:

1. Pipe: Domestic Only, ASTM B88, Type K, soft drawn copper water tube. PEX tubing.
2. Fittings: No joints below ground. For pipes below grade double wrap with Scotch Wrap #51 or PASCO Wrap, with 50% overlap.

- D. Domestic Water Pipe & Fittings (Below Grade):
1. Pipe: ASTM B88, Type K hard drawn copper water tube.
 2. Fittings: Domestic Only, Elkhart, ANSI B16.22, wrought copper, 95%-5% tin-antimony solder joints. Wrap underground piping with Scotch Wrap or Pasco Wrap.
- E. Domestic Cold Water Pipe and Fittings (Above Grade):
1. Pipe: Schedule 10 type 304 stainless steel with roll groove fittings. ASTM A268.
 2. Fittings: Victaulic grooved stainless steel fittings.
 3. Joints: Roll groove.
- F. Condensate and indirect drains:
1. Pipe: ASTM B88, Type M, hard drawn copper water tube.
 2. Fittings: ANSI B16.22, wrought copper.
 3. Joints: Lead-free solder joints. Solder shall be lead-free nickel/silver bearing solder meeting ASTM B-32, ASTM B-828. Flux shall be water soluble and shall meet CDA standard test method 1.0 and ASTM B813-91.
 4. Insulate condensate drain pipes with minimum ½" insulation to prevent moisture dripping from pipe.
- G. Domestic Hot and Cold Water Pipe & Fittings (Above Grade):
1. Pipe: ASTM B88, Type L, hard drawn copper water tube.
 2. Fittings: ANSI B16.22, wrought copper, 95%-5% tin-antimony solder joints. Alternative Domestic Water Pipe Fitting (See Section 3.8F): Copper press fittings shall conform to the material and sizing requirements of ASME B16.22. O-rings for copper press fittings shall be EPDM. Viega/Ridgid or approved equal.
- H. Domestic Hot and Cold Water Pipe & Fittings-Alternative (Above Grade):
1. Pipe: ASTM F876 and F877, ViegaPEX cross linked high density polyethylene.
 2. Fittings: ASTM F876, F877 and ASTM/NSF-61, Bronze PEX Press Fittings, Viega Pureflow bronze PEX Press Fittings and stainless steel press sleeves.
- I. Domestic Cold and Hot Water Pipe & Fittings Above and Below Grade (2-1/2" and Larger):
1. Pipe: ASTM D1784, Corzan® IPS (iron pipe size) Rigid CPVC (chlorinated polyvinyl chloride) Schedule 80, Cell Class of 24448, NSF certified. Pipe shall meet ASTM F441.
 2. Fittings: Fitting shall meet Cell Class 23447 and carry a pressure rating listed by the Plastics Pipe Institute (PPI) of PPI TR-3 and in accordance with ASTM D-2837. ASTM F439 socket, ASTM F437 for threaded CPVC Schedule 80 fittings. Threaded fittings shall have taper pipe threads in accordance with ASTM F1498. Unions and flanges shall meet the requirements of ASTM F1970. Two step-low VOC, ASTM F493 & ASTM F656 primer and solvent cement application per manufacturer's instructions and in accordance with ASTM D-2855 and ASTM F402.
 3. Compound manufacturer shall conduct a program that lists those ancillary building products (including, but not limited to: fire stops/caulks, thread sealents, leak detectors/snoop, etc...)

that are chemically compatible with the CPVC compounds (pipe and fittings). This compatibility program shall be administered by an independent third party testing agency.

4. Contractor shall have received training from a manufacturer trained representative, and shall have received and be able to show proof of training via the use of "Proof of Training" card or other completion training certificate for the system he is installing.
- J. Domestic Cold and Hot Water Pipe & Fittings Above and Below Grade (2" and Smaller):
1. Pipe: ASTM D1784, FlowGuard Gold® CTS (copper tube size) Rigid CPVC (chlorinated polyvinyl chloride) pipe with a minimum Cell Class of 24448, NSF certified. Pipe shall meet ASTM D2846.
 2. Fittings: Fitting shall meet ASTM D1784 with a Cell Class of 23447. One step-low VOC, ASTM F493 solvent cement, application per manufacturer's instructions and in accordance with ASTM D-2855 and ASTM F402.
 3. Compound manufacturer shall conduct a program that lists those ancillary building products (including, but not limited to: fire stops/caulks, thread sealents, leak detectors/snoop, etc.) that are chemically compatible with the CPVC compounds (pipe and fittings). This compatibility program shall be administered by an independent third party testing agency.
 4. Contractor shall have received training from a manufacturer trained representative, and shall have received and be able to show proof of training via the use of "Proof of Training" card or other completion training certificate for the system he is installing.
- K. Sanitary Sewer, Vent, & Fittings:
1. Pipe: Tyler or AB&I or Charlotte Pipe and Foundry, ASTM A-74, ASTM A-888 cast iron, bituminous coated, "No-Hub". Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and manufactured by AB &I, Charlotte or Tyler. Pipe showing rust or cracks in coating shall be removed and replaced.
 2. Fittings: No-hub, ASTM A-888.
 3. Couplings Below Grade: Heavy Duty Type 304 stainless steel couplings conforming to FM 1680 with neoprene sealing sleeve conforming to ASTM C-1540 having minimum shield thickness of 28 gauge. Husky SD-4000 or Clamp All 125 only.
 4. Couplings Above Grade: Type 304 stainless steel couplings conforming to ASTM C-1540 and neoprene sealing sleeve, having minimum shield thickness of 34 gauge. Anaco or Ideal.
 5. Vent: ABS with solvent cement joints.
 6. Couplings Above Grade: Band type stainless steel couplings conforming to ASTM C-1540 having a minimum thickness of 31 gauge with neoprene sealing sleeve conforming to ASTM C-564. Husky 2000 or Clamp All 80 only.
- L. Sanitary Sewer, Vent & Fittings-Alternative:
1. Pipe: Charlotte Pipe and Foundry, ASTM F 628, ASTM D 3965, NSF Standard 14, ABS (acrylonitrile-butadiene-styrene) compound with Cell Class 42222. Use in non-pressure applications where operating temperature will not exceed 160°F.
 2. Fittings: ASTM D 2661, ASTM D 2235, ABS DWV Fittings shall be by a single manufacturer and to be installed in accordance with manufacturer's recommendations. Solvent cement joints.

- M. Sanitary Sewer, Vent & Fittings-Alternative:
 - 1. Pipe: Charlotte Pipe and Foundry, ASTM D 1785, ASTM D 1784, NSF Standard 14, PVC Schedule 40 (polyvinyl chloride) compound with Cell Class 12454. Use in non-pressure applications where operating temperature will not exceed 140°F
 - 2. Fittings: ASTM D 2665, ASTM D 2564, PVC DWV Fittings shall be by a single manufacturer and to be installed in accordance with manufacturer's recommendations. Solvent cement joints.
- N. Vent Piping (Above Grade) (Contractor's Option):
 - 1. Pipe: ASTM B306, DWV class, copper tube.
 - 2. Fittings: Elkhart, ANSI B16.23 cast bronze or ANSI B16.29 wrought copper, sweat solder no lead joint. Submit sample of solder for Engineer's review and approval.
- O. Water Service to Building:
 - 1. Pipe: Class 52 ductile iron, ANSI A21.51, AWWA C1510-70, 150 psi cement lined; factory encased with 8 mil polyethylene tube or sheet.
 - 2. Fittings: ANSI A21.10 mechanical joint, AWWA C110-1971, 250 psi. fittings to be double field wrapped with 2", 20 mil vinyl tape, 50% overlap.
 - 3. All fittings shall be restrained with 2000 psi thrust blocks in accordance with NFPA
 - 4. Fire Protection: Refer to Specification SECTION 21 10 00 - FIRE PROTECTION.

2.3 VALVES: GENERAL

- A. General: Valve ratings shall exceed respective system operating pressures by 50% (minimum). All valves shall be line size unless otherwise noted.
- B. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing manufacturer's figure number, size, location, and valve features for each required valve.
- C. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.
- D. Acceptable manufacturers (manufacturer and model number listed for individual valves indicates minimum acceptable by all manufacturers):
 - 1. Gate, Ball, Check or Butterfly: Apollo, Hammond, Nibco (commercial grade, US manufacturer only), Milwaukee, Victaulic or Watts.
 - 2. Lubricated Plug Valves: Homestead, Resun, or Rockwell.
 - 3. Backflow Preventors: Apollo, Ames, Febco, Cla-Val, Watts or Wilkins.
 - 4. Pressure Reducing Valves: Apollo, Cash-Acme, Cla-Val, Watts, or Wilkins.
 - 5. Solenoid Valves: ASCO, Automatic or Magnatrol.
 - 6. Circuit Setters: Griswold (Venturi with characterized ball valve only), Wheatley (Y-globe type only), Armstrong, or Tour & Anderson.
- E. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on the valve body.

- F. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves, other than plug valves. Provide one wrench for every 10 plug valves, and one in each size. Provide extended levers/stems for valves on insulated lines. For manual valves 2 ½" and larger located 8 feet above the floor in mechanical rooms provide chain operator to permit operating the valve from 4'-0" above floor.
- G. Valve Features:
 1. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.
 2. Drain: Comply with MSS SP-45, and provide threaded pipe plugs.
 3. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).
 4. Threaded: Valve ends complying with ANSI B2.1.
 5. Solder-Joint: Valve ends complying with ANSI B16.18.
 6. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

2.4 DOMESTIC PLUMBING SERVICE VALVES

- A. Butterfly Valves:
 1. 2-1/2" and Larger: MSS SP-67, lug wafer, ductile iron body, stainless steel disc, stainless steel stem, EPDM seat, memory stop control, lever handle thru 5" size and worm gear operator for 6" and larger. Mount stem in horizontal position.
- B. Ball Valves:
 1. 2" and Smaller: 600 psi, 2 piece, bronze body, soldered ends for copper pipe and threaded ends for iron pipe, chrome plated brass ball, Teflon seat, brass stem, steel handle, full port.
- C. Check Valves:
 1. 2" and Smaller: Class 125, MSS SP-80, ASTM B62 and ASTM B16, cast bronze body, soldered ends for copper pipe, screwed cap, swing type, Teflon bronze disc.
 2. 2-1/2" and Larger: Class 125, MSS SP-71, ASTM A126 class B cast iron body, bolted bonnet flanged ends, bolted cap, swing type, cast iron disc with bronze face rings.
 3. Vertical or High Flow: Class 125, cast bronze, high-flow body, TFE seat, brass check, stainless steel guide and spring.

2.5 PROPANE GAS SERVICE VALVES

- A. General: All valves to be U.L. listed for the required fluid service.
- B. Ball Valves:
 1. 1/2" and 3/4": Brass body, U.L. listed, CSA approved for pressure of system, bronze ball valve, 175 WOG, with integral lever handle. Apollo 64 series or Watts #FBV-1.
 2. 1" thru 1-1/2": 175 psi working pressure, CSA and UL approved, bronze body, welded ends, stainless steel ball, stainless steel stem, steel handle with memory stop tab, conventional port.

3. Lubricated Plug Valve, 2" and Larger: Class 125, MSS SP-78, 200 PSI, UL listed, CSA approved for pressure of system, lubricated plug type, semi-steel body, loose wrench operated, straight way pattern round port, combination button head fitting and lubricant screw, Teflon seal and discs.

C. Seismic Gas Shutoff Valves:

1. 3/4" thru 2" (low and medium pressure, screwed body): U.L. Listed valve meeting ASCE 25-97, positive closure, soft seal seating, visual open-close indicator, manual reset, and closure time interval within 5 seconds when subjected to a sinusoidal oscillation with peak acceleration of 0.3G and a period of 0.4 seconds. Koso/California Valve Series EV, or approved equal, sized for 0.5 PSI or 20 PSI max operating pressure, respectively.
2. 2", 3" and 4" (High pressure, screwed body): U.L. Listed valve meeting ASCE 25-97, manual reset, soft seat construction for positive sealing, visual open-close indicator, tripping mechanism with non-creeping rolling latch, and closure time interval within 5 seconds when subjected to sinusoidal oscillation with peak acceleration of 0.3G and a period of 0.4 seconds. Koso/California Valve Series EV315, or approved equal, sized for 20 PSI max. operating pressure.
3. 6" (high Pressure, Flanged body): U.L. Listed valve meeting ASCE 25-97, manual reset, soft seat construction for positive sealing, visual open-close indicator, tripping mechanism with non-creeping rolling latch, and closure time interval within 5 seconds when subjected to sinusoidal oscillation with peak acceleration of 0.3G and a period of 0.4 seconds. Koso/California Valve Series EV317, or approved equal, sized for 60 PSI max. operating pressure.

2.6 BALANCING VALVES: MAXIMUM 125 PSIG SYSTEM WORKING WATER PRESSURE

A. Pressure Dependent Water Flow:

1. 1/2" and Larger: Construction and attachment style as required by piping system. Ball or globe valve design with memory stop. Valves shall be field adjustable. Install in pipe with minimum length of unrestricted straight pipe equivalent to five pipe diameters upstream and two pipe diameters downstream. Presso Venturi B-Plus series, Armstrong, or Tour & Anderson.

2.7 BACKFLOW PREVENTION VALVES

A. General: All backflow prevention valves shall be State approved and listed.

B. Double Check Valve for Low Hazard Applications:

1. 2" and Smaller: Assembly shall consist of shutoff ball valves in inlet and outlet, and strainer on inlet. Assemblies shall include test cocks and two positive seating check valves and shall comply with requirements of ASSE Standard 1015 and AWWA C510. Bronze construction, threaded ends, and stainless steel internal parts. Watts #007-QT-S.
2. 2-1/2" and Larger: Assembly shall consist of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies shall include test cocks and two positive seating check valves and shall comply with requirements of ASSE Standard 1015 and AWWA C506. Epoxy coated cast iron body construction, flanged ends, and stainless steel internal parts. Watts #709-S-OSY.

C. Atmospheric Vacuum Breaker: Assembly shall consist of a bronze vacuum breaker body with silicone disc, and full size orifice. Device shall be IAPMO listed, meet ASSE std. 1001, and ANSI std. A113.1.1 Chrome plated in finish areas.

- D. Pressure Vacuum Breaker: Assembly shall consist of a one piece bronze or stainless steel body, with stainless steel spring loaded check, rubber diaphragm, and atmospheric vent, breakaway set screw. Provide chrome plated in finish areas.

2.8 PRESSURE REDUCING VALVES

- A. Single seated, direct operated type; high capacity, having bronze body with strainer, by-pass feature, pressure gauge tappings and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and fail-off at inlet and outlet pressure indicated. Watts #U5 series or equal.
- B. Single seated, pilot operated globe valve type having ductile iron body with FDA approved epoxy coating inside and out, with Y strainer, stainless steel seat, FDA approved diaphragm, copper control tubing, pressure gauge tappings and complying with requirements of ANSI Standard A112.26.2. Select proper size for maximum flow rate and fail-off at inlet and outlet pressure indicated. Watts 115 series or equal.

2.9 PRESSURE RELIEF VALVES

- A. Pressure Relief Valves: Constructed in accordance with ASME, 125-pound setting, and so stamped. Size as required. Watts #740 series or equal.
- B. Temperature and Pressure Relief Valve: Constructed in accordance with ASME, 125-pound setting, and so stamped. Size as required. Watts #100XL, 40XL, 140, N240, or 340 series or equal.

2.10 GAS PRESSURE REGULATOR VALVES

- A. Diaphragm operated, steel construction of size and capacity as indicated on drawings. Regulators shall be approved serving gas supplier, CSA and UL listed. Fisher, Sherwood, or approved equal.

2.11 THERMOSTATIC MIXING VALVES

- A. General: Thermostatic valve constructed of brass and stainless steel, with screwdriver locking temp. regulator and adjustable check stops. Provide access door with cylinder lock. Finish as selected by Architect. Powers E480 or Leonard #210 SB.
- B. Master: High-low master thermostatic assembly of size and capacity as indicated on drawings. Bi-metal motor, adjustable checkstops, inlet and outlet pressure gauges, thermometer with full port outlet ball valves shutoffs, locking temperature regulator and surface mount stainless steel cabinet as specified. Powers 1432-RC-E-Q or Leonard type TM186-PRV-RF-LTR-STSTL.

2.12 SOLENOID VALVES

- A. UL listed, globe pattern bronze valve with threaded ends, stainless steel pilot, bronze piston, malleable iron solenoid assembly with ½" tapped conduit connections and Class "A" coil, 120 Volt, 60 Hertz. Solenoid valve shall be wired to the Fire Alarm System. The valve shall close instantly on application of current and open when de-energized. Provide solenoid valve on gas line into boiler and water heating rooms where the aggregate gas input is over 400,000 Btuh. Wire to "mushroom" button(s) outside of each door to room.

2.13 FIRE PROTECTION VALVES:

- A. Refer to SECTION 21 10 00 - FIRE PROTECTION.

2.14 THERMOMETERS AND GAUGES

A. General:

1. Certification: Provide meters and gauges whose accuracies, under specified operating conditions, are certified by manufacturer.
2. No mercury shall be used in thermometers due to hazardous material classification.
3. Acceptable Manufacturers: Weksler, Winters, Trerice, Marshalltown or US Gauge.

B. Thermometers:

1. Bi-Metal Type: Provide bi-metal glass thermometers of materials, capacities, and ranges indicated, designed and constructed in service indicated. Accuracy shall be 1% +/- full scale with adjustable recalibration.
 - a. Case: Type 300 series stainless steel, hermetically sealed, glass window, 3" diameter dial, with adjustable angle.
 - b. Adjustable Joint: Die cast aluminum, finished to match case, 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.
 - c. Scale: Satin faced, non-reflective aluminum, permanently etched markings.
 - d. Stem: Stainless steel, adjustable angle socket, length to suit installation.
2. Glass Thermometer: Provide adjustable angle 9" thermometer of materials, capacities and ranges as appropriate to medium being measured and designed and constructed for service indicated. Accuracy to be 1% +/- of full scale.
 - a. Case: Aluminum or Valox
 - b. Temperature Sensitive Gage Liquid: Organic non-toxic. No mercury permitted.
 - c. Scale: Aluminum painted white with black markings.
 - d. Connection: ½" NPT with thermowell, 1 ¼" UNF swivel nut without thermowell.
3. Photovoltaic Cell Powered LCD Thermometer
 - a. Case: ABS Plastic
 - b. Accuracy: 1% of full scale.
 - c. Display: 16 LUX rating LCD display. Switchable Fahrenheit and Celcius.
 - d. Connection: 3/4" NPT with thermowell 1 ¼" UNF swivel nut without thermowell.
4. Range: Conform to the following:
 - i. Hot Water: 20°F - 240°F with 2°F scale divisions.
 - ii. Cold Water: -40°F - 160°F with 2°F scale divisions.

C. Thermometer Test Wells:

1. Provide thermometer test wells as indicated, constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

D. Temperature Gauge Connector Plugs:

1. Provide temperature gauge connector plugs pressure rated for 500 psi and 200°F (93°C). Construct of brass and finish in nickel-plate, equip with ½" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

E. Pressure Gauges:

1. General: Provide pressure gauges of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.
2. Type: General use, 1% accuracy ANSI B40.1 grade A, phosphor bronze bourbon type, bottom connection.
3. Case: Drawn steel or brass, glass lens, 4-1/2" diameter.
4. Connector: Brass with ¼" male NPT.
5. Scale: White coated aluminum, with permanently etched markings.
6. Pressure differential range shall be 100 psig minimum for the appropriate application with maximum 1 psig divisions.

F. Pressure Gauge Cocks:

1. General: Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Gauge cock constructed of brass with ¼" female NPT on each end, and "T" handle brass plug.
2. Syphon: ¼" straight coil constructed of brass tubing with ¼" male NPT on each end.
3. Snubber: ¼" brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

G. Pressure Gauge Connector Test Plugs:

1. Provide pressure gauge connector plugs pressure rated for 500 psi and 200°F (93°C). Constructed of brass and finish in nickel-plate, equip with ½" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion pressure gauge. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

2.15 PIPING SPECIALTIES

A. General:

1. Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or provide proper selection to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is installer's option.

B. Pipe Escutcheons:

1. Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe

sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime zinc base paint finish for unoccupied areas.

2. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide stainless steel, cast brass or sheet brass escutcheons, solid or split hinged.
 3. Pipe Escutcheons for Dry Areas: Provide stainless steel escutcheons, solid or split hinged.
- C. Low Pressure Y-Type Pipeline Strainers:
1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125% of the working pressure of piping system, with Type 304 stainless steel screens, with 3/64" perforations at 233 0.045" perforations per square inch.
 2. Threaded ends, 2" and smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with hose bibb. Sarco, Wheatley or Mueller.
 3. Flanged ends, 2-1/2" and larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with hose bibb. Sarco, Wheatley or Mueller.
 4. Grooved ends 2 ½ and larger: Ductile iron body, bolted screen retainer with off center blowdown fitted with hose bibb.
- D. Drip Pans:
1. Provide drip pans fabricated from 16-gauge galvanized sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top by structural angles. Provide hole, gasket, and flange at low point for watertight joint and 1" copper drain line connection. Extend 1" drain to nearest approved receptor.
- E. Air Vent with Valves:
1. Install in all closed and open loop water systems at high points of systems and at any other point necessary to free system of air. A shut-off valve shall be provided in riser to each automatic vent valve to facilitate servicing. A 3/8" type "L" copper tubing drain line shall be run to drain receptor to carry away water that valve discharges. Manual type vent may be used in lieu of automatic type, where specifically shown on the Drawings. Hoffman #79 or Dole.
- F. Dielectric Unions:
1. Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.
- G. Dielectric Flanges: Provide dielectric flanges for flanged transitions between dissimilar metal piping. Watts Series 3100 or approved equal.
- H. Unions:
1. Unions shall be of type specified in following schedule:
 - a. Black Steel, 2" and smaller: 250 lb. screwed malleable iron, ground joint, brass to iron seat.
 - b. Black Steel, 2-1/2" and larger: 150 lb. cast iron screwed flanged, flat faced, full faced gasket.

- c. Soldered Copper or Brass Pipe, 2" and smaller: 150 lb. cast bronze or copper, ground joint, non-ferrous seat with soldered ends.
- d. Screwed Copper or Brass Pipe, 2" and smaller: 150 lb. cast brass, ground joint, brass to brass seat, with threaded ends.
- e. Flanged Copper or Brass Pipe, 2-1/2" and larger: two (2) 150 lb. cast bronze flanges.
- f. Manufacturer: EPCO, Mueller, Stanley G. Flagg or Watts.

I. Flanges:

- 1. Provide flanges at flanged connections to equipment, tanks and valves. Faces of flanges being connected shall be alike in all cases. Connection of raised-face flange to flat-faced flange not permitted.
- 2. Use ASTM A307, Grade B, bolts and nuts for cast iron flanges and ASTM A193 for steel flanges. Regular square head unfinished bolts with heavy semi-finished hex nuts ASTM A194. Cadmium plated where exposed to weather. Rating: 150 lb. or 300 lb. in high pressure portions.
- 3. Type of pipe and corresponding flanges as follows:
 - a. Screwed Black Steel Pipelines: 125 lb. black cast iron screwed flange, flat faces.
 - b. Welded Steel Pipe, 150 lb. black forges steel welding flanges, 1/16" raised fact ASTM A181 Grade I. Use flat face when connected to flat faced companion flange.

J. Pipe Sleeves:

- 1. Provide fire proof sleeve assemblies utilizing UL rated sealant systems at all fire rated penetrations. For non-rated sleeve penetrations pack the annular space between the pipe and sleeve with fiberglass and/or mastic.
- 2. Sleeves shall provide a minimum ½" annular clearance around pipe.
- 3. Sheet metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3" and smaller, 20 gauge; 4" to 6", 16 gauge; over 6", 14 gauge.
- 4. Steel pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
- 5. Iron pipe: Fabricate from cast iron or ductile-iron pipe; remove burrs.
- 6. Plastic and copper pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.
- 7. Sleeves through interior concrete walls and floors: Telescopic, submerged, adjustable sleeves by Adjust-to-Crete, AMI or Shamrock. Floor sleeves to extend a minimum of 1" above finished floor.
- 8. Through exterior walls and floor on grade: 150-pound class cast-iron pipe sleeve. Where waterproof membranes are used, provide membrane clamps. For insulated piping, sleeve diameter shall not be less than diameter of insulated pipe.
- 9. Cast-in-place watertight device for protecting penetrating objects from expansion and contraction of concrete. Factory-assembled for use in cast-in-place concrete floors and walls and consisting of two outer sleeves and a one-piece radial extended-flange waterstop gasket, with mid-body seal for embedment and sealing to concrete slab and continuous water seal extending to the penetrating pipe.

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbard Enterprises/HOLDRITE; Hydro Preseal, or a comparable product.
- b. Outer Sleeves: EPDM or NBR attached to the mid-body seal forming an area with which to attach the device to the structural reinforcing rod determining the position of sleeve in the wall.
- c. Water Stop Mid-body Seal: Flexible polymer seal with radial extended flange consisting of one to three concentric raised rings which lock into concrete, maintaining seal over time as concrete contracts from sleeve.

K. Sleeve Seals:

- 1. All sleeves shall be sealed to prevent intrusion of moisture, dust or insects.
- 2. Underground: For sleeves passing through exterior or foundation walls, provide mechanical link seal assembly.
- 3. Aboveground: For sleeves passing through walls or floors provide a non-toxic 3-hour rated fire resistant silicone foam sealant with a Flame Spread Rating of 20. Sealant to be tested and approved under UL 263, ASTM E119, and NFPA 251 Standards. All fire rated penetrations shall be sealed with approved UL System.
- 4. Local Approvals: All seals to be provided shall be in accordance with the regulations of all governing agencies of the city, county, and State Fire Marshal's Office.

L. PIPE COATING

M. All underground steel and copper pipe fittings, and all above ground steel and copper pipe and fittings in corrosive air environments shall be covered with one of the following methods:

- 1. Twice Wrap 20 Mil. Scotch Wrap PVC No. 51, 50% overlap.
- 2. Prefabricated extruded plastic cover with joints sealed with two coats of 20 Mil. Scotch Wrap No. 51 or Pasco Wrap 20 mil weight.

N. Furnish corrugated stainless steel tubing (CSST) with factory-applied corrosion –resistant polyethylene jacket for use in corrosive atmosphere. Coating properties include the following:

- 1. Gastite corrugated stainless steel tube jacket shall be UV-Resistant polyethylene meeting the requirements of ASTM E84 for flame spread and smoke density.

2.16 GAS CONNECTORS

- A. General Areas: CSA rated, UL listed, braided stainless steel gas hose of size and capacity to meet appliance input requirements.
- B. Gas connectors for outdoor applications shall be listed for exterior use.

2.17 EXPANSION COMPENSATORS

- A. General: Pipe expansion, in general, is to be absorbed in bends, swing joints, expansion loops, and offsets. All piping mains, branches and runouts shall be installed to allow for free expansion and contraction without developing leaks or undue stressing of pipe. Stresses shall be within allowable limits of ASME B31.1 for pressure piping. Vertical piping for domestic hot water, chilled water, heating water, steam and steam condensate shall be provided with expansion joints at each floor. Expansion products to conform to the standards of the Expansion Joint Manufacturer's Association. Expansion joints shall not required packing. Installer shall select materials and

pressure/temperature ratings to suit intended service. Select packless expansion joints to provide 150% absorption capacity of calculated maximum piping expansion between anchors. All connections shall have ends to match piping system application.

- B. Expansion Compensators (Pipe Compression and Extension): Multiple stainless steel bellows and stainless steel liner with shroud and end fittings. Keflex #311 series or approved equal.
- C. Flexible Expansion Joint/Seismic Connector for Steel Pipe: Stainless steel hose and braid, 180° return, CSA approved, and end fittings. Metraflex #Metraloop or approved equal.
- D. Flexible Connection for Steel Pipe (Piping and Equipment Located Outside the Building): Stainless steel hose and braid, with threaded or flanged ends. Metraflex #SST or approved equal.
- E. Flexible Connection for Copper Pipe: Bronze hose and braid, copper tube ends. Metraflex #BBS or approved equal.
 - 1. For non-critical pump connections. Furnish with fluorelastomer tube and cover to ASTM D2000 Grade 1HK710. The body shall be reinforced with rectangular body rings and six bias plies of fiberglass/kevlar fabric rated 190#/26" vacuum at 250°F. Provide galvanized flat (not L shaped) back up rings and control rods to limit maximum axial extension. Garlock #206 EZ-FLO or approved equal.
 - 2. Flexible Ball Pipe Joints: Provide flexible ball pipe joints where indicated for piping systems, with materials and pressure/temperature ratings selected by installer to suit intended service. Design joints for 360° rotation, and with minimum of 50° angular flexing movement for sizes ¼" to 4". Provide two composition gaskets for each joint. Barco or approved equal.
- F. Pipe Alignment Guides: Provide pipe alignment guides on both sides of expansion joints, and elsewhere as indicated on drawings. Guide shall be of carbon steel construction with split guiding cylinder and integral anchor base and internal four finger two-piece spider. Cylinder wall thickness shall be equal to schedule 40 wall thickness of pipe being guided. Spider shall be capable of clamping directly to pipe and moving only in an axial direction while inside cylinder. Anchoring directly to building substrate. Metraflex #Style IV or equal.
- G. Expansion Loops: Provide field fabricated pipe expansion loops as detailed on the drawings or in place of mechanical expansion joints.

PART 3 - EXECUTION

3.1 GENERAL

- A. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.
- B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal, or otherwise irregular work unless so indicated on Drawings or approved by Architect.

3.2 MANUFACTURER'S DIRECTIONS

- A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.

3.3 INSTALLATION

- A. Coordinate the work between the various Plumbing Sections and with the work specified under other Divisions of the work or contracts toward rapid completion of the entire project. If any cooperative work must be altered due to lack of proper supervision or failure to make proper provisions in time, then the work hereunder shall include all expenses of such changes as are necessary in the work under other contracts, and such changes shall be directly supervised by and made to the satisfaction of the Engineer.
- B. The cooperative work not included in the Plumbing Division related to the general construction work is as follows:
 - 1. All formed concrete work.
 - 2. Framed openings in masonry and other Architectural and Structural elements.
 - 3. Wood grounds and nailing strips in masonry and concrete.
 - 4. Sloping of floors to drains and floor sinks.
 - 5. Sloping of roof-to-roof drains and overflow drains.
- C. Inspect all material, equipment, and apparatus upon delivery and do not install any that may be subject to rejection as a result of damage or other defects. Provide tarps and visqueen cover to protect equipment and piping delivered to and stored at the site.

3.4 WORKING PRESSURES

- A. All fittings, valves, pipe, specialties equipment shall be rated for the working pressure subjected in the installed locations.
- B. Drawings indicate working pressure in each system. The rating of the equipment and material shall not be less than that of the system pressures.
- C. Low pressure, 0.5 psig (11 inch Water Column) or less, Propane Gas Systems: Use 1/2 to 2-inch NPS: Gastite corrugated stainless steel tube and brass fittings.
- D. Pipes Sizes to Equipment:
 - 1. General: Pipe sizes indicated shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within one foot of equipment.
- E. Piping Installation:
 - 1. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints or couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Comply with ASME B31 Code for Pressure Piping.
 - 2. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct space or block access for servicing building and its equipment. Hold piping close to walls, overhead

construction, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Whenever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated.

3. CSST tubing, fitting, and strike-protection are to be Gastite[®] and shall be installed per the current version of the Gastite[®] Design & Installation Guide and per Local Code. Gastite[®] supplied training shall be obtained by all installers prior to installation. The gas-piping system shall be pressure tested in accordance with all requirements of Local Code, ANSI LC-1 and the most current edition of the Gastite[®] Design and Installation Guide.

3.5 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
 1. Retain subparagraph below when cast-in-place watertight sleeve seals are required.
 2. When cast-in-place watertight sleeve seals are required, select sleeve size to match the size and type of pipe to be installed.
 3. Retain subparagraph below if applicable.
 4. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in SECTION 07 92 00 - JOINT SEALANTS.
 4. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in DIVISION 7 – THERMAL AND MOISTURE PROTECTION, SECTION - FIRESTOPPING."Exception: When fire-resistance-rated cast-in-place watertight sleeve seals are required for floor penetrations, additional firestopping is not necessary.

3.6 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.
- C. Aboveground, Cast-in-Place Watertight Sleeves. Select sleeve size based on pipe size and material to be inserted, and thickness of wall.
 - 1. Install cast-in-place watertight sleeves for pipes NPS 6 (DN 150) and smaller in diameter.
 - 2. Position cast-in-place water tight sleeve in wall space securing sleeve to reinforcing steel using tie wire.
- D. Underground, Exterior-Wall, Cast-in-Place Watertight Penetrations. Select sleeve size based on pipe size and material to be inserted, and thickness of wall.
 - 1. Install cast-in-place watertight sleeves for pipes NPS 6 (DN 150) and smaller in diameter.
 - 2. Secure sleeve to the reinforcing steel using tie wire.
- E. Fire-Resistance Rated, Cast-in-Place Sleeve Installation: Select sleeve size based on size and type of pipe and thickness of the floor. Position and secure sleeve to concrete form using nails or staples. Place concrete, and finish even with top of sleeve.

3.7 WELDING

- A. Qualifications of Welders: Welders performing work under this Contract shall be certified and qualified in accordance with tests prescribed by the National Certified Welding Bureau (NCWB) or by other approved test procedures using methodology and procedures covered in the ASME Boiler and Pressure Vessel Code, Section IX, "Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators". Installation shall conform to ANSI 31.1 "Power Piping".
 - 1. Submit for approval the names, identification, and welder's assigned number, letter or symbol of welders assigned to this project.
 - 2. The assigned identification symbol shall be used to identify the work of each welder and shall be indelibly stamped immediately upon completion of each weld.
 - 3. Welders shall be tested and certified for all positions.
 - 4. Submit identifying stenciled test coupons made by each operator.
 - 5. Any or all welders may be required to retake welding certification tests without additional expense.
 - 6. When so requested, a welder shall not be permitted to work as a welder on this project until he has been recertified in accordance with NCWB.
 - 7. Recertification of the welder shall be made after the welder has taken and passed the required tests.
 - 8. Where piping 1-1/2 inches and smaller is butt or socket welded, submit 3 samples of test welds for approval.

3.8 PIPING SYSTEM JOINTS

- A. All piping shall be cut squarely, free of rough edges and reamed to full bore. Piping shall be mechanically cleaned prior to make-up of joints and fully inserted into fittings.
- B. Provide joints of type indicated in each piping system.
- C. Thread pipe in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- D. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM. B-32, in accordance with IAPMO IS 3-93, ASTM B-828 and Copper Development Association recommended procedures. Joints shall be cleaned by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes shall be applied liberally to the outside of the pipe and the solder cup of the fitting. Fluxes shall be water soluble for copper and brass potable water applications, and shall meet CDA standard test method 1.0 and ASTM B813-91. Solder shall be applied until a full fillet is present around the joint. Solder and flux shall not be applied in such excessive quantities as to run down interior of pipe. Lead solder or corrosive flux shall not be present at the jobsite.
 - 1. Manufacturers:
 - a. Solder: JW Harris "Bridgit" or Englehard "Silvabrite 100".
 - b. Flux: Laco "Flux-Rite 90", MW Dunton "Nokorode CDA Flux", Hercules "Fluid Action Solder Flux".
- E. Braze copper tube and fitting socket or extrude joints (T-drill) with BCUP series filler metal without flux. Listed brazing flux shall be used for joining of copper tube to brass or bronze fittings and shall meet AWS FB3A or FB3C. A continuous fillet shall be visible around the completed joint. After cooling, flux residue shall be thoroughly removed with warm water and a brush prior to testing. Do not use BCUP filler on copper alloys containing over 10% nickel.
- F. Corrugated stainless steel tube (CSST) fittings joints: Gastite[®] mechanical tube fittings manufactured from ASTM B16 type 360 brass whose design incorporates a double wall flare for gas-tight seal with Jacket Lock[™], mechanical capture of the jacket for enhanced tubing protection.
- G. Alternative domestic water piping mechanical press type connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. Copper press fittings shall conform to the material and sizing requirements of ASME B16.22. O-rings for copper press fittings shall be EPDM. Viega/Ridgid or approved equal.
- H. Piping shall be capped during construction to prevent entry of foreign material.
- I. Weld pipe joints in accordance with recognized industry practice and as follows:
 - 1. Weld pipe joints only when ambient temperature is above 0°F.
 - 2. Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.

3. Use pipe clamps or tack-weld joints with 1" long welds, 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".
 4. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and at edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes, and non-metallic inclusions.
 5. Do not weld out piping system imperfections by tack-welding procedures. Refabricate to comply with requirements.
 6. At Installer's option, install forged branch-connection fittings whenever branch pipe is indicated, or install regular T-fitting.
- J. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
- K. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

3.9 VALVES

- A. General: Except as otherwise indicated, comply with the following requirements:
1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided as necessary. Install valves on all services connected to kitchen equipment.
 2. Install valves, except butterfly valves, with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane without prior written approval. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.
 3. Install butterfly valves with stems mounted horizontally.
 4. All valves mounted higher than 7' above floor in mechanical rooms and where indicated shall be installed with stem horizontal and equipped with chain wheels and chains extending to 6' above floor.
 5. Provide Seismic shut off valve on gas main downstream of meter.
- B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.
- C. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends of types of pipe/tube connections:
1. Copper Pipe, 2-1/2" and Smaller: Soldered-joint valves.
 2. Steel Pipe, 2" and Smaller: Threaded joint valves.
 3. Larger Pipe Sizes: One of the following, at installer's option:
 - a. Flanged valves.
 - b. Lug valves.

- D. Non-Metallic Disc: Limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.
- E. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.
- F. Fluid Control: Except as otherwise indicated, install gate, ball, plug, circuit setter, globe, and butterfly valves to comply with ASME B31.9.
- G. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.
- H. Wafer Check: Install between 2 flanges in horizontal or vertical position.
- I. Ball Valve: Ball valve used on gas systems shall be UL listed, CSA approved for pressure of system, no exception.
- J. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.
- K. Valve Identification: Tag each valve in accordance with SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS.
- L. Cleaning: Clean factory-finished surfaces. Repair marred or scratched surfaces with manufacturer's touch-up paint.

3.10 TEMPERATURE GAUGES

- A. General: Install temperature gauges in vertical upright position, and tilted so as to be easily read by observer standing on floor without supplemental illumination. All gages to be installed with snubbers to absorb system shock.
- B. Install in the following locations, and elsewhere as indicated:
 1. At outlet of hot water heaters.

3.11 MECHANICAL SLEEVE SEALS

- A. Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form a watertight seal.
- B. Fire Barrier Penetration Seals: Fill entire opening with sealing compound in compliance approved and listed UL system number. Adhere to manufacturer's installation instructions.

3.12 SUPPORTS AND HANGERS (SEE SECTION 22 05 00 – BASIC MATERIALS AND METHODS)

3.13 PIPE PORTALS

- A. Install per manufacturer's instructions.
- B. Coordinate with other trades so units are installed when roofing is being installed.
- C. Verify roof insulation thickness and adjust raise of cant to match.

3.14 EXPANSION LOOPS

- A. Expansion Loops: Fabricate expansion loops as indicated, in locations indicated, and elsewhere as determined by installer for adequate expansion of installed piping system. Subject loop to cold

spring which will absorb 50% of total expansion between hot and cold conditions. Provide pipe anchors and pipe alignment guides as indicated, and elsewhere as determined by installer to properly anchor piping in relationship to expansion loops.

- B. Expansion Compensation for Risers and Terminals: Install connection between piping mains and risers with at least five pipe fittings including tee in main. Install connections between piping risers and terminal units with at least four pipe fittings including tee in riser.

3.15 EXPANSION COMPENSATORS

- A. Install as noted on plans. Where plans do not indicate spacing of guides or other pertinent information, install per manufacturer's recommendations.

3.16 EXCAVATION AND BACKFILL

- A. Underground piping shall be installed in stable, open trench work. Trench excavations shall be a minimum of 16" wide, true to line and grade. Contractor shall exercise all due shoring and safety procedures. No stones larger than 1" may be present in the trench to a minimum depth of 4" below the trench bottom. The trench shall be free of job site debris, and free of corrosive media. Pipe crown shall be not less than 24" below the finished ground surface for metallic pipe, and 30" for non-metallic pipe, unless otherwise indicated on the drawings or directed by the Architect. Trenches shall be kept free of excess moisture, and shall be kept open for only a short a time as necessary for installation, testing and inspection. Dispose of surplus excavation and seepage water as directed by the Architect.
- B. Piping shall be properly bedded and backfilled over stable trench bottom to a level of at least 12" above the pipe crown with thin layers of unwashed sand, dampened but not puddle, and free of organic or corrosive materials and excessive moisture. Backfill shall be placed in thin layers not to exceed 6" and tamped by mechanical tampers to a minimum 90% Modified Proctor Density, in accordance with ASTM D-1557-58T. Trenches shall be backfilled to a minimum depth of 36" prior to being wheel loaded. Replace to their original condition all turf, plants, concrete, asphalt, or other improvements which constitute landscaping, traffic areas or other improved areas which become disturbed by excavation. In graded and undeveloped areas, in addition to procedures specified above, backfill trenches with crown 8" above the surrounding surface.
- C. Excavated and backfill in soils of unstable nature shall be provided as directed by Architect.

3.17 PIPE INSPECTIONS

- A. It is the intent of the Contract Documents that systems be inspected at completion of each phase while under tests required for administrative authorities, and prior to concealment, i.e. "Rough-in" "top-out" and final.
- B. Inspection – Below Grade: All piping installed below grade shall be inspected prior to burial by the Architect, the Owner's Representative or the Engineer. Contractor must notify Architect no less than 24 working hours prior to inspection time. Should the piping be buried prior to inspection the contractor may be requested to uncover the piping at no delay to the project and at no additional cost to the Owner.
- C. Inspection – Above Grade: All piping installed above grade shall be made available for inspection upon completion and prior to finish of walls and ceilings. Notify the Architect, the Owner's Representative or the Engineer. Contractor must notify Architect no less than 24 working hours prior to the desired inspection time. Should the piping be hidden within the structure prior to

inspection the contractor may be requested to uncover the piping at no delay to the project and at no additional cost to the Owner.

3.18 CLEANING, FLUSHING, DISINFECTING

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any).
- B. Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports, and accessory items.
- C. Inspect pressure piping in accordance with procedures of ASME B31.
- D. Disinfect water mains and water service piping in accordance with SECTION 22 05 01 - PLUMBING.

3.19 TESTING

- A. Provide all tests specified hereinafter and as otherwise required. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing, that the specified tests have been performed and that the installation complies with the specified requirements and provide a report of the test observations signed by qualified inspector.
- B. Piping: Remove from the system, during testing, all equipment which would be damaged by test pressure. Replace removed equipment when testing has been accomplished. The system may be tested in sections as the work progresses; however, any previously tested portion shall become a part of any latter test of a composite system. Correct leaks by remaking joints with new material.
- C. Test time will be accrued only while full test pressure is on the system, unless indicated otherwise. "Tolerance" shall be no pressure drop, except that due to temperature change in a 24-hour period. Inspect and test all work prior to burying or concealing. Test pressure shall be one and one-half times the system operating pressure or the listed test pressure below, whichever is greater:

System	Test Medium	Test Pressure	Tolerance-Test Period
Domestic Water	Water	150 psig	None – 8 hours
Soil and Waste	Water	10 ft head, 5 psi	No leaks – 8 hours
Vent	Water	Top of Vent Terminal	No leaks – 8 hours
Automatic Fire	Water	200 psig	None – 8 hours
Natural Gas/Propane	Air or Nitrogen	100 psig	None – 24 hours

- D. Final Drainage, Waste and Vent Test: Upon project closeout, Contractor shall perform and certify that the DWV system has passed the following test:
 - 1. After all plumbing fixtures have been installed and their traps filled with water, all vent terminals and building drains shall be closed and a U-tube water manometer shall be inserted into the trap of water closet and an air compressor testing apparatus shall be attached to any suitable opening. An air pressure of 1" water column as indicated on the manometer shall be introduced into the system. The pressure shall hold constant for a period of 15 minutes without the introduction of additional air. Leaks revealed during this test may be located by smoke test of other recognition methods.
- E. Valves: Test all valve bonnets for tightness. Test operate all valves at least once from closed-to-open-to-closed position while valve is under test pressure. Test all automatic valves, including solenoid valves, and temperature and pressure relief valves, safety valves, and temperature and pressure relief valves not less than three (3) times.

- F. Piping Specialties: Test all thermometers, pressure gauges, and water meters for accurate indication; automatic water feeders, air vents, trap primers, and vacuum breakers for proper performance. Test all air vent points to ensure that all air has been vented.
- G. Backflow Preventers: Each testable backflow prevention device shall be tested and approved by certified testers after installation. Submit test results.

END SECTION 22 21 13

SECTION 22 21 23 PUMPS AND SPECIALTIES

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, and SECTION 22 05 00 - BASIC MATERIALS AND METHODS, and other Sections in DIVISION 22 specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this Section shall comply with all the requirements of DIVISION 1, and shall include, but not necessarily be limited to, the following:
 - 1. Domestic hot water recirculating pumps
 - 2. Expansion tanks - diaphragm type pre-pressurized.
 - 3. Related Work Specified Elsewhere
- B. SECTION 22 05 00 - BASIC MATERIALS AND METHODS
- C. SECTION 22 05 01 - PLUMBING
- D. SECTION 22 40 00 - PLUMBING FIXTURES
- E. DIVISION 26 – ELECTRICAL

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Provide systems that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products.
- B. Codes and Standards: Provide pumps which conform to the requirements of:
 - 1. Hydraulic Institute (HI): Manufacturer pumps in accordance with "Standards for Centrifugal Rotary and Reciprocating Pumps."
 - 2. National Electrical Manufacturers Association (NEMA): Provide electrical components which comply with NEMA Standards.
 - 3. National Fire Protection Association (NFPA):
 - a. 70: National electrical Code
 - 4. Underwriters Laboratories (UL):
 - a. UL-778: Motor Operated Water Pumps

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for units showing dimensions, weights (shipping, installed, and operating), capacities, ratings, performance with operating point clearly indicated, motor electrical characteristics, finishes of materials, and installation instructions.
 - 1. Parallel pump plots: For all parallel and series pump applications submit a combined pump curve showing parallel pump operation and single pump non-overloaded operation verifying that the pump selections operate non-overloading on curve in a single pump operation.

2. Submittal information to verify all scheduled characteristics are met including efficiency.
- B. Shop Drawings: Submit manufacturer's shop drawings indicating dimensions, weight (shipping, operating), required clearances, methods of assembly of components, and location and size of each field connection.
 - C. Maintenance Data:
 1. Submit maintenance instructions, including instructions for lubrication, tube replacement, motor and drive replacement, and spare parts lists.
 2. Include this data, product data, shop drawings, and wiring diagrams in operating and maintenance manuals.
 - D. Wiring Diagrams:
 1. Submit manufacturer's ladder-type wiring diagrams for power and control wiring required.
 2. Differentiate between factory-installed and field-installed wiring.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver units to the site in containers with manufacturer's stamp or label affixed.
- B. Store and protect products and units against dirt, water, chemical, and mechanical damage. Do not install damaged units - remove from project site.
- C. Rigging: Comply with the manufacturer's rigging and installation instructions.

1.6 WARRANTY

- A. Provide general one year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

PART 2 - PRODUCTS

2.1 HOT WATER RECIRCULATING PUMPS

- A. Furnish and install pumps with capacities as shown on plans.
 1. Pumps shall be in-line type for installation in vertical or horizontal piping.
 2. Pump must be capable of being serviced without disturbing piping connections.
- B. Pump body shall be of all bronze construction, rated 175 psi working pressure, with gauge ports at nozzles, and with vent and drain ports.
- C. Impeller shall be non-ferrous material, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew or nut.
- D. The liquid cavity shall be sealed off at the motor shaft by an internally-flushed mechanical seal with ceramic seal seat, and carbon seal ring, suitable for continuous operation at 225° F. A non-ferrous shaft sleeve shall completely cover the wetted area under the seal.
- E. Pump bearing bracket shall have oil lubricated bronze journal and thrust bearings. Bracket shaft shall be alloy steel having ground and hardened thrust bearing faces. A flexible coupling to dampen starting torque and torsional vibration shall be employed.
- F. Motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the plans.

- G. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.
- H. Provide H-O-A switch with overload protection. Pump shall be controlled by an aquastat on the return line and a flow switch on the cold water makeup. Wiring between switch and pump provided under DIVISION 22, as stated in SECTION 22 05 00 - BASIC MATERIALS AND METHODS.
- I. Manufacturer: ITT Bell and Gossett Series 60, TACO, Thrush or Grundfos.

2.2 EXPANSION TANKS

- A. Diaphragm Type Pre-pressurized:
 - 1. The pressurization system shall include a diaphragm-type expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at all components in the system to the maximum allowable pressure at those components. It shall maintain minimum operating pressure necessary to eliminate all air. The only air in the system shall be the permanent sealed-in air cushion contained in the diaphragm-type tank.
 - 2. The expansion tank shall be welded steel, constructed, tested and stamped in accordance with Section VIII of the ASME Code for a working pressure of 125 psi and precharged to the minimum operating pressure.
 - 3. The manufacturer shall be Wessels, Amtrol or approved equal with at least five years experience in the fabrication of diaphragm-type ASME expansion tanks.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All equipment, unless otherwise shown or noted on the Drawings, is to be installed in accordance with industry standards and manufacturer's recommended installation instructions.
- B. Grouting Pump Base: For all base mounted flexibly coupled pumps fill the pump base frame with grout after completing pump/motor alignment.
- C. Provide vibration isolation, inertia bases, seismic snubber, flexible pipe connections, etc, as specified in related specification sections.
- D. For variable flow pumping applications, see SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING for additional requirements.
- E. Contractor to assist testing and balancing contractor in verifying correct pump rotation and system operation.
- F. Flush and clean equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls.
- G. Isolation for Service: Provide pump installations with a discrete isolation valve on both the supply and intake side of the pump to permit service of the pump and any related strainer, check or balancing valves. Triple duty valves are not equivalent for this shut-off service.
- H. Balancing Coordination and Impeller Trimming: Coordinate final pump flow with test and balance contractor. For pumps larger than 5 horsepower, if the system tests and balance indicate that flow

exceeds the specified flow by greater than 20%, it is not acceptable to reduce flow merely by adjusting balance valves to create additional head or reducing VFD peak flows. Excess system flow must be reduced by trimming the impeller to match the load.

3.2 MANUFACTURER'S START-UP SERVICES

- A. The manufacturer shall provide start-up service in the form of a factory trained service technician. The service technician shall verify correct installation, verify pump systems mounting, verify piping installation, verify control wiring, verify power wiring, and check for proper operation. The service technician shall provide final adjustments to meet the specified performance requirements. Fully staffed parts and service personnel shall be within four hours travel from the jobsite.

END SECTION 22 21 23

SECTION 22 40 00 PLUMBING FIXTURES

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, and SECTION 22 05 00 - BASIC MATERIALS AND METHODS, and other Sections in DIVISION 22 specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this section shall include, but not necessarily be limited to, the installation of plumbing fixtures and trim.

1.3 RELATED WORK IN OTHER SECTIONS

- A. SECTION 22 05 00 - BASIC MATERIALS AND METHODS
- B. SECTION 22 05 01 - PLUMBING
- C. SECTION 22 11 23 - PLUMBING EQUIPMENT

1.4 SUBMITTALS

- A. Prior to construction submit for approval all materials and equipment in accordance with DIVISION 1. Submit manufacturer's data, colors, installation instructions, and maintenance and operating instructions for all components of this section including, but not limited to, the following:
 - 1. Plumbing fixtures.
 - 2. Piping specialties.
 - 3. Toilets.
 - 4. Urinals.
 - 5. Lavatories.
 - 6. Sinks.
 - 7. Showers or tubs.
 - 8. Drinking fountains.
- B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings specified in DIVISION 6 for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.
- C. Samples: Submit samples of any piece of equipment requested by Architect for review and approval.
- D. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.

1.5 CODES AND STANDARDS

- A. Uniform Plumbing Code (UPC) with State Amendments.
- B. All fixtures and faucets must meet all requirements of Americans with Disabilities Act (ADA).

- C. State Energy Code
- D. ARI Standard 1010: "Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver units to the site in containers with manufacturer's stamp or label affixed.
- B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products. Remove damaged products from project site.

1.7 MAINTENANCE

- A. Extra Stock:
 - 1. Furnish special wrenches and other devices necessary for servicing plumbing fixtures, flush valves, and trim to Owner with receipt in a quantity of one device for each 10 fixtures.
 - 2. Furnish faucet repair kits complete with all necessary washers, springs, pins, retainers, packings, o-rings, sleeves, and seats in a quantity of 1 kit for each 10 faucets.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide fixtures as specified. Fixtures in any secure or public areas shall be vandal proofed.
- B. Architect/Engineer shall review and approve any substitution requested by Contractor.
- C. Provide fixture as specified, acceptable manufacturers:
 - 1. Vitreous China or Cast Iron Fixtures: American Standard, Eljer, Zurn or Kohler.
 - 2. Stainless Steel Sinks: Elkay or Just
 - a. All stainless steel is 18 gauge, type 304 unless otherwise specified.
 - 3. Drinking Fountains: Elkay or Haws.
 - 4. Terrazzo Service Sinks: Florestone or Stern Williams.
 - 5. Showers enclosures: Lasco, Fiber Fab, Aquaglass and Aqua Bath.
- D. Provide faucet as specified. Acceptable manufacturers: Chicago Faucets, Zurn, Symmons, T and S or as indicated.
- E. Provide a thermostatic mixing valve conforming to ASSE 1070 for all public lavatories and tub only fillers.
- F. Provide flush valve as specified. Acceptable manufacturers: Sloan, Hydrotek or Zurn.
- G. Provide commercial grade toilet seat as specified. Acceptable manufacturers: Beneke, Bemis, Church or Olsonite.
- H. Provide heavy-duty cast iron commercial grade carrier as specified. Provide compact carriers where space is limited. Acceptable manufacturers: Ancon, Jay R. Smith, Wade or Zurn. No plastic parts on foundry items.
 - 1. Wall hung water closet: J.R. Smith figs: 0210L/Ry-M12, 0210DY-M12, 0240L/Ry-M12, 0240DY-M12, 0410R/Ly-M12 and 0410DY-M12.

2. Wall hung urinal: J.R. Smith fig: 0634-M12 or Zurn Z-1221-58.
 3. Wall hung lavatory: J.R. Smith fig: 0700(D) –M31 concealed arm carrier.
- I. Provide heavy duty commercial grade 17-gauge P-Trap and supplies with stops as specified. Provide heavy duty commercial grade lavatory supplies. Provide supplies meeting AB1953 no lead requirements. Supplies shall be ½" x 3/8" x 12" ground joint flexible riser with loose key angle stop with chrome plates I.P.S. brass nipple. Sink supplies shall be ½" x 12" ground joint flexible riser with loose-key angle stop with chrome plated I.P.S. brass nipple. Provide bell type escutcheons for both P-trap and supplies. Acceptable manufacturers: Zurn, Brasscraft, Chicago, or McGuire.
1. P-trap - Lav: McGuire C8902-DF or Zurn Z-8701.
 2. P-trap - Sink: McGuire C8912-DF or Zurn Z-8702.
 3. Supply for Lavatory: McGuire LFH2165LK or Zurn ZH88-XL-LK.
 4. Offset supply for barrier free lavatory: McGuire 158 WC.
 5. Supply for Sink: McGuire LFH2167LK or Zurn ZH8803-XL-LR.
 6. Supply for Water Closet: McGuire H2169LK or Zurn ZH-8807-CR.
 7. Escutcheons: McGuire WE00D Series, wrought brass, bell type.
 8. Lavatory grid strainer: McGuire 155A or Zurn Z-8743.
 9. Barrier-free lavatory offset grid strainer: McGuire 155WC or Zurn 8746.
 10. Sink Strainer: Elkay LK-18B.
- J. Provide standard grade P-Traps and supplies with stops as specified in residences. Provide supplies meeting AB1953 no lead requirements. Lavatory supplies shall be 1/2" x 3/8" x 12" ground joint flexible riser with round wheel handles and chrome plated I.P.S. brass nipple. Sink supplies shall be 1/2" x 12" ground joint flexible riser with round wheel handle angle stop with chrome plated I.P.S. brass nipple. Provide bell type chrome plated escutcheon for traps and supplies. Acceptable manufacturers: McGuire, Zurn, Chicago or Brass Craft.
1. P-Trap Lavatory: McGuire 8901-C or Zurn 8706.
 2. P-Trap Sink: McGuire 8892-C or Zurn 8708.
 3. Supply Lavatory: McGuire LF2165 or Zurn ZH8801-XL-LR.
 4. Supply Sink: McGuire LF2167 or Zurn ZH8803-XL-LR.
 5. Supply Water Closet: McGuire 2169 or Zurn Z8807CR.
 6. Offset Supply for ADA Lavatory: McGuire 158W or Zurn Z-8855-WL.
 7. Offset Trap Arm for ADA Lavatory: McGuire 155WC or Zurn Z-8746.
 8. Offset Trap Arm for ADA Sink: McGuire 1151AWC or Zurn Z-8749.
 9. Escutcheons: McGuire chrome plated WE125TR, WE150, WE125D and WE150D or Zurn.
- K. Insulation: provide white molded closed cell vinyl pre-fab insulation on P-Trap and on both hot and cold water supply for barrier free lavatories and sinks. Acceptable manufacturers: Plumberex, True-Bro, and Zurn. Bag type insulators are not acceptable.

2.2 FIXTURE LISTING

- A. Refer to Plumbing Fixture Schedule located on the Drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.
- C. Examine walls, floors and cabinets for suitable conditions where fixtures are to be installed.
- D. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.
- E. Comply with the installation requirements of ADA with respect to plumbing fixtures for the physically handicapped.
- F. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
- G. Install a stop valve in an accessible location in the water connection to each fixture.
- H. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.
- I. Seal fixtures to walls and floors using silicone sealant as specified in DIVISION 7. Match sealant color to fixture color.
- J. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
- K. Inspect each installed unit for damage. Replace damaged fixtures.
- L. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream.
- M. Replace washers or cartridges of leaking or dripping faucets and stops.
- N. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.
- O. During construction cover all installed fixtures, sinks, and water coolers with cardboard boxes and wrap with Visqueen.
- P. Provide flush valve and faucet support behind wall.

END SECTION 22 40 00

END DIVISION 22 – PLUMBING

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 05 00 BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and DIVISION 1 – GENERAL REQUIREMENTS, and shall include all Mechanical Sections specified herein.

1.2 SCOPE OF THIS SECTION

- A. All work to be furnished and installed under this Section shall comply with all the requirements of DIVISION 1, and shall include, but not necessarily be limited to, the following:
 - 1. Compliance with all codes and standards applicable to this jurisdiction
 - 2. Shop Drawings for Equipment
 - 3. Coordination Documents
 - 4. Record Drawings
 - 5. Start-up Service and Building Commissioning
 - 6. Instruction, Maintenance, and O & M Manuals
 - 7. Work associated with Delivery, Storage, and Handling of products
 - 8. Work associated with provision of Temporary Facilities
 - 9. Preparation of Posted Operating Instructions
 - 10. Meeting Project Safety and Indemnity requirements
 - 11. Proper Cleaning and Closing
 - 12. Supplying proper Warranty information
 - 13. Supply specified Guarantee documentation
 - 14. Design and provision of Supports and Anchors
 - 15. Pipe Portals
 - 16. Pipe Supports
 - 17. Equipment Rails
 - 18. Access Panels and Doors
 - 19. Identification Markers
 - 20. Coordination of Electrical requirements for equipment provided

1.3 DESCRIPTION OF WORK

- A. The Contract Documents, including Specifications and Construction Drawings, are intended to provide all material and labor to install complete heating, ventilating, air conditioning systems for the building and shall interface with all existing building systems affected by new construction.

- B. The Contractor shall refer to the architectural interior details, floor plans, elevations, and the structural and other Contract Drawings and he shall coordinate his work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of the fixtures, equipment, and pipe lines and are not to be scaled; all dimensions and existing conditions shall be checked at the building.
- C. The Contractor shall comply with the project closeout requirements as detailed in General Requirements of DIVISION 1.
- D. Where project involves interface with existing building and site systems, every effort has been made to note existing utilities and services. However, the Contractor should thoroughly familiarize themselves with existing conditions and be aware that in some cases information is not available as to concealed conditions, which exist in portions of the existing building affected by this work.

1.4 DESCRIPTION OF BID DOCUMENTS

- A. Specifications:
 1. Specifications, in general, describe quality and character of materials and equipment.
 2. Specifications are of simplified form and include incomplete sentences.
- B. Drawings:
 1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation.
 2. Before proceeding with work check and verify all dimensions.
 3. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
 4. Make adjustments that may be necessary or requested, in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
 5. Where existing pipes, conduits and/or ducts prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits and/or ducts. Verify exact location and elevation of existing piping prior to any construction.
 6. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect or Engineer for his interpretation and decision as early as possible.

1.5 DEFINITIONS

- A. "Above Grade": Not buried in the ground and not embedded in concrete slab on ground.
- B. "Accessible": Ability to perform recommended maintenance without removal of services or equipment and requiring no special platforms.
- C. "Actuating" or "Control" Devices: Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.
- D. "Below Grade": Buried in the ground or embedded in concrete slab on ground.
- E. "Concealed": Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures. In general, any item not visible or directly accessible.

- F. "Connect": Complete hook-up of item with required service.
- G. "Exposed": Not installed underground or "concealed."
- H. "Furnish": To supply equipment and products as specified.
- I. "Indicated," "Shown" or "Noted": As indicated, shown or noted on Drawings or Specifications.
- J. "Install": To erect, mount and connect complete with related accessories.
- K. "Motor Controllers": Manual or magnetic starters (with or without switches), individual push buttons or hand-off-automatic (HOA) switches controlling the operation of motors.
- L. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.
- M. "Provide": To supply, install and connect as specified for a complete, safe and operationally ready system.
- N. "Reviewed," "Satisfactory" or "Directed": As reviewed, satisfactory, or directed by or to Architect/Engineer/Owner.
- O. "Rough-In": Provide all indicated services in the necessary arrangement suitable for making final connections to fixture or equipment.
- P. "Shall": An exhortation or command to complete the specified task.
- Q. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified products.
- R. "Supply": To purchase, procure, acquire and deliver complete with related accessories.
- S. "Typical" or "Typ": Exhibiting the qualities, traits, or characteristics that identify a kind, class, number, group or category. Of or relating to a representative specimen. Application shall apply to all other similarly identified on plan or detail.
- T. "Will": A desire to complete the specified task. Allows some flexibility in application as opposed to "Shall".
- U. "Wiring": Raceway, fittings, wire, boxes and related items.
- V. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

1.6 RELATED WORK SPECIFIED ELSEWHERE

- A. All DIVISION 23 Mechanical sections included herein.
- B. DIVISION 33: Utility Site Work. Coordination with Civil Engineer
 - 1. Coordination of excavation of trenches and the installation of mechanical systems and piping on site.
- C. DIVISION 3: Concrete.
 - 1. All concrete work for Mechanical Division shall be included in DIVISION 23 under the appropriate Sections and shall include:
 - a. Concrete curbs and housekeeping pads for the mechanical equipment.
 - b. Thrust blocks, pads, and boxes for mechanical equipment.

- c. Coordination of floor drain and floor sink installations in sloped floors.
- D. DIVISION 7 – THERMAL AND MOISTURE PROTECTION.
 - 1. Flashing and sheet metal
 - 2. Sealants and caulking
 - 3. Firestopping
- E. DIVISION 9 – FINISHES:
 - 1. DIVISION 23 installers shall perform all painting, except where specifically stated otherwise in DIVISION 9.
 - 2. Painting of all exposed steel, piping, ductwork, insulation, equipment and materials
 - 3. Paint all exposed gas piping, interior and exterior to the building, yellow.
- F. DIVISION 26 – ELECTRICAL is related to work of:
 - 1. Power connections to all mechanical equipment

1.7 CODES AND STANDARDS

- A. The Contractor is cautioned that code requirements not explicitly detailed in these specifications or drawings, but which may be reasonably inferred or implied from the nature of the project, must be provided as part of the contract.
- B. Perform all tests required by governing authorities and required under all DIVISION 23 Sections. Provide written reports on all tests.
- C. Electrical devices and wiring shall conform to the latest standards of NEC; all devices shall be UL listed and labeled.
- D. All mechanical work shall comply with the Americans with Disabilities Act (ADA).
- E. All excavation work must comply with all provisions of state laws including notification to all owners of underground utilities at least 48 business day hours, but not more than 10 business days, before commencing an excavation.
- F. Provide in accordance with rules and regulations of the following:
 - 1. Building Codes enforced by the Authority Having Jurisdiction:
 - a. 2010 Building Standards Administrative Code, Part 1, Title 24 C.C.R.
 - b. 2010 California Building Code (CBC), Part 2, Title 24 C.C.R.(2009 International Building Code and 2010 California Amendments)
 - c. 2010 California Electrical Code (CEC), Part 3, Title 24 C.C.R. (2008 National Electrical Code and 2010 California Amendments)
 - d. 2010 California Mechanical Code (CMC) Part 4, Title 24 C.C.R. 2009 Uniform Mechanical Code and 2010 California Amendments)
 - e. 2010 California Plumbing Code (CPC), Part 5, Title 24 C.C.R. (2009 Uniform Plumbing Code and 2010 California Amendments)
 - f. 2010 California Energy Code (CEC), Part 6, Title 24 C.C.R.

- g. 2010 California Fire Code, Part 9, Title 24 C.C.R. (2009 International Fire Code and 2010 California Amendments)
 - h. 2010 California Green building Standards Code (CALGreen), Part 11, Title 24 C.C.R.
 - i. 2010 California Referenced Standards, Part 12, Title 24 C.C.R.
 - j. Title 19 C.C.R. Public Safety, State Fire Marshal Regulations.
- 2. Local, city, county and state codes and ordinances
 - 3. Local Bureau of Buildings
 - 4. Local Health Department
 - 5. Local and State Fire Prevention Districts
 - 6. State Administrative Codes
- G. Provide in accordance with appropriate referenced standards of the following:
- 1. NFPA - National Fire Protection Association
 - 2. AABC - Associated Air Balance Council
 - 3. CSA - Canadian Standards Association
 - 4. ADC - Air Diffuser Council
 - 5. AMCA - Air Moving and Conditioning Association
 - 6. ANSI - American National Standards Institute
 - 7. ARI - Air Conditioning and Refrigeration Institute
 - 8. ASHRAE - American Society of Heating, Refrigerating & Air Conditioning Engineers
 - 9. ASME - American Society of Mechanical Engineers
 - 10. ASTM - American Society for Testing Materials
 - 11. AWS - American Welding Society
 - 12. FM - Factory Mutual
 - 13. MSS - Manufacturer's Standardization Society
 - 14. NEMA - National Electrical Manufacturer's Association
 - 15. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
 - 16. UL - Underwriter's Laboratories
 - 17. ADA - Americans with Disabilities Act
 - 18. ETL - Electrical Testing Laboratories

1.8 QUALITY ASSURANCE

- A. Manufacturer's Nameplates: Nameplates on manufactured items shall be aluminum or Type 304 stainless steel sheet, not less than 20 USG (0.0375"), riveted or bolted to the manufactured item, with nameplate data engraved or punched to form a non-erasable record of equipment data.

- B. Current Models. All work shall be as follows:
 - 1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
 - 2. Replacement parts shall be readily available and stocked in the USA.
- C. Experience: Unless more stringent requirements are specified in other sections of DIVISION 23, manufactured items shall have been installed and used, without modification, renovation or repair, on other projects for not less than one year prior to the date of bidding for this project.

1.9 GENERAL REQUIREMENTS

- A. Examine all existing conditions at building site.
- B. Review contract documents and technical specifications for extent of new work to be provided.
- C. Provide and pay for all permits, licenses, fees and inspections.
- D. Prepare a Construction IAQ Management Plan meeting the SMACNA IAQ guidelines. See SECTION 23 31 13 - AIR DISTRIBUTION for a summary of requirements.
- E. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing. This work shall include furnishing and installing all access doors required for mechanical access.
- F. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to Equipment Specifications in DIVISION 2 through DIVISION 33 for rough-in requirements.
- G. Coordinate mechanical equipment and materials installation with other building components.
- H. Verify all dimensions by field measurements.
- I. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
- J. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- K. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- L. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials. Contractor to provide for all cutting and patching required for installation of his work unless otherwise noted.
- M. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- N. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, without interference with other installations.
- O. Coordinate the installation of mechanical materials and equipment above ceilings with ductwork, piping, conduits, suspension system, light fixtures, cable trays, sprinkler piping and heads, and other installations.

- P. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- Q. Coordinate with Owner in advance to schedule shutdown of existing systems to make new connections. Provide valves in new piping to allow existing system to be put back in service with minimum down time.
- R. Coordinate installation of floor drains and floor sinks with work of other trades, such that finished floor slopes to drains and floor sinks are flush with surrounding floor.
- S. Products made of or containing lead, asbestos, mercury or other known toxic or hazardous materials are not acceptable for installation under this Division. Any such products installed as part of the work of the Division shall be removed and replaced and all costs for removal and replacement shall be borne solely by the installing Contractor.

1.10 MINOR DEVIATIONS

- A. The Drawings are diagrammatic and show the general arrangements of all mechanical work and requirements to be performed. It is not intended to show or indicate all offsets, fittings, and accessories which will be required as a part of the work of this section.
- B. The Contractor shall review the structural and architectural conditions affecting his work. It is the specific intention of this section that the contractor's scope of work shall include:
 - 1. Proper code complying support systems for all equipment whether or not scheduled or detailed on drawings or in these specifications
 - 2. Minor deviations from the mechanical plans required by architectural and structural coordination.
- C. The Contractor shall study the operational requirements of each system, and shall arrange his work accordingly, and shall furnish such fittings, offsets, supports, accessories, as are required for the proper and efficient installation of all systems from the physical space available for use by this section. This requirement extends to the Contractor's coordination of this section's work with the "Electrical Work". Should conflicts occur due to lack of coordination, the time delay, cost of rectification, demolition, labor and materials, shall be borne by the Contractor and shall not be at a cost to the Owner.
- D. Minor deviations in order to avoid conflict shall be permitted where the design intent is not altered.
- E. Advise the Architect, in writing, in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.

1.11 PRODUCT SUBSTITUTIONS

- A. The Contractor shall certify the following items are correct when using substituted products other than those scheduled or shown on the drawings as a basis of design:
 - 1. The proposed substitution does not affect dimensions shown on drawings.
 - 2. The Contractor shall pay for changes to building design, including engineering design, detailing, structural supports, and construction costs caused by proposed substitution.
 - 3. The proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.

4. Maintenance and service parts available locally are readily obtainable for the proposed substitute.
- B. The Contractor further certifies function, appearance, and quality of proposed substitution are equivalent or superior to specified item.
- C. The Contractor agrees that the terms and conditions for the substituted product that are found in the contract documents apply to this proposed substitution.
- D. Product substitutions shall also comply with SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS. Should any conflict arise between this specification Section and SECTION 01 33 00 - PRODUCT SUBMITTALS AND SUBSTITUTIONS, the latter shall take precedence.

1.12 SHOP DRAWINGS AND EQUIPMENT SUBMITTALS

- A. Prior to construction submit for review all materials and equipment in accordance with DIVISION 1 requirements.
- B. After approval of preliminary list of materials, the Contractor shall submit Shop Drawings and manufacturer's Certified Drawings to the Architect for approval.
- C. The Contractor shall submit **approved** Shop Drawings and manufacturer's equipment cuts, of all equipment requiring connection by DIVISION 26, to the Electrical Contractor for final coordination of electrical requirements. Contractor shall bear all additional costs for failure to coordinate with DIVISION 26.
- D. Submittals and Shop Drawings:
 1. Submitting contract drawings to demonstrate compliance with the requirement for preparation of shop drawing will not be accepted.
 2. Paper Submittals: Provide submittal as a complete package bound in a 3-ring binder with tabs for each specification section. Submit six (6) typed copies of submittals
 3. Electronic Submittals: Provide electronic submittals as a coordinated package.
 4. The approved submittals shall be converted into Operations & Maintenance Manuals at the completion of the project. Refer to DIVISION 1 for additional requirements.

1.13 COORDINATION DOCUMENTS

- A. The Contractors shall prepare coordinated Shop Drawings or electronic versions thereof to coordinate the installation and location of all HVAC equipment, ductwork, grilles, diffusers, piping, fire sprinklers, lights, audio/video systems, electrical services and all system appurtenances. The Drawings shall include all mechanical rooms and floor plans. The Drawings shall be coordinated drawings using either Overlay Drawings showing each discipline on a single sheet or electronic documents intended for the same purpose. The Drawings shall be keyed to the structural column identification system, and shall be progressively numbered. Prior to completion of the Drawings, the Contractor shall coordinate the proposed installation with the Architect and the structural requirements, and all other trades (including HVAC, Plumbing, Fire Protection, Electrical, Ceiling Suspension, and Tile Systems), and provide reasonable maintenance access requirements. When conflicts are identified, modify system layout as necessary to resolve. Do not fabricate, order or install any equipment or materials until coordination documents are approved by the General Contractor, Architect, and Owner. Within thirty (30) days after award of Contract, submit proposed coordination document Shop Drawing schedule, allowing adequate time for review and approval by

parties mentioned above. Drawings or electronic coordination should be prepared and submitted for approval on a floor-by-floor basis to phase with building construction.

- B. The coordination work shall be prepared as follows:
 - 1. Two dimensional paper or AutoCAD based documents:
 - a. The Sheet Metal (Mechanical) Contractor shall prepare Drawings to an accurate scale of 1/4" = 1'-0" or larger, on reproducible media sheets or AutoCAD files. Lettering shall be minimum 1/8" high. Provide a "Hold Harmless Release" to obtain paper or AutoCAD files of the HVAC design from the Architect, or Engineer. Drawings are to be same size as Contract Drawings and shall indicate location, size and elevation above finished floor, of all HVAC equipment, ductwork, and piping. Plans shall also indicate proposed ceiling grid and lighting layout, as shown on electrical plans and reflected ceiling plans.
 - b. The Plumbing Contractor shall obtain reproducible plans or AutoCAD files from the Mechanical Contractor, and indicate all plumbing lines including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
 - c. The Fire Protection Contractor shall obtain reproducible plans or AutoCAD files with the detailed mechanical and plumbing work shown. The Sprinkler Contractor shall indicate location of all sprinkler heads and piping, including valves and fittings, dimensions from column lines, and bottom of pipe elevations above finished floor.
 - d. Plans are to incorporate all addenda items and change orders.
 - e. Distribute plans to all trades and provide additional coordination as needed.
- C. Advise the Architect in the event a conflict occurs in the location or connection of equipment. Bear all costs for relocation of equipment, resulting from failure to properly coordinate the installation or failure to advise the Architect of conflict.
- D. Provide means of access to all valves, dampers, controllers, operable devices, and other apparatus that may require adjustment or servicing.
- E. Verify in field exact size, location, invert, and clearances regarding all existing material, equipment and apparatus, and advise the Architect of any discrepancies between those indicated on the Drawings and those existing in the field prior to any installation related thereto.
- F. Final Coordination Drawings with all appropriate information added are to be submitted as Record Drawings at completion of project.
- G. Provide copy of Record Drawings to Testing and Balancing Contractor for their use when doing their work.

1.14 RECORD DRAWINGS

- A. Before commencing installation, obtain an extra set of prints from Architect, marked "Record". Keep this set of Drawings at the job site at all times, and use it for no other purpose but to mark on it all the changes and revisions to the Contract Drawings resulting from coordination with other trades. At the completion of the project:
 - 1. Obtain a clean set of reproducible from the Architect or Engineer, at cost plus, and transfer the revisions to these reproducible in a neat and orderly fashion.

OR

2. Edit project AutoCAD files to incorporate all site markups, changes, and revisions to the Contract Drawings. Submit plots of Record Drawings and six copies CD Roms labeled with all record AutoCAD drawing files.
- B. Provide copy of Record Drawings to Testing and Balancing Contractor for use when doing his work.
- C. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e. – valves, traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- D. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.
- E. Refer also to Special Conditions in DIVISION 1 for full scope of requirements.

1.15 START-UP SERVICE AND BUILDING COMMISSIONING

- A. Prior to start-up, be assured that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrication, venting, controls, and installed and properly set relief and safety valves.
- B. Provide services of factory-trained technicians for start-up of air conditioning units, temperature controls, chillers, boilers, pumps, and other major pieces of equipment. Certify in writing compliance with this Paragraph, stating names of personnel involved and the date work was performed.
- C. Provide certificates of calibration for all sensors required for control and monitoring including temperature and pressure.
- D. Refer to other DIVISION 23 Sections for additional requirements.

1.16 INSTRUCTION, MAINTENANCE, AND O&M MANUALS

- A. O&M Manuals: Upon completion of the work, and prior to training of Owner's personnel, the Contractor shall submit to the Architect complete set of operating instructions, maintenance instructions, part lists, and all other bulletins and brochures pertinent to the operation and maintenance for equipment furnished and installed as specified in this section, bound in a durable binder. Refer to DIVISION 1.
- B. Contractor shall be responsible for providing proper instruction of the of Owner's personnel for operation and maintenance of equipment, and apparatus installed as specified in DIVISION 23 to be no less than two hours for each piece of equipment. The Contractor shall develop and submit training materials prior to this training. These materials shall include qualifications of the trainer, training agenda, learning objectives, and a written test to be administered at the end of the training session. Operation and Maintenance manuals must present, incorporated and referenced in the training sessions.

1.17 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Store equipment and materials in an environmentally controlled area at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage. Piping shall be stored in bundles covered with visqueen. Piping showing signs of rust shall be removed from site and replaced.
- C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.18 POSTED OPERATING INSTRUCTIONS

- A. Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. Attach or post operating instructions adjacent to each principal system and equipment including start-up, operating, shutdown, safety precautions and procedure in the event of equipment failure. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal.

1.19 SAFETY AND INDEMNITY

- A. The Contractor shall be solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal hours of work.
- B. No act, service, Drawing, review, or Construction Review by the Owner, Architect, the Engineers or their consultants, is intended to include the review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify and defend the Owner, the Architect, the Engineers and their consultants, and each of their officers, employees and agents from any and all liability claim, losses or damage arising, or alleged to arise from bodily injury, sickness, or death of a person or persons, and for all damages arising out of injury to or destruction of property arising directly or indirectly out of, or in connection with, the performance of the work under the Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the Construction Contract Documents; but not including the sole negligence of the Owner, the Architect, the Engineers, and their consultants or their officers, employees and agents.

1.20 CLEANING AND CLOSING

- A. All work shall be inspected, tested, and approved before being concealed or placed in operation.
- B. Upon completion of the work, all equipment installed as specified in this section, and all areas where work was performed, shall be cleaned to provide operating conditions satisfactory to the Architect.

1.21 WARRANTIES

- A. All equipment shall be provided with a minimum one-year warranty to include parts and labor. Refer to individual Equipment Specifications for extended or longer-term warranty requirements.
- B. Provide complete warranty information for each item, to include product or equipment, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, telephone numbers and procedures for filing a claim and obtaining warranty services.
- C. Service during warranty period: Contractor shall provide maintenance as specified elsewhere during the 12-month warranty period.

1.22 GUARANTEE

- A. The Contractor shall guarantee and service all workmanship and materials to be as represented by him and shall repair or replace, at no additional cost to the Owner, any part thereof which may become defective within the period of one (1) year after the Date of Final Acceptance, ordinary wear and tear excepted.
- B. Contractor shall be responsible for and pay for any damages caused by or resulting from defects in his work.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Furnish and install all new material, equipment, and apparatus hereinafter specified unless specifically noted otherwise. All material, equipment, and apparatus shall be identified by the manufacturer's name, nameplate, and pertinent data.
- B. All materials, equipment, and apparatus are mentioned as standards unless noted otherwise. The words "or approved equal" shall be considered to be subsequent to all manufacturers' names used herein, unless specifically noted that substitutes are not allowed.

2.2 SUPPORTS AND ANCHORS

- A. General: Comply with applicable codes pertaining to product materials and installation of supports and anchors, including, but not limited to, the following:
 - 1. UL and FM Compliance: Provide products, which are UL listed and FM approved.
 - 2. ASCE 7-05: "American Society of Civil Engineers."
 - 3. 2009 International Building Code (IBC)
 - 4. MSS Standard Compliance: Manufacturer's Standardization Society (MSS).
 - 5. SMACNA: "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 - 6. NFPA: Pamphlet number 13 and 14 for fire protection systems.
 - 7. Provide copper plated or plastic coated supports and attachment for copper piping systems. Field applied coatings or tape is unacceptable.
 - 8. Manufacturer: Hilti Inc., B-Line, Anvil International, Michigan, Tolco, Kin-Line, Simpson Strong-Tie Co. Inc., or Superstrut.

- B. Horizontal Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated hangers and supports of one of the following MSS types listed.
1. Adjustable Steel Clevis Hangers: MSS Type 1.
 2. Adjustable Steel Swivel Band Hangers: MSS Type 10.
 3. U-Bolts: MSS Type 24.
 4. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
 - a. Plate: Unguided type.
 - b. Plate: Guided type.
 - c. Plate: Hold-down clamp type.
 5. Pipe Saddle Supports: MSS Type 36, including steel pipe base support and cast iron floor flange.
 6. Pipe Saddle Supports with U-Bolt: MSS Type 37, including steel pipe base support and cast iron floor flange.
 7. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast iron floor flange.
 8. Single Pipe Roller with Malleable Sockets: MSS Type 41.
 9. Adjustable Roller Hangers: MSS Type 43.
 10. Pipe Roll Stands: MSS Type 44.
 11. Pipe Guides: Provide factory-fabricated guides of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.
- C. Horizontal Cushioned Pipe Clamp: Where pipe hangers are called out to absorb vibration or shock install a piping clamp with thermoplastic elastomer insert. Cush-A-Clamp or equal.
- D. Vertical Piping Clamps: Provide factory-fabricated two-bolt vertical piping riser clamps, MSS Type 8.
- E. Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments of one of the following MSS types listed.
1. Steel Turnbuckles: MSS Type 13.
 2. Steel Clevises: MSS Type 14.
 3. Swivel Turnbuckles: MSS Type 15.
 4. Malleable Iron Eye Sockets: MSS Type 16.
 5. Steel Weldless Eye Nuts: MSS Type 17.
- F. Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments of one of the following types listed.
1. Concrete Inserts: HCI-MD (for metal deck) or HCI-WF (for wood forms) cast-in anchors by Hilti Inc. or MSS Type 18 or Blue Banger Hanger by Simpson Strong-Tie Co. Inc.

2. Steel Brackets: One of the following for indicated loading:
 - a. Light Duty: MSS Type 31.
 - b. Medium Duty: MSS Type 32.
 - c. Heavy Duty: MSS Type 33.
 3. Horizontal Travelers: MSS Type 58.
 4. Concrete Screw Anchors: KWIK HUS EZ-I by Hilti Inc., Titen HD (or Rod Hanger version) by Simpson Strong-Tie Co. Inc. or approved equal.
 5. Torque-Controlled Expansion Anchor: KWIK BOLT-TZ by Hilti Inc., Strong-Bolt 2 by Simpson Strong-Tit Co. Inc or approved equal.
- G. Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
1. Pipe Covering Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
 2. Insulation Protection Shields: MSS Type 40, 18" minimum, or of the length recommended by manufacturer to prevent crushing of insulation. High-density insulation insert lengths shall match or exceed shield length.
 3. Thermal Hanger Shields: Constructed of 360° insert of waterproofed calcium silicate (60 psi flexural strength minimum) encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation. Shield length shall match or exceed length of calcium silicate insert. Alternately Polyisocyanurate Urethane with a minimum flexural strength of 60psi, fully encased in 360 PVC (1.524 mm thick)SNAPPITZ. Provide assembly of same thickness as adjoining insulation.
 4. Thermal Hanger Couplings: Constructed of high strength plastic coupling to retain tubing and join insulation at clevis hangers and strut-mounted clamps. Klo-Shure Insulation Coupling or equal.
- H. Miscellaneous Materials:
1. Metal Framing: Provide products complying with NEMA STD ML1.
 2. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A36.
 3. Cement Grout: Portland Cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand by volume, with minimum amount of water required for placement and hydration.
 4. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required. Weld steel in accordance with AWS standards.
 5. Pipe Brackets: "HoldRite" copper plated brackets. Insulate brackets attached to metal studs with felt.

2.3 PIPE PORTALS

- A. Where pipe portals are not provided by other sections of Specification, provide prefabricated insulated pipe portals as required for piping penetrating through the roof where shown on plans. Field built pipe portals are acceptable alternatives - provide detail of construction for review.

- B. Standard pipe portals, unless otherwise noted, shall be constructed as follows:
1. Curb shall be constructed of heavy gauge galvanized steel with continuous welds on shell seams.
 2. Insulation to be 1-½" thick, 3 lb density rigid fiberglass.
 3. Curb to have a raised 3" (minimum), 45° cant.
 4. Curb to have 1-1/2" x 1-1/2" wood nailer (minimum).
 5. Curb height to be 8" (minimum) above roof deck.
 6. Cant shall be raised to match roof insulation thickness.
 7. Cover or flashing to be constructed of galvanized steel or other suitable material to provide sturdy weather tight closure. Provide collars and rubber nipples with draw bands of sizes required by piping. Size curb, cover and nipples per manufacturer's recommendations.
 8. Manufacturer: Roof Products Systems or Pate.

2.4 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic or stainless steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 2. Base: Plastic or stainless steel.
 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 2. Bases: One or more; plastic.
 3. Vertical Members: Two or more protective-coated-steel channels.
 4. Horizontal Member: Protective-coated-steel channel.
 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

- G. Manufacturer: Pate, Roof Products Systems, Portable Pipe Hangers, Roof Top Blox, or Erico Caddy Pyramid.

2.5 EQUIPMENT/PIPING RAILS

- A. Where equipment/pipe rails are not provided by other sections of Specification, provide prefabricated reinforced equipment rails as required for support of equipment and piping. Field built curbs are acceptable alternatives - provide detail of construction for review.
- B. Standard equipment rail, unless otherwise noted, shall be constructed as follows:
 - 1. Construct of heavy gauge galvanized steel with continuous welds on shell seams.
 - 2. Provide internal reinforcing supports welded as required to meet application requirements.
 - 3. Equipment rails to have raised 3" (minimum), 45° cant.
 - 4. Equipment rails to have 1 1/2" x 1 1/2" wood nailer (minimum) and counterflashing.
 - 5. Equipment rail height to be 6" (minimum) above roof deck.
 - 6. Cant shall be raised to match roof insulation thickness.
- C. Equipment rails to be constructed to meet equipment size and weight requirements. Provide tapered rails to match roof pitch where required.
- D. Manufacturer: Pate, Vent Products, Thy Curb or Roof Products Systems.

2.6 ACCESS PANELS AND ACCESS DOORS

- A. Provide all access doors and panels to serve equipment under this work, including those which must be installed, in finished architectural surfaces. Frame of 16-gauge steel, door of 20 gauge steel. 1" flange width, continuous piano hinge, key operated, prime coated. Refer to Architectural Specifications for the required product Specification for each surface. Contractor is to submit schedule of access panels for approval. Exact size, number and location of access panels are not shown on Plans. Access doors shall be of a size to permit removal of equipment for servicing. Access door shall have same rating as the wall or ceiling in which it is mounted. Provide access panel for each trap primer or concealed valve, for fire and combination fire/smoke dampers, and for volume dampers. Use no panel smaller than 12" x 12" for simple manual access, or smaller than 24" x 24" where personnel must pass through. Provide cylinder lock for access door serving mixing or critical valves in public areas.
- B. Included under this work is the responsibility for verifying the exact location and type of each access panel or door required to serve equipment under this work and in the proper sequence to keep in tune with construction and with prior approval of the Architect. Access doors in fire rated partitions and ceilings shall carry all label ratings as required to maintain the rating of the rated assembly.
- C. Acceptable Manufacturers: Milcor, Karp, Nystrom, or Elmdor/Stoneman.
- D. Submit markup of architectural plans showing size and location of access panels required for equipment access for approval by Architect.

2.7 IDENTIFICATION MARKERS

- A. Mechanical Identification Materials: Provide products of categories and types required for each application as referenced in other DIVISION 23 Sections. Where more than single type is specified for application, selection is installer's option, but provide single selection for each product category. Stencils are not acceptable.

B. Plastic Pipe Markers:

1. Snap-On Type: Provide pre-printed, semi-rigid snap-on, color coded pipe markers, complying with ANSI A13.1.
2. Pressure Sensitive Type: Provide pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers, complying with ANSI A13.1. Secure both ends of markers with color coded adhesive vinyl tape.
3. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
4. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

C. Plastic Duct Markers:

1. Provide 4 1/2" x 6" laminated plastic, ANSI A13.1 color coded duct markers with white core lettering.
2. Nomenclature: Include the following:
 - a. Direction of air flow
3. Duct service (supply, return, exhaust, etc.).
 - a. Duct origin (from)
 - b. Duct destination (to)
 - c. Design cfm
4. Provide a minimum of every 20 feet on all ducts with a diameter or width greater than 12".

D. Underground-Type Plastic Line Markers: Provide 6" wide x 4 mils thick multi-ply tape, consisting of solid metallic foil core between 2 layers of plastic tape. Markers to be permanent, bright colored, continuous printed, intended for direct burial service.

E. Valve Tags:

1. Brass Valve Tags: Provide 1 1/2" diameter 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Fill tag engraving with black enamel.
2. Plastic Laminate Valve Tags: Provide 3/32" thick engraved plastic laminate valve tags, with piping system abbreviations in 1/4" high letters and sequenced valve number 1/2" high, and with 5/32" hole for fasteners.
3. Valve Tag Fasteners: Provide solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
4. Access Panel Markers: Provide 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.
5. Non-potable Water Tags: 1/16" thick, engraved, plastic tags as indicated on Drawings.

F. Plastic Equipment Signs:

1. Provide 4-1/2" x 6" plastic laminate sign, ANSI A.13 color coded with engraved white core lettering.
2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
3. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters, such as pressure drop, entering and leaving conditions, rpm, etc.

G. Acceptable Manufacturers: Craftmark, Seton, Brady, Marking Services, Inc., or Brimar.

2.8 ELECTRICAL

A. General:

1. All electrical material, equipment, and apparatus specified herein shall conform to the requirements of DIVISION 26.
2. Provide all motors for equipment specified herein. Provide motor starters, controllers, and other electrical apparatus and wiring which are required for the operation of the equipment specified herein.
3. Set and align all motors and drives in equipment specified herein.
4. Provide expanded metal or solid sheet metal guards on all V-belt drives to totally enclose the drive on all sides. Provide holes for tachometer readings. Support guards separately from rotating equipment.
5. Provide for all rotating shafts, couplings, etc., a solid sheet metal, inverted "U" cover over the entire length of the exposed shaft and support separately from rotating equipment. Cover shall extend to below the bottom of the shaft and coupling, and shall meet the requirements of the State Industrial Safety Regulations.
6. Specific electrical requirements (i.e., horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.

B. Quality Assurance:

1. Electrical components and materials shall be UL or ETL listed/labeled as suitable for location and use - no exceptions.

C. Motors:

1. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment Specifications.
2. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.

3. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. Unless otherwise noted on plans, all motors ½ HP or larger shall be rated for 208 or 460 volt, 3-phase, operation. Unless otherwise noted on plans, all motors less than 1/2 HP shall be rated for 120 volt, single phase operation.
4. Temperature Rating: Motor meets class B rise with class F insulation.
5. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.
6. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design “B”, except “C” where required for high starting torque.
 - a. Frames: NEMA Standard No. 48 or 56; use driven equipment manufacturer's standards to suit specific application.
 - b. VFD driven motors to be provided as inverter ready and equipped with a shaft grounding device, or inverter duty complying with NEMA Standard MG-1, Part 31 as supplied by same manufacturer as VFD.
 - c. Bearings:
 - i. Ball or roller bearings with inner and outer shaft seals.
 - ii. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
 - iii. Designed to resist thrust loading where belt drives or other drives product lateral or axial thrust in motor.
 - iv. For fractional horsepower, light duty motors, sleeve type bearings are permitted.
 - v. Enclosure Type:
 - a) Open drip-proof (ODP) motors for indoor use in clean air environments.
 - b) Totally enclosed fan cooled (TEFC) motors for outdoor use and indoor application in dirty environments.
 - c) Totally enclosed air over (TEAO) motors for motors in the airstream of cooling towers and fluid coolers.
 - d) Guarded drip-proof motors where exposed to contact by employees or building occupants.
 - e) Weather protected Type I for outdoor use, Type II where not housed.
 - d. Overload Protection: Built-in thermal overload protection where external overload protection is not provided and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
 - e. Noise Rating: “Quiet.”
 - f. Efficiency:
 - i. Motors shall have a minimum efficiency per governing State or Federal codes, whichever is higher.
 - ii. Motors shall meet the NEMA premium efficiency standard.

- g. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
- D. Starters and Electrical Devices:
 - 1. Motor Starter Characteristics:
 - a. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs.
 - b. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
 - 2. Manual switches shall have pilot lights and all required switch positions for multi-speed motors. Overload Protection: Melting alloy or bi-metallic type thermal overload relays, sized according to actual operating current (field measured).
 - 3. Magnetic Starters:
 - a. Heavy duty, oil resistant, hand-off-auto (HOA), or as indicated, and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
 - b. Trip-free thermal overload relays, each phase, sized according to actual operating current (field measured).
 - c. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of DIVISION 23 Controls sections.
 - d. Built-in primary and secondary fused control circuit transformer, supplied from load side of equipment disconnect.
 - e. Externally operated manual reset.
 - f. Under-voltage release or protection for all motors over 20 hp.
 - 4. Motor Connections: Liquid tight, flexible conduit, except where plug-in electrical cords are specifically indicated.
- E. Low Voltage Control Wiring:
 - 1. General: 14 gauge, Type THHN, color coded, installed in conduit.
 - 2. Manufacturer: General Cable Corp., Alcan Cable, American Insulated Wire Corp., Senator Wire and Cable Co., or Southwire Co.
- F. Disconnect Switches:
 - 1. Fusible Switches: For equipment 1/2 HP or larger, provide fused, each phase; heavy duty; horsepower rated; spring loaded quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated.
 - 2. Non-Fusible Switches: For equipment less than 1/2 horsepower, switch shall be horsepower rated; toggle switch type with thermal overload quantity of poles and voltage rating as required.

PART 3 - EXECUTION

3.1 GENERAL

- A. Workmanship shall be performed by licensed journeymen or master mechanics and shall result in an installation consistent with the best practices of trades.
- B. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal, or otherwise irregular work unless so indicated on Drawings or approved by Architect.

3.2 MANUFACTURER'S DIRECTIONS

- A. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.
 - 1. If the contractor must deviate from the manufacturer's recommendations provide a letter from the manufacturer indicating the clearance to be provided is acceptable for scheduled performance and maintenance.

3.3 INSTALLATION

- A. Coordinate the work between the various Mechanical Sections and with the work specified under other Divisions. If any cooperative work must be altered due to lack of proper supervision or failure to make proper and timely provisions, the alternations shall be made to the satisfaction of the Engineer and at the Contractor's cost. Coordinate wall and ceiling work with the General Contractor, and his subcontractors in locating ceiling air outlets, wall registers, etc.
- B. Inspect all material, equipment, and apparatus upon delivery and do not install any damaged or defected materials.

3.4 SUPPORTS AND HANGERS

- A. Prior to installation of hangers, supports, anchors, and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives, (if any), installers of other work with requirements specified.
- B. Installation of Building Attachments: Install building attachments at required locations within concrete or on structural steel for proper piping support. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed. Fasten insert securely to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through opening at top of inserts.
- C. Proceed with installation of hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to, proper placement of inserts, anchors, and other building structural attachments.
- D. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

- E. Install hangers within 12 inches of every change in piping direction, end of pipe run or concentrated load, and within 36 inches of every major piece of equipment. Hangers shall be installed on both sides of flexible connections. Where flexible connection connects directly to a piece of equipment only one hanger is required.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- G. Support sprinkler piping and gas independently of other piping.
- H. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- I. Hanger Spacing in accordance with following minimum schedules for support of individual pipes (other spacings and rod sizes may be used in accordance with the SMACNA Seismic Restraint Manual using a safety factor of five):

1. Steel Pipe (Water Filled):

<u>Pipe Size</u>	<u>Max. Hanger Spacing</u>	<u>Rod Size</u>
1/2" to 1 1/4"	5 feet	3/8"
1 1/2" to 2"	7 feet	3/8"
2 1/2" to 3"	10 feet	1/2"
4" to 12"	12 feet	5/8"

2. Steel Pipe (Gas/Air Filled):

<u>Pipe Size</u>	<u>Max. Hanger Spacing</u>	<u>Rod Size</u>
1/2" to 1 1/4"	6 feet	3/8"
1 1/2" and larger	10 feet	1/2"

3. Copper Pipe:

<u>Pipe Size</u>	<u>Max. Hanger Spacing</u>	<u>Rod Size</u>
1/2" to 2"	6 feet	3/8"
2 1/2" and larger	8 feet	1/2"

4. Glass Pipe:

<u>Pipe Size</u>	<u>Max. Hanger Spacing</u>	<u>Rod Size</u>
1/2" to 2"	6 feet	3/8"
2 1/2" and larger	8 feet	1/2"

5. Plastic/Fiberglass Pipe:

<u>Pipe Size</u>	<u>Max. Hanger Spacing</u>	<u>Rod Size</u>
1/2" to 2"	4 feet	3/8"
2 1/2" and larger	6 feet	1/2"

- 6. Caulked Bell and Spigot and Glass Pipe: Provide hanger for each section of pipe, located at shoulder of bell. Where an excessive number of fittings are installed between hangers, provide additional reinforcing.
- 7. Trapeze support: Provide details stamped by a registered structural engineer for the project state indicating trapeze channels, support rod sizes, and spacing.

J. Sloping, Air Venting, and Draining:

1. Steam:

- a. Slope steam piping as specified and as indicated, true to line and grade, and free of traps and air pockets downward a minimum of ¼ inch per 10 ft of run in the direction of flow.
- b. Where horizontal piping must be reduced in size, use eccentric reducers that allow continuous uniform pitch along the bottom of the piping. Avoid concentric reducers in horizontal piping.
- c. Takeoffs from steam mains are to be taken from the top of the main preferably at a 45 degree angle.
- d. Where branch takeoffs are less than 10 feet in length, the branch line is to be pitched back ½ inch per 10 feet providing drip legs.

2. Chilled, heating, and condensing water:

- a. Connect all heating and chilled water branch piping to the bottom or side of their respective mains. Where connection must be made to the top of the main piping, make provision for venting of air.
- b. Provide drain valves and hose adapters at all low points in piping.
- c. Provide vents at all high points in water piping.

K. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connecting equipment.
3. Insulated Piping: Comply with the following installation requirements:
 - a. Clamps: Attach clamps, including spacers, (if any), to piping with clamps projecting through insulation.
 - b. Shields: Where low compressive strength insulation or vapor barriers are indicated on cold or chilled water piping, install shields or inserts.
 - c. Saddles: Where insulation without vapor barrier is indicated install protection saddles.

L. Installation of Anchors:

1. Install anchors at proper locations to prevent excessive stresses and to prevent transfer of loading and stresses to connected equipment.
2. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure.
3. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

4. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends.

M. Equipment Supports:

1. Provide all concrete bases, unless otherwise furnished as work of DIVISION 3. Furnish to DIVISION 3 Contractor scaled layouts of all required bases, with dimensions of bases, and location to column centerlines. Furnish templates, anchor bolts, and accessories necessary for base construction.
2. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks.

N. Adjusting:

1. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
2. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
3. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.5 ROOF CURBS, EQUIPMENT RAILS, PIPE PORTALS

- A. Install per manufacturer's instructions.
- B. Coordinate with other trades so units are installed when roofing is being installed.
- C. Verify roof insulation thickness and adjust raise of cant to match.

3.6 ELECTRICAL REQUIREMENTS

- A. Mechanical Contractor shall coordinate with DIVISION 26 work to provide complete systems as required to operate all mechanical devices installed under this Division of work.
- B. Installation of Electrical Connections: Furnish, install, and wire (except as may be otherwise indicated) all heating, ventilating, air conditioning, etc., motors and controls in accordance with the following schedule and in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC, and NECA's "Standard of Installation" to ensure that products fulfill requirements. Carefully coordinate with work performed under the Mechanical Division of these Specifications.
- C. DIVISION 23 has responsibilities for electrically powered or controlled mechanical equipment which is specified in DIVISION 23 Specifications or scheduled on DIVISION 23 Drawings. The specific division of responsibilities between DIVISION 23 and DIVISION 26 for furnishing or wiring this equipment is as follows:
 1. DIVISION 23 Mechanical Responsibilities:
 - a. Motors: Furnish and install all motors necessary for mechanical equipment.
 - b. Magnetic Starters: Furnish all magnetic starters whether manually or automatically controlled which are necessary for mechanical equipment. Furnish these starters with all control relays or transformers necessary to interface with mechanical controls. If the starter is factory installed on a piece of DIVISION 23 equipment, also furnish and install the power wiring between starter and motor.

- c. Variable Frequency Drives: Provide all VFD's associated with mechanical equipment. If the drive is installed on a piece of factory assembled equipment the wiring between motor and drive is to be provided as part of the factory equipment.
- d. Disconnects: Provide the disconnects which are part of factory wired DIVISION 23 equipment. Factory wiring to include wiring between motor and disconnect or combination starter/disconnect.
- e. Controls: DIVISION 23 Contractor (including the temperature controls subcontractor) is responsible for the following equipment in its entirety. This equipment includes but is not limited to the following:
 - i. Control relays necessary for controlling DIVISION 23 equipment.
 - ii. Control transformers necessary for providing power to controls for DIVISION 23 equipment.
 - iii. Line voltage thermostats.
 - iv. Low or non-load voltage control components.
 - v. Remote bulb thermostats.
 - vi. Non-life safety related valve or damper actuators.
 - vii. Float switches.
 - viii. Solenoid valves, EP and PE switches.
 - ix. Refrigeration controls. (DIVISION 26 provides power to refrigeration panels.)
- f. Fire and Life Safety Equipment:
 - i. Fire/Smoke Dampers: DIVISION 23 is responsible for providing and physically installing the damper and for installing any required control interface wiring to DIVISION 23 controls.
 - a) Where fire/smoke dampers are part of an integrated smoke control system, DIVISION 23 is responsible for providing dampers with necessary end switches for proof of closure. (See SECTION 23 31 13 - AIR DISTRIBUTION.)
 - b) Where these dampers are not part of an integrated area wide smoke detection system, DIVISION 23 is responsible for providing each fire/smoke damper with a dedicated duct detector installed per the requirements of the building code. (See SECTION 23 31 13 - AIR DISTRIBUTION.) If not integral with the damper assembly, the detector is to be installed by DIVISION 23 but wired for damper control by DIVISION 26.
 - ii. Fire Sprinkler System: DIVISION 23 is responsible for providing necessary controls including flow switches and alarm bells.
 - iii. Specialized fire suppression systems: DIVISION 23 is responsible for providing necessary system controls and any required control interface wiring to these controls. DIVISION 26 is responsible for bringing power to point of connection with the system.

- D. DIVISION 26 has responsibilities for electrically powered or controlled mechanical equipment, which is specified in DIVISION 23 Specifications or scheduled on DIVISION 23 Drawings. The specific division of responsibilities between DIVISION 23 and DIVISION 26 for furnishing or wiring this equipment is as follows:
1. DIVISION 26 Electrical Responsibilities:
 - a. Motors: Provide the power wiring for the motors.
 - b. Magnetic Starters: Except where magnetic starters are factory installed on DIVISION 23 factory assembled equipment, DIVISION 26 is to install magnetic starters furnished by DIVISION 23 and install the necessary power wiring to the starter and from the starter to the motor. In the case of factory installed starters, DIVISION 26 is to install the necessary power wiring to the starter.
 - c. Variable Frequency Drives: Physically mount all VFD's, which are not specified to be installed on DIVISION 23 factory assembled equipment. Provide the necessary power wiring to the VFD and from the VFD to the motor except in the case of factory installed VFD's where wiring between the motor and VFD is to be by DIVISION 23. Where disconnects are installed between a VFD and a motor provide the interlocking wiring between the disconnect and VFD to insure that the drive is shutdown simultaneously with motor.
 - d. Disconnects: Provide all disconnects necessary for DIVISION 23 mechanical equipment which are not provided as part of factory wired DIVISION 23 equipment. Provide power wiring to all disconnects. In addition provide power wiring between motor and disconnect when the disconnect is not factory installed. See also Variable Frequency Drive above for special wiring requirements.
 - e. Controls: DIVISION 26 Contractor is responsible for providing power to control panels and control circuit outlets.
 - f. Fire and Life Safety Equipment:
 - i. Fire/Smoke Dampers: DIVISION 26 is responsible for power wiring to the damper and as follows:
 - a) Where these dampers are part of an integrated smoke control system DIVISION 26 is responsible for providing the detectors and for all fire detection system wiring necessary to integrate dampers and related end switches into the system.
 - b) Where these dampers are not part of an integrated area wide smoke detection system, DIVISION 23 is responsible for providing each fire/smoke damper with a dedicated duct detector installed per the requirements of the building code. (See SECTION 23 31 13 - AIR DISTRIBUTION.) If not integral with the damper assembly, the detector is to be installed by DIVISION 23 but wired for damper control by DIVISION 26.
 - ii. Fire Sprinkler System: DIVISION 26 is responsible for providing power wiring to fire protection controls including flow switches and alarm bells.
 - iii. Specialized fire suppression systems: DIVISION 26 is responsible for providing power wiring to suppression system and its controls.

2. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
 3. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
 4. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner, or Architect/Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
 5. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
 6. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- E. Motors and Motor Control Equipment: Conform to the standards of the NEMA. Equip motors with magnetic or manual line starters with overload protection. Motor starters and line voltage controls shall be installed under Electrical Section but located and coordinated as required under this Section of the work. Starters shall be combination type with non-fusible disconnect switches. All single phase fractional horsepower motors shall have built-in overload protection.

3.7 PAINTING

- A. All painting shall be provided under this Division work, unless otherwise specified under SECTION 09 90 00 - PAINTING AND COATING. Painting schemes shall comply with ANSI A13.1. Paint all exposed materials such as piping, ductwork, equipment, insulation, steel, etc. Exposed gas piping inside and outside the building shall be painted with two coats of "Rust-O-Leum" Yellow. The inside surface of visible ductwork above diffusers/grilles shall be painted flat black. Exposed copper indirect waste piping serving food service equipment shall be painted metallic chrome.
- B. All exposed work under DIVISION 23 shall receive either a factory finish or a field prime coat finish, except:
 1. Exposed copper piping.
 2. Aluminum jacketed outdoor insulated piping.

3.8 IDENTIFICATION MARKERS

- A. General: Where identification is to be applied to surfaces which require insulation, painting, or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

- B. Piping System Identification:
1. Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.
 2. Locate pipe markers as follows:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
 - d. At access doors, manholes, and similar access points which permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced horizontally at maximum spacing of 20' along each piping run, with minimum of one in each room. Vertically spaced at each story transversed.
- C. Underground Piping Identification: During backfilling/topsoiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.
- D. Ductwork Identification: A minimum of every 20' for all ductwork 12" or more in diameter or width.
- E. Mechanical Equipment Identification: Locate engraved plastic laminate signs on or near each major item of mechanical equipment and each operational device. Provide signs for the following:
1. Main control and operating valves, including safety devices.
 2. Meters, gauges, thermometers, and similar units.
 3. Pumps, compressors, chillers, and similar motor-driven units.
 4. Hot water system mixing valves and similar equipment.
 5. Boilers, heat exchangers and similar equipment.
 6. Fans, blowers, primary balancing dampers, and mixing boxes.
 7. Packaged HVAC central-station and zone-type units.
 8. Tanks and pressure vessels.
 9. Strainers, filters, treatment systems and similar equipment.
 10. Sprinkler and standpipe equipment.
- F. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations. Equipment signs shall include an identification of the area or other equipment served by the equipment being labeled.

3.9 VIBRATION AND DYNAMIC BALANCING

- A. Vibration tolerances shall be as specified by the “International Research and Development Corporation”, Worthington, Ohio, measured by the displacement, peak to peak, as follows:
 - 1. All Fans: Below severity chart labeled “FAIR”, maximum velocity of 0.0786 in/sec, peak.
 - 2. Pump and Electric Motors: Below severity chart labeled “SLIGHTLY ROUGH”, maximum vibration velocity of 0.157 in/sec, peak.
 - 3. Compressors: Same as pumps.
- B. Correction shall be made to all equipment, which exceeds vibration tolerances specified above. Final vibration levels shall be reported as described above.

3.10 TESTING

- A. Provide all tests specified hereinafter and as otherwise required. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing, that the specified tests have been performed and that the installation complies with the specified requirements and provide a report of the test observations signed by qualified inspector.
- B. Ductwork: Test all air quantities as specified in SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING. Pressure tests per SMACNA.
- C. Registers and Diffusers: Test for proper operation of manually operated control feature. Test all air quantities as specified in SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING.
- D. Temperature Control: Test all control functions to assure that all systems are controlling as specified or as otherwise necessary and that all controls are adjusted to maintain proper room temperatures. The manufacturer's representative shall perform all tests.

END SECTION 23 05 00

SECTION 23 05 93 TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS, and other Sections in DIVISION 23 specified herein.

1.2 WORK RELATED IN OTHER SECTIONS

- A. SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS
- B. SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS
- C. SECTION 23 31 13 - AIR DISTRIBUTION
- D. DIVISION 26 – ELECTRICAL.

1.3 SUMMARY

- A. Scope: Extent of testing, adjusting and balancing work required by this Section is indicated on the drawings, in schedules, and by the requirements of this Section, and SECTION 23 05 00 - BASIC HVAC MECHANICAL REQUIREMENTS.
- B. Systems: Testing, adjusting and balancing specified in this Section shall include, but not be limited to, the following systems:
 - 1. Air handling systems including supply, return and exhaust.
 - 2. Air distribution ductwork including supply, return and exhaust.
 - 3. General exhaust systems.
 - 4. Domestic hot water recirculation piping.
 - 5. Instruction of Owner's personnel for future balancing of systems.
- C. Reference Standards
 - 1. ASHRAE-Standard 111-2008 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, and Air Conditioning Systems.
 - 2. ASHRAE - 2011 HVAC Applications Handbook: Chapter 38--Testing, Adjusting and Balancing.
 - 3. ASHRAE 90.1-2010 Energy Standard for Buildings Except Low-Rise Residential Buildings, Chapter 6.
 - 4. AABC-National Standards for Total System Balance.
 - 5. NEBB-Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
 - 6. SMACNA-HVAC Systems-Testing, Adjusting and Balancing.
 - 7. SMACNA-HVAC Air Duct Leakage Test Manual.
 - 8. Sheet Metal Industry--Testing, Adjusting, Balancing Bureau (TABB) Certified Technician Standards, Procedures and Specifications.

9. American National Standards Institute (ANSI): Comply with the following:
10. Chapter 4 of applicable Mechanical Code.

1.4 QUALITY ASSURANCE

- A. Contractor's Qualifications: A specialist certified by the National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC) with at least 5 years of experience in those testing, adjusting and balancing requirements similar to those required for this project, who is not the installer of the system to be tested and is otherwise independent of the project. Testing, adjusting, and balancing shall be performed by a certified NEBB technician or a certified AABC technician under direct field supervision of a Certified NEBB Supervisor or a Certified AABC Supervisor. Testing and balancing agency must submit qualifications for review and approval prior to acceptance for work.
- B. Penalty: The Contractor shall submit the name of the organization he proposes to employ for approval within 30 days after contract award. If the Contractor fails to submit the name of an acceptable agency within the specified time, a firm may be selected to accomplish the work, and this selection shall be binding upon the Contractor at no additional cost.
- C. Retainages: In addition to any other sums retained or withheld pursuant to the provisions of this Contract, the amount of dollars will be withheld from payments to the contractor until such time as the work has been completed and accepted. In no event will this amount be paid to the Contractor prior to 60 days following acceptance of the project; during such time, the Contractor shall investigate and correct any reported deficiencies unless such deficiencies are a result of unauthorized tampering by building occupants.
- D. Calibration of Testing Instruments: All measurement instruments used for testing, adjusting, balancing, and commissioning shall be calibrated. The time between the most recent calibration data and the final test report date shall not be over 6 months.
- E. Testing and balancing agency, as part of its contract, shall act as authorized inspection agency responsible to Consulting Engineer and Owner, and shall list all items that are installed incorrectly, require correction, or have not been installed in accordance with contract Drawings and Specifications, pertaining to air distribution, cooling and heating systems. The testing and balancing agency is required to provide written reports of all deficiencies and proposed recommendations to the Owner' Representative, Contractor, Architect and Engineer.
- F. The testing and balancing agency shall provide a performance guarantee covering all phases of the work as herein specified.
- G. The General and Mechanical Contractors shall cooperate with the selected testing and balancing agency in the following manner:
 1. Provide sufficient time before final completion dates so that tests and balancing can be accomplished.
 2. The various system installers, suppliers and contractors shall provide all required materials, labor and tools to make corrections when required without undue delay. Install balancing dampers as required by testing and balancing agency.
 3. The contractor shall put all heating, ventilating and air conditioning systems and equipment into full operation and shall continue the operation of the same during each working day of testing and balancing.

4. Testing and balancing agency shall be kept informed of any major changes made to the system during construction, and shall be provided with a complete set of Record Drawings.
5. The General Contractor shall make space and other facilities available to the testing and balancing agency to enable their work to progress. The General Contractor shall schedule the work of other trades to avoid conflicts with this work.

1.5 SUBMITTALS

- A. Conform to the Submittals requirements of DIVISION 1.
- B. Forms: The Contractor shall deliver a complete copy of either NEBB or AABC standard forms for testing and balancing work associated with the project. These forms shall serve as specific guidelines for producing final test report. Hybrid or non-standards forms are not acceptable. Data shall include, but not be limited to, a title page with building information, instrument lists, air flows, water flows, temperatures, sound levels, capacities, nameplate data.
- C. Test Reports: Provide six (6) certified test reports, signed by the test and balance supervisor who performed the work. The final reports shall include identification and types of instruments used, and their most recent calibration date, and key plans identifying all inlets and outlets. Final test reports shall be typed. Hand written reports are not acceptable.
- D. Maintenance Data: Include, in maintenance manuals, copies of certified test reports and identification of instruments.
- E. Qualifications: The Contractor shall submit the certified individual qualifications of all persons responsible for supervising and performing the actual work and the name of the certifying engineer. Provide a reference list of five (5) similar size projects with contact person and telephone number.

1.6 AGENDA

- A. Agenda: A preliminary report and agenda shall be submitted and approved prior to the start of testing and balancing work.
 1. Review plans and specifications prior to installation of any of the affected systems, and submit a report indicating any deficiencies in the systems that would preclude the proper adjusting, balancing, and testing of the systems.
 2. The agenda shall include a general description of each air and water system with its associated equipment and operation cycles for heating and cooling.
 3. The agenda shall include a list of all air and water flows to be performed at all mechanical equipment.
 4. The agenda shall incorporate the proposed selection points for sound measurements, including typical spaces as well as sound sensitive areas such as conference rooms.
 5. The agenda shall also include specific test procedures and parameters for determining specified quantities (e.g. flow, drafts, sound levels) from the actual field measurements to establish compliance with contract requirements. Samples of forms showing application of procedures and calculations to typical systems shall be submitted.
 6. Specific test procedures for measuring air quantities at terminals shall specify type of instrument to be used, method of instrument application (by sketch) and factors for:
 - a. Air terminal configuration.

- b. Flow direction (supply or exhaust).
 - c. Velocity corrections.
 - d. Effective area applicable to each size and type of air terminal.
 - e. Density corrections.
7. The agenda shall include identification and types of measurement instruments to be used, and their most recent calibration date.

1.7 JOB CONDITIONS

- A. General: Do not proceed with testing, adjusting and balancing work until the following conditions have been met.
- 1. Work has been completed and is operable. Ensure that there is no latent residual work yet to be completed on the tested equipment.
 - 2. Work scheduled for testing, adjusting and balancing is clean and free from debris, dirt and discarded building materials.
 - 3. All architectural openings (doors, windows, and other openings) which may affect the operation of the system to be tested, adjusted, and balanced shall be at their normal states.
 - 4. All related mechanical systems which may affect the operation of the system to be tested, adjusted, and balanced shall be at their normal operating conditions.

PART 2 - PRODUCTS

2.1 TEST HOLES

- A. Test holes shall be provided in ducts, housings and pipes as necessary for the proper air and water measurements and to balance systems. At each location where ducts or plenums are insulated, test holes shall be provided with an approved extension with plug fitting.

2.2 PATCHING MATERIALS

- A. Material: Seal, patch and repair ductwork, piping and equipment drilled or cut for testing purposes.
- 1. Plastic plugs with retainers may be used to patch drilled holes in ductwork and housings.
 - 2. Piping shall be capped with materials the same as the piping system.
 - 3. Insulation shall be neatly hemmed with metal or plastic edging, leaving test points visible for future testing.

2.3 TEST INSTRUMENTS

- A. Standards: Utilize instruments and equipment of type, precision, and capacity as recommended in the NEBB "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and AABC manual MN-1.
- B. Test Instruments: All instruments used for measurements shall be accurate and calibration histories for each instrument shall be available for examination. Each test instrument shall be calibrated by an approved laboratory or by the manufacturer. A representative has the right to request instrument recalibration, or the use of other instruments and test methodology, where accuracy of readings is questionable.

- C. Additional Instruments: Permanently installed measuring instruments, such as temperature and pressure gauges, shall be checked against transfer standard instruments. Any instrument which does not meet specification requirement shall be replaced or recalibrated.
- D. Cone Instruments: The Contractor shall employ manufactured enclosure type cones, capable of air volume direct readings, for all diffuser/grille/register air flow measurements. The readout meters shall meet calibration requirements.

PART 3 - EXECUTION

3.1 PROCEDURES AND INSTRUMENTS, GENERAL

- A. Requirements: All systems and components thereof shall be adjusted to perform as required by drawings and specifications.
- B. Test Duration: Operating tests of heating and cooling coils, fans, and other equipment shall be of not less than four hours duration after stabilized operating conditions have been established. Capacities shall be based on temperatures and air and water quantities measured during such tests.
- C. Instrumentation: Method of application of instrumentation shall be in accordance with the approved agenda.
 - 1. All instruments shall be applied in accordance with the manufacturer's certified instructions.
 - 2. All labor, instruments, and appliances required shall be furnished by the Contractor. Permanently installed instruments used for the tests (e.g., flow meters and Btu meters) shall not be installed until the entire system has been cleaned and ready for operation.

3.2 DUCT SMOKE DETECTORS

- A. The testing and balancing agency shall direct the placement of all duct mounted smoke detectors.
 - 1. Obtain information from the Contractor who is to furnish the smoke detectors on the proper device placement and installation limitations and on the proper differential pressure across the sampling tubes of the duct detectors.
 - 2. Based on the submitted manufacturer's installation guidelines indicate the proper mounting location to the installing Contractor.
- B. After the installation of all smoke detectors test them again in the final installation position and report differential pressures.

3.3 AIR SYSTEM PROCEDURES

- A. Adjustments: Adjust all air handling systems to provide approximate design air quantity to or through, each component, and to maintain stable and comfortable interior temperatures, free of drafts or stagnant conditions. Adjusting and balancing of all systems shall be conducted during periods of the year approximating maximum seasonal operation.
- B. Equalizers: Equalizing devices shall be adjusted to provide uniform velocity across the inlets (duct side for supply) of terminals prior to measuring flow rates.

- C. Balance: Flow adjusting (volume control) devices shall be used to balance air quantities (i.e., proportion flow between various terminals comprising system) to the extent that their adjustments do not create objectionable air motion or sound (i.e., in excess of specified limits).
1. Balancing between runs (submains, branch mains, and branches) generally shall be accomplished by flow regulating devices at, or in, the divided-flow fitting.
 2. Restriction imposed by flow regulating devices in or at terminals shall be minimal.
 3. Final measurements of air quality shall be made after the air terminal has been adjusted to provide the optimum air patterns of diffusion.
- D. Fan Adjustment: Total air system quantities, generally, shall be varied by adjustment of fan speeds or axial-flow fan wheel blade pitch. Damper restriction of a system's total flow may be used only for systems with direct-connected fans (without adjustable pitch blades), provided system pressure is less than 1/2-inch W.G. and sound level criteria is met.
- E. Air Measurement: Where air quantity measuring devices are specified in other sections such systems shall be used as a cross-check of portable measuring equipment.
1. Except as specifically indicated herein, pitot tube traverses shall be made of each duct to measure air flow therein. Pitot tubes, associated instruments, traverses, and techniques shall conform to the ASHRAE "Handbook Fundamentals Inch Pound Edition."
 2. For ducts serving modular office areas with movable partitions, which are subject to change, pitot tube traverses may be omitted provided the duct serves only a single room or space and its design volume is less than 2000 cfm. In lieu of pitot tube traverses, airflow in the duct shall be determined by totaling volume of individual terminals served, measured as described herein.
 3. Where duct's design velocity and air quantity are both less than 1000 (fpm/cfm), air quantity may be determined by measurements at terminals served.
- F. Test Holes: Test holes shall be in a straight duct, as far as possible downstream from elbows, bends, take-offs, and other turbulence generating devices, to optimize reliability of flow measurements.
- G. Air Terminal Balancing: Generally, measurement of flow rates by means of velocity meters applied to individual terminals, with or without cones or other adapters, shall be used only for balancing. Measurement of air quantities at each type of air terminal (inlet and outlet) shall be determined by the method approved for the balancing agenda. Laboratory tests shall be conducted to prove of methodology when so directed. Such tests shall be conducted in conformance with applicable ASHRAE or American Society of Mechanical Engineers (ASME) codes and shall be made at no cost.
- H. Air Motion: Air motion and distribution shall be as specified and indicated on drawings. The Contractor at no additional cost shall, in addition to air motion measurements, make smoke tests wherever requested to demonstrate the air distribution from air terminals.
- I. Air system test and balance procedures shall include, but not be limited to the following requirements:
1. Test and adjust blower RPM to design requirements.
 2. Test and record motor full load amperes.
 3. Make pitot tube traverse of main supply ducts and obtain design CFM at fans.
 4. Test and record system pressures, suction and discharge.

5. Test and adjust system for design recirculated air, CFM.
6. Test and adjust system for design CFM outside air.
7. Test and record entering air temperatures.
8. Test and record leaving air temperatures.
9. Adjust all supply, return and exhaust air ducts to proper design CFM.
10. Adjust all zones to proper design CFM, supply and return.
11. Test and adjust duct systems and each diffuser, grille, and/or register to within 10% of design requirements.
12. Each grille, diffuser and register shall be identified as to location and area.
13. Size, type and manufacturer of VAV boxes, diffusers, grilles, registers and all tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations.
14. Readings and tests of diffusers, grilles and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustment.
15. In cooperation with the control manufacturer's representative, setting adjustments of automatically operated dampers to operate as specified, indicated, and/or noted. Testing agency shall check all controls requiring adjustment by control installers. Room thermostats shall be checked for cooling and heating response.
16. All diffusers, grilles and registers shall be adjusted to minimize drafts in all areas.
17. Adjust overall system balances to allow all self-closing exterior doors to close from any open position. Maximum interior air pressure in all operational modes shall not exceed 0.05" static pressure relative to the outside air pressure. Comply with chapter 10 of the Building Code to assure that self-closing doors with release with a maximum force of 15 lbs.
18. As part of the work of this contract, the HVAC contractor shall make any changes in the pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by air balance agency, at no additional cost to Owner.
19. After air balancing is completed and RPM determined, HVAC Contractor shall provide fixed pitch pulleys.
20. All mixing boxes, VAV air valves, control dampers, smoke dampers and similar devices which operate at 100% shut off shall be tested for leakage.
21. Variable Air Volume Fan Systems: The primary balancing mode is 100% outside air with all terminal boxes on a full call for cooling. Also check and record performance at minimum outside air with all terminal boxes on call for full cooling and at minimum outside air with all terminal boxes on call for full heating. Verify that the systems are operating on a stable part of the fan curves in each mode. Record final duct static controller settings
22. Editor-remove the following if no UFAD.
23. Provide testing of underfloor air distribution plenum floor mock-ups and final floor installation to document that plenum does not exceed 5% air leakage rate at maximum 0.10" w.g. positive differential pressure. Editor-remove the following if no stairwells.

24. Stairwell pressurization balancing including doors and vestibule differential pressures and forces as required by the local ordinances and fire marshal.\
25. Editor-remove the following if no smoke control system.
26. Smoke control systems per chapter 9 of the Building Code and as required by the local ordinances and fire marshal.

3.4 AIR SYSTEM DATA

A. Report: The certified report shall include for each air handling system the data listed below.

1. Equipment (Fan or Factory Fabricated Station Unit):
 - a. Installation data
 - i. Manufacturer and model
 - ii. Size
 - iii. Arrangement, discharge and class
 - iv. Motor hp, voltage, phase, cycles, and full load amps
 - v. Location and local identification data
 - b. Design data
 - i. Data listed in schedules on drawings and specifications.
 - c. Fan recorded (test) data
 - i. cfm
 - ii. static pressure
 - iii. rpm
 - iv. motor operating amps
 - v. motor operating bhp
2. Duct Systems:
 - a. Duct air quantities (maximum and minimum) - main, submains, branches, outdoor (outside) air, total air, and exhaust:
 - i. duct size(s)
 - ii. number of pitot tube (pressure measurements)
 - iii. sum of velocity measurements (Note: Do not add pressure measurements)
 - iv. average velocity
 - v. recorded (test) cfm
 - vi. design cfm
 - b. Individual air terminals
 - i. terminal identification supply or exhaust, location and number designation
 - ii. type size, manufacturer and catalog identification applicable factor for application, velocity, area, etc., and designated area

- iii. design and recorded velocities - fpm (state "core," "inlet," etc., as applicable)
- iv. design and recorded quantities - cfm (deflector vane or diffusion cone settings)

3.5 DUCTWORK AIR LEAKAGE TESTING

- A. Test and balance agency shall perform active air flow testing of ductwork systems or sections of ductworks. Agency shall inspect and confirm that all ductwork is sealed per the specification requirements prior to performing any testing. Calculate maximum allowable air leakage by system based on total design air flow rate. Maximum allowable system leakage shall not exceed 5%. Test a random sample of 10% of the ductwork. If any ductwork within the sample fails to meet the criteria than an additional 10% (20% total) sample must be measured. If any ductwork within this second 10% sample fails than 100% of all ductwork must be tested and verified to have a leakage rate than does not exceed the maximum allowable limit.
- B. Ductwork systems to be leakage tested shall include:
 - 1. Testing shall be performed at 1.5 times the peak design outlet static pressure from the air handling unit/fan, but not greater than the maximum SMACNA pressure rating of the ductwork construction classification. Testing is not required of flexible ductwork or ductwork downstream of VAV terminal units.
 - 2. Leakage through manufactured products, such as dampers, fire smoke dampers and terminal units may be excluded from the leakage calculations based on manufacturer stated values, at pressure, or these units may be temporarily sealed with painter's tape during testing to seal any openings and must be removed after testing.
 - 3. Supply air ductwork from outlet of the air handling unit/fan to inlet side of terminal units or connection to flexible ductwork.
 - 4. All supply, return and exhaust air ductwork located outside the building envelope.
 - 5. Return and exhaust air ductwork located in unconditioned spaces from inlet of the air handling unit/fan to the ductwork terminations upstream of each return air grille.
- C. Ductwork installer shall prepare ductwork for pressure testing as deemed appropriate to maintain construction schedule. Ductwork may be tested as total systems or in sections. Sectional testing will require documentation to prove the totalized system leakage is within allowable range of entire system. Ductwork inlets and outlets may be temporarily sealed airtight with plastic, or other means, to facilitate testing pressures.
- D. Testing may occur through ductwork devices such as balancing dampers, smoke fire dampers and coils. Manufacturer provided air leakage allowances for such devices may be excluded from duct leakage measurement but must be documented in final report.
- E. Perform all testing utilizing a duct leakage testing system, Oriflow Duct Leakage Tester or equal, with calibrated fan, orifice, gauges, ductwork, pressure tips and tubing.

3.6 WATER SYSTEM PROCEDURES

- A. Preparation:
 - 1. Open all valves to full open position. Close coil bypass stop valves. Set mixing valve to full coil flow.
 - 2. Remove all strainers and clean same. Reinstall.

3. Examine water system and determine if water has been treated and cleaned.
 4. Check pump rotation.
 5. Check expansion tank to determine they are not air bound and the system is completely full of water.
 6. Check all air vents at high points of water systems and determine that all are installed and operating freely.
 7. Check operation of automatic bypass valve.
 8. Check and set operating temperatures of all equipment at design requirements.
 9. Complete air balance must have been accomplished before actual water balance begins.
- B. Adjustment: All heating, cooling and condensing water systems shall be adjusted to provide required quantity to or through each component.
- C. Metering: Water quantities and pressures shall be measured with calibrated meters.
1. Venturi tubes, orifices, or other metering fittings and pressure gauges shall be used to measure water flow rates and balance systems. Systems shall be adjusted to provide the approved pressure drops through the heat transfer equipment (coils except room units, converters, etc.) prior to the capacity testing.
 2. Where flow metering fittings are not installed, in air/water type heat transfer equipment, flow balance shall be determined by measuring the air side energy differential across the heat transfer equipment. Measurement of water temperature differential shall be performed with the air system, adjusted as described herein, in operation.
- D. Automatic Controls: Automatic control valves shall be positioned for full flow through the heat transfer equipment of the system during tests.
- E. Distribution: Adjustment of distribution shall be effected by means of balancing devices (cocks, valves, and fittings) and automatic flow control valves as provided; service valves shall not be used.
1. Where automatic flow control valves are utilized in lieu of Venturi tubes, only pressure differential need be recorded, provided that the pressure is at least the minimum applicable to the tag rating.
- F. Special Procedures: Where available pump capacity (as designed) is less than total flow requirements of individual heat transfer units of system served, full flow may be simulated by the temporary restriction of flow to portions of the system; specific procedures shall be delineated in the agenda.
- G. Water System Test and Balance Procedure: Perform the following tests, and balance each system in accordance with the following requirements:
1. Set chilled, heating and condenser water pumps to proper gallons per minute delivery.
 2. Adjust chilled water flow through chiller(s).
 3. Adjust heating water flow through boiler(s).
 4. Adjust condenser water flow through cooling tower(s).
 5. Test and record entering and leaving water temperatures through chillers, boilers and cooling towers.

6. Test and record water temperatures at inlet and outlet side of each terminal unit. Note rise or drop of temperatures from source.
7. Proceed to balance each terminal unit.
8. Upon completion of flow readings and adjustments at coils, mark all settings and record data.
9. After adjustments to coils are made, recheck settings at the pumps, chiller, boilers, and cooling towers and readjust if required.
10. Record and check the following items at each coil.
 - a. Inlet water temperatures.
 - b. Leaving water temperatures.
 - c. Water pressure drop of each coil.
11. Pump operating suction and discharge pressures and final total dynamic head.
12. List all mechanical specifications of pumps.
13. Rated and actual running amperage of pump motor.
14. Water metering device readings.

3.7 WATER SYSTEM DATA

A. Report: The certified report for reach water system shall include the data listed below.

1. Pumps:
 - a. Installation data
 - i. manufacturer and model
 - ii. size
 - iii. type drive
 - iv. motor hp, voltage, phase, and full load amps
 - b. Design data
 - i. gpm
 - ii. head
 - iii. rpm and amps
 - c. Recorded data
 - i. discharge pressures (full-flow and no-flow)
 - ii. suction pressures (full-flow and no-flow) operating head
 - iii. operating gpm (from pump curves if metering is not provided) no-load
 - iv. amps
 - v. full-flow amps
 - vi. no-flow amps

2. Air Heating and Cooling Equipment:
 - a. Design data
 - i. load in Btu or MBh
 - ii. gpm
 - iii. entering and leaving water temperature
 - iv. entering and leaving air conditions (DB and WB)
 - v. cfm
 - vi. water pressure drop
 - vii. entering steam pressure
 - b. Recorded data
 - i. type of equipment and identification (location or number designation)
 - ii. entering and leaving air conditions (DB and WB)
 - iii. entering and leaving water temperatures
 - iv. gpm (if metered)
 - v. temperature rise or drop
 - vi. entering steam pressure
3. Water Chilling Units:
 - a. Installation data
 - i. manufacturer and model
 - ii. motor hp, voltage, cycles, phase, and full load amps
 - iii. part load amperes
 - iv. gpm - chiller and condenser
 - v. water pressure drop - chiller and condenser
 - vi. entering and leaving water temperature - chiller and condenser
 - b. Recorded data (chiller and condenser)
 - i. gpm
 - ii. water pressure drop
 - iii. entering and leaving water temperature
 - iv. amperes
4. Heat Exchangers:
 - a. Installation Data
 - i. manufacturer, model, and type
 - ii. flow rate

- iii. inlet (entering) and outlet (leaving) temperatures
- iv. inlet (entering) and outlet (leaving) pressures
- b. Recorded Data
 - i. flow rate
 - ii. entering and leaving water temperatures
 - iii. entering and leaving pressures

3.8 HEAT EXCHANGER CAPACITY VERIFICATION

- A. Air coil capacities shall be verified from air side measurement data. Capacities of coils shall be the difference of the energy carried by the air between the up stream and down stream of the coils.
- B. The measured air flow rate for the fan may be used for air coil capacity calculations providing no ducted bypassing of coil is occurring.
- C. Water/water heat exchanger equipment capacity shall be verified by measuring the flow rate and temperature differential of the water.
- D. Capacity verification shall be performed after air and water systems have been balanced.
- E. False load shall be applied if the upstream air or water does not meet the specified conditions at the time of test.

3.9 SOUND TEST PROCEDURES

- A. Scope: Tests of sound levels shall be made at each selection point included in the agenda.
- B. Timing: Sound level measurements shall be taken at times when the building is unoccupied, or when activity in surrounding areas and background noise level in areas tested are at a minimum and relatively free from sudden changes in noise levels.
 - 1. Measurements shall be taken with all equipment turned off, except that being tested.
 - 2. The required sound levels shall be measured at any point within a room not less than 6 feet from an air terminal or room unit, and not closer than 3 feet from any floor, wall, or ceiling surface.
- C. Meters: Sound levels shall be measured with a sound meter complying with ANSI S1.4. The "A" scale shall be used to measure over all sound levels. To determine the specified octave band levels, the above sound level meter, set on "C" scale, shall be supplemented by an octave band analyzer complying with ANSI S1.11.
- D. Equipment Components: The "Equipment Component" of room sound equals LPt-C. The "Equipment Component" of room sound (noise) levels shall be determined for each of eight octave bands as follows:
 - 1. Measure room sound pressure level "LPb" with equipment to be tested shut off.
 - 2. Measure room sound pressure level "LPt" with equipment to be tested turned on.
 - 3. Calculate LPt-LPb; if this value is less than 1, applicable test must be rerun with lower background level (LPb) unless LPt is within sound pressure level specified for equipment.

4. Determine "c" from the table below.

LPT-LPb (db)	c (db)
1	7
2	4
3	3
4 to 4- ½	2
5 to 5- ½	1 - ½
6 to 7- ½	1
8 to 12	½
over 12	0

3.10 SOUND LEVEL DATA

- A. Report: certified report shall record data on sound levels, taken at each selected location, as follows:
 1. Source of sound and location.
 2. Diagram or description of relationship of sound source to measuring instrument.
 3. "A" scale readings equipment being tested turned off (ambient) equipment being tested turned on (operating conditions).
 4. Readings at each specified octave band frequency equipment being tested turned off (ambient) equipment being tested turned on (operating conditions).
 5. "Equipment Components" of sound (noise) levels with applicable calculations per "Sound Test Procedures".
 6. Graph showing relationship between pressure levels specified and recorded readings
- B. Retest: Subsequent to any correctional construction work, such as acoustic corrections, measurement shall be made to verify that associated air and water quantities, as previously measured, have not been disrupted.
 1. Certified report shall record all sound data, and their locations, after final adjustments of air and water systems involves.

3.11 CERTIFIED REPORTS

- A. Submittals: Six (6) copies of the reports described herein, covering air and water system performance, air motion (fpm), and sound pressure levels, shall be submitted prior to final tests and inspection.
- B. Instrument Records: Types, serial numbers, and dates of calibration of all instruments shall be included.
- C. Reports: Reports shall conspicuously identify items not conforming to contract requirements, or obvious malfunction and design deficiencies.
- D. Certification: Certification shall include checking of adherence to agenda, of calculations, of procedures, and evaluation of final summaries.

3.12 FINAL COMMISSIONING TESTS, INSPECTIONS AND ACCEPTANCE

- A. Scope: Test shall be made to demonstrate that capacities and performance of air and water systems comply with contract requirements.
 - 1. At the time of final inspection, the Contractor shall recheck, random selection of data (water and air quantities, air motion, and sound levels) recorded in the certified report. In addition, all courtrooms, auditoriums, and conference rooms shall be rechecked.
 - 2. Points and areas for recheck shall be selected by the commissioning team.
 - 3. Measurement and test procedures shall be the same as approved for work forming basis of certified report.
 - 4. Selections for recheck (specific plus random), in general, will not exceed 25 percent of the total number tabulated in the report, except that special air systems may require a complete recheck for safety reasons.
- B. Retests: If random tests elicit a measured flow deviation of 10 percent or more from, or a sound level of 2 db or more greater than, that recorded in the certified report listings, as 10 percent or more of the rechecked selections, the report shall be automatically rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, new certified reports submitted, and new inspection tests made, all at no additional cost. Retainage time shall be based on the date of the final acceptance of the certified report.
- C. Marking of Settings: Following final acceptance of certified reports, the settings of all valves, splitters, dampers, and other adjustment devices shall be permanently marked by the Contractor so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after final acceptance.

END SECTION 23 05 93

SECTION 23 07 00 HVAC INSULATION

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, and SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS, and other Sections in DIVISION 23 specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this Section shall include, but not necessarily be limited to, providing insulation for the following:
1. Ductwork Insulation:
 2. Duct wrap insulation.
 3. Acoustic duct lining.
 4. Rigid board ductwork and plenum insulation.
 5. Field applied jackets, indoor and outdoor.
 6. Section Includes insulating the following duct services:
 7. All supply air ductwork, unless otherwise shown on drawings.
 8. All return air ductwork, unless otherwise shown on drawings.
 9. Acoustical duct lining, in vertical/horizontal supply and return ducts within 5 feet (5') of air handling equipment and where otherwise shown on drawings.
 10. Outside air ductwork in return plenums, mechanical rooms and in freezing climates
 11. Piping Insulation:
 12. Piping insulation.
 13. Insulation Jackets
 14. Removable Covers.
 15. HVAC equipment insulation - section includes the following HVAC equipment that is not factory insulated:
 16. Heat exchangers.
 17. Plenums and equipment rooms, as noted.
- B. Types of mechanical insulation specified in this Section include the following:
1. Duct wrap insulation: Fiberglass.
 2. Acoustic duct liner: Fiberglass.
 3. Acoustic duct liner: Natural fiber.
 4. Rigid board duct and plenum insulation: Fiberglass.
 5. Pipe insulation: Fiberglass.

6. Pipe insulation: Closed cell phenolic.
7. Pipe insulation: Cellular glass.
8. Pipe insulation: Flexible elastomeric closed cell foam.
9. Equipment insulation: Fiberglass.
10. Equipment insulation: Cellular glass.
11. Equipment insulation: Flexible elastomeric closed cell foam.
12. Insulation jackets.
13. Removable covers
14. Insulation accessories.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 22 05 01 - PLUMBING.
- B. SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS.

1.4 DEFINITIONS

- A. Ambient: The air temperature to be maintained in a conditioned room. Typically between 70°F and 78°F.
- B. Insert: Spacer placed between the pipe support system and the piping to allow for the space required for insulation.
- C. Insulation Group (IG): Definition of Insulation Materials and Operating Temperatures.
- D. Insulation Shield: Buffer material placed between the pipe support system and the insulation to prevent the insulation material from crushing.
- E. Jacket: Protective covering over the pipe insulation; may be factory applied such as “all service jacket” or field applied to provide additional protection; of such materials as canvas, PVC, aluminum or stainless steel.
- F. Piping Insulation: Thermal insulation applied to prevent heat transmission to or from a piping system.
- G. Vapor Barrier Jacket: Insulation jacket material that impedes the transmission of water vapor.
- H. Freezing Climate: Where outdoor design temperature is less than 33° F, as stated in ASHRAE fundamentals under 99% column for winter design conditions.
- I. Unconditioned Space: any space whose airstream is not directly conditioned by mechanical equipment or maintained to temperature by mechanical equipment.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Provide products conforming to the requirements of the following:
 1. American Society for Testing and Materials (ASTM): Manufacture and test insulation in accordance with the ASTM Standards, including:
 2. B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plat.

3. C165 - Recommended Practice for Measuring Compressive Properties of Thermal Insulation.
4. C167 - Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.
5. C177 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
6. C195 - Specification for Mineral Fiber Thermal Insulating Cement.
7. C196 - Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement.
8. C302 - Test Method for Density of Preformed Pipe-Covering-Type Thermal Insulation.
10. C303 - Test Method for Density of Preformed Block-Type Thermal Insulation.
11. C305 - Test for Thermal Conductivity of Pipe Insulation.
12. C356 - Test for Linear Shrinkage of Preformed High-Temperature Thermal Insulation.
13. C411 - Test for Hot-Surface Performance of High Temperature Thermal Insulation.
14. C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
15. C449 - Specification of Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
16. C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
17. C533 - Specification for Calcium Silicate Block and Pipe Thermal Insulation.
18. C534 - Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
19. C547 - Specification for Mineral Fiber Preformed Pipe Insulation.
20. C552 - Specification for Cellular Glass Block and Pipe Thermal Insulation.
21. C553 - Specification for Mineral Fiber Blanket-Type Pipe Insulation (Industrial Type).
22. C592 - Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered).
23. C612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
24. C916 - Standard Specification for Adhesives for Duct Thermal Insulation.
25. C921 - Practice for Determining Properties of Jacketing Materials for Thermal Insulation.
26. C1104 - Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
27. C1071 - Standard Specification for Thermal and Acoustical Insulation.
28. C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
29. E84 - Test Method for Surface Burning Characteristics of Building Materials.
30. E119 - Test for Fire Resistance.
31. G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

32. G22 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria.
 33. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Provide and install pipe and duct insulation in accordance with the following ASHRAE Standard:
 34. 90 Energy Conservation in New Building Design.
 35. National Fire Protection Association (NFPA): Manufacture insulation in accordance with the following NFPA standards:
 36. 255 Test Methods, Surface Burning Characteristics of Building Materials.
- B. Do not provide materials with flame proofing treatments subject to deterioration due to the effects of moisture or high humidity.
- C. Products Containing Prohibited Chemicals:
1. Products containing the following prohibited chemicals for use as flame retardants or for other purposes will not be acceptable when present in quantities greater than 0.1% by mass:
 2. Pentabrominated diphenyl ether (CAS#32534-81-9)
 3. Octabrominated diphenyl ether (CAS#32536-52-0)
 4. Decabrominated diphenyl ether (CAS#1163-19-50)
- D. Flame/Smoke Rating: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) Method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories, Inc., label or listing; or satisfactory certified test report from an approved testing laboratory to prove the fire hazard ratings for materials proposed for use do not exceed those specified.
- E. Corrosiveness: Provide insulation such that when tested in accordance with the following test, the steel plate in contact with the insulation shows no greater corrosion than sterile cotton in contact with a steel plate for comparison.
1. Test Specimen: Two specimens shall be used, each measuring 1" by 4" by approximately ½" thick.
 2. Apparatus: Provide a humidity test chamber in which two polished-steel test plates, 1" wide, 4" long and 0.020" thick, shall be placed. Plates shall be clear finish, cold-rolled strip steel, American quality, quarter hard, temper No. 3, weighing 0.85 lb/sq. ft.
 3. Procedure: The steel test plates shall be rinsed with cp benzol until their surfaces are free from oil and grease and allowed to dry. One piece of cold-rolled steel shall be placed between the two insulation specimens and secured with tape or twine. The test specimen and uncovered plate shall be suspended vertically in an atmosphere having a relative humidity of 95% (plus or minus 3%), and a temperature of 120°F (plus or minus 3°F), for 96 hours, and then be examined for corrosion.
- F. Insulation thickness shall be the greater standard of that specified here or the State energy conservation requirements.

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation. Also furnish necessary test data certified by an independent testing laboratory. Submit samples.
- B. Provide a statement with the submittal indicating that no product submitted contains an amount equal to or greater than 0.10% by mass of the following chemicals:
 - 1. Pentabrominated diphenyl ether (CAS#32534-81-9)
 - 2. Octabrominated diphenyl ether (CAS#32536-52-0)
 - 3. Decabrominated diphenyl ether (CAS#1163-19-50)
- C. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product in maintenance manual.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coating to the site in containers with manufacturer's stamp or label affixed showing fire hazard indexes of products.
- B. Store and protect insulation against dirt, water, chemical, and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Johns Manville, Owens-Corning, Knauf, Armstrong, Pittsburgh-Corning, Trymer, IIG, Certainteed, Halstead, Rubatex, 3M FireMaster, Pabco, Reflectix, or approved equal. Manufacturer and insulation types listed below indicate a minimum acceptable level of quality required for each classification.

2.2 DUCT WRAP INSULATION:

- A. Type DW-A. Flexible Fiberglass Blanket: Johns Manville Microlite XG, formaldehyde-free Type 75 Flexible Blanket, Knauf ECOSE Duct Wrap:
 - 1. Application: Insulation wrap for ductwork, or other HVAC systems.
 - 2. 'K' Value: ASTM C553-92, 0.27 Btu•in./(hr•ft²•°F) at 75°F installed full thickness.
 - 3. Density: 0.75 lb/cu ft.
 - 4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft.
 - 5. Installation: See Part 3 below.
- B. Type DW-B. Radiant Bubble Wrap: Radiant Guard, Reflectix or approved equal:
 - 1. Application: Insulation wrap for ductwork, or other HVAC systems in general or ISO rated clean environments
 - 2. Two layers of 5/32" barrier bubble film laminated between two layers of foil. Nylon reinforced. Installation of spacers between layers to create air space is required.

3. Flame spread – less than 25 ASTM 84 Smoke Development – less than 50 ASTM E84 Fire Rating – Class A/Class 1
 4. R-Value: R-4.2 wrapped without any spacers direct to duct. R-6 using single layer with ¾” spacers and air space between wrap and duct. R-8 using two layers with ¾” spacers between ductwork and each layer of wrap.
 5. Vapor Barrier Tape: Pressure sensitive aluminum foil. 2.0 mil.
- C. Type DW-C Elastomeric Foam: Armacell Industries model AP Armaflex and AP Coilflex or equal, Flexible insulation:
1. Greenguard certified, low VOC.
 2. Elastomeric foam insulation with acrylic polymer airstream coating.
 3. K' Value: ASTM C518, 0.25 Btu•in./(hr•ft²•°F) at 75°F.
 4. R' value per inch thickness: ASTM C518, 4.0 (hr•ft²•°F) / Btu at 75°F.
 5. Density: ASTM D 1622, 3.0-6.0 lb/ft³.
 6. Water vapor sorbtion: ASTM C 1104, less than 2% by weight.
 7. Fungal and bacteria resistance: ASTM G 21/22, no growth.
 8. Noise Reduction Coefficient: ASTM C 423, 0.49 or higher based on "Type A mounting."
 9. Maximum Velocity on Mat or Coated Air Side: 5,000 ft/min.
 10. Maximum operating temperature: 250 degrees F.
 11. Flame spread index: ASTM E84, less than 25
 12. Smoke developed index: ASTM E84, less than 50
 13. Adhesive: UL listed waterproof type compliant with ASTM C916.

2.3 ACOUSTIC DUCT LINER:

- A. Type ADL-A. Fiberglass Acoustic Duct Liner: Johns Manville Duct Liner PM with Anti-Microbial Treatment.
1. Application: Duct lining for acoustic or thermal purposes.
 2. 'K' Value: ASTM 1071, 0.23 Btu•in./(hr•ft²•°F) at 75°F.
 3. Noise Reduction Coefficient: 0.65 or higher based on "Type A mounting."
 4. Maximum Velocity on Mat or Coated Air Side: 5,000 ft/min.
 5. Adhesive: UL listed waterproof type compliant with ASTM C916.
 6. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
- B. Type ADL-B Natural Fiber (Cotton) Acoustic Duct Liner: Reflectix #HVNF, Flexible Blanket with Anti-Microbial Treatment:
1. 'K' Value: ASTM C518, 0.25 Btu•in./(hr•ft²•°F) at 75°F.
 2. Noise Reduction Coefficient: 0.75 or higher based on "Type A mounting."
 3. Maximum Velocity on Mat or Coated Air Side: 5,000 ft/min.

4. Adhesive: UL listed waterproof type compliant with ASTM C916.
 5. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
- C. Type ADL-C Elastomeric Foam Duct Liner: Armacell Industries model AP Armaflex and AP Coilflex or equal, Flexible insulation:
1. Greenguard certified, low VOC.
 2. Elastomeric foam insulation with acrylic polymer airstream coating.
 3. K' Value: ASTM C518, 0.25 Btu•in./((hr•ft²•°F) at 75°F.
 4. R' value per inch thickness: ASTM C518, 4.0 (hr•ft²•°F) / Btu at 75°F.
 5. Density: ASTM D 1622, 3.0-6.0 lb/ft³.
 6. Water vapor sorbtion: ASTM C 1104, less than 2% by weight.
 7. Fungal and bacteria resistance: ASTM G 21/22, no growth.
 8. Noise Reduction Coefficient: ASTM C 423, 0.49 or higher based on "Type A mounting."
 9. Maximum Velocity on Mat or Coated Air Side: 5,000 ft/min.
 10. Maximum operating temperature: 250 degrees F.
 11. Flame spread index: ASTM E84, less than 25
 12. Smoke developed index: ASTM E84, less than 50
 13. Adhesive: UL listed waterproof type compliant with ASTM C916.
 14. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
- D. Type ADL-D Polyimide Foam Acoustic Duct Liner: Evonic Industries model SOLCOUSTIC, or equal, Flexible Blanket:
1. Greenguard certified, low VOC.
 2. Polyimide foam insulation with acrylic polymer airstream coating.
 3. K' Value: ASTM C518, 0.30 Btu•in./((hr•ft²•°F) at 75°F.
 4. R' value per inch thickness: ASTM C518, 3.3 (hr•ft²•°F) / Btu at 75°F.
 5. Density: ASTM D 3574, 0.80 lb/ft³.
 6. Water vapor sorbtion: ASTM C 1104, less than 2% by weight.
 7. Fungal and bacteria resistance: ASTM G 21/22, no growth.
 8. Noise Reduction Coefficient: ASTM C 423, 0.70 or higher based on "Type A mounting."
 9. Maximum Velocity on Mat or Coated Air Side: 5,000 ft/min.
 10. Maximum operating temperature: 250 degrees F.
 11. Flame spread index: ASTM E84, less than 25
 12. Smoke developed index: ASTM E84, less than 50
 13. Adhesive: UL listed waterproof type compliant with ASTM C916.
 14. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.

2.4 RIGID BOARD DUCTWORK AND PLENUM INSULATION:

- A. Type RB – A. Hydrous Calcium Silicate: IIGThermo-12/Gold ASTM C533; Rigid Molded Block Insulation; Asbestos-Free Coded Throughout Material Thickness and Maintained Throughout Temperature Range:
1. "K" Value: 0.40 Btu•in./(hr•ft²•°F) at 300°F.
 2. Maximum Service Temperature: 1,200°F.
 3. Compressive Strength (block): Minimum of 200 psi to produce 5% compression at 1½" thickness.
 4. Tie Bands: Secure blocks in places with staggered joints using ⅜" or ½" stainless steel bands on 12" centers.
- B. Type RB – B Rigid Fiberglass Board: Knauf ECOSE insulation board:
1. Application: insulation for HVAC plenums.
 2. 'K' Value: ASTM C1071, 0.23 Btu•in./(hr•ft²•°F) at 75°F.
 3. Density: 3.0 lb/cu ft.
 4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft paper.
 5. Installation: See Part 3 below.

2.5 FIELD APPLIED DUCTWORK INSULATION JACKETS

- A. Field Applied Jackets (For Exterior Applications):
1. Longitudinal seams shall not be located on top of ducts when exposed to outdoor environment.
 2. Stainless Steel Jacket: Type 304 stainless steel, 0.010" minimum (smooth/corrugated) finish.
 3. Aluminum Jacket: 0.016" aluminum with factory applied moisture barrier positioned such that the longitudinal overlap provides a watershed.
 4. Circumferential joints shall be wide enough to provide weather-proofing jacket.
 5. Secure jacket with ⅜" or ½" stainless steel bands on 12" centers for round ductwork and objects.
 6. Secure to rectangular sheet metal with sheet metal screws. Seal screw penetrations with silicon caulk.
- B. Field Applied Jackets (For Interior Applications):
1. All longitudinal seams shall be located on bottom of ductwork
 2. PVC Plastic: Johns Manville Zeston 2000. One piece molded type fitting covers and jacketing material, gloss white. Connect with tacks and pressure sensitive color matching vinyl tape.

2.6 PIPE INSULATIONS

- A. Glass Fiber: Molded fibrous glass pipe insulation shall comply with the requirements of ASTM C 547 and meet ASTM C 585 for sizes required in the particular system. For all fluid distribution temperatures below 45°F the system shall be of a wicking type.

1. Type PI-A: Fiberglass, Non-Wicking:
 2. Manufacturers:
 - i. Johns Manville Micro-Lok Meeting ASTM C547; or FSK faced Micro-Flex (pipe sizes larger than 18")
 - ii. Knauf
 - iii. einsulation
 3. Applications: Insulation of piping up to 18" in diameter and 3" thick insulation.
 4. 'K' Value: 0.23 at 75°F.
 5. Maximum Service Temperature: 850°F.
 6. Vapor Retarder Jacket: AP-T PLUS white kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or AP jacket with outward clinch expanding staples or vapor barrier mastic as needed.
- B. Type PI- B: Closed cell phenolic foam: Trymer Supercel, Kingspan Koolphen K, Resolco Insul-phen, or approved equal meeting ASTM C 1126 .
1. 'K' Value: 0.16 at 75°F (24°C)
 2. Maximum Continuous Service Temperature: 300°F.
 3. Vapor Retarder Jacket – straight sections: Saran 540/SSL or Mylar laminate, factory applied with self sealing lap.
 4. Vapor Retarder Jacket - fittings: Saran 540/SSL spiral wrapped in field for fittings.
- C. Type PI- C: Rigid polyisocyanurate foam: Trymer 2000 XP, HiTHERM HT-300, Duna Corafoam, Dyplast ISO-25, or approved equal meeting ASTM C 591.
1. 'K' Value: 0.19 at 75°F (24°C)
 2. Maximum Continuous Service Temperature: 300°F.
 3. Vapor Retarder Jacket: Saran 540/SSL or Mylar laminate.
- D. Type PI-D: Hydrous Calcium Silicate: Johns Manville, IIG Thermo-12/Gold, ASTM C533; Rigid Molded Pipe:
1. 'K' Value: 0.40 at 300°F.
 2. Maximum Service Temperature: 1,200°F.
 3. Compressive Strength (block): Minimum of 200 psi to produce 5% compression at 1½" thickness.
 4. Tie Wire: 16 gauge stainless steel with twisted ends on maximum 12" centers.
- E. Type PI-E: Cellular Glass: Pittsburgh-Corning Foamglas Meeting ASTM C522: Cellular Glass Thermal Insulation:
1. 'K' Value: 0.35 at 75°F.
 2. Density: 8.0 lbs./cu. ft.
 3. Maximum Service Temperature: 900°F.

4. Vapor Retarder Jacket – straight sections: Saran 540/SSL or Mylar laminate, factory applied with self sealing lap.
 5. Vapor Retarder Jacket – fittings: Saran 540/SSL spirally wrapped in field for fittings.
- F. Type PI-F: Flexible Elastomeric Closed Cell Thermal Insulation: Armacel AP Armaflex, Rubatex K-Flex ECO, Aeroflex Aerocel, closed-cell, halogen free, elastomeric insulation. Comply with ASTM-C177, ASTM E 84 and UL 181.
1. 'K' Value: 0.27 at 75°F.
 2. Density: 3.0 to 6.0 lbs./cu.ft.
 3. Maximum Service Temperature: 260°F.
 4. Seal all seams and joints with contact adhesive.
- G. Field Applied Jackets (For Interior Applications):
1. All longitudinal seams shall be located on bottom of pipes.
 2. PVC Plastic: Johns Manville Zeston 2000. One piece molded type fitting covers and jacketing material, gloss white. Connect with tacks and pressure sensitive color matching vinyl tape.
 3. Canvas Jacket: UL listed fabric, 6 oz/sq. yd. plain weave cotton, treated with dilute fire retardant lagging adhesive.
 4. Aluminum Jacket: 0.016" thick sheet, smooth finish, with longitudinal slip joints and 2" laps, die shaped fitting covers with factory attached protective liner.
 5. Secure aluminum jackets with 3/8" or 1/2" stainless steel bands on 12" centers.
- H. Field Applied Jackets (For Exterior Applications):
1. All longitudinal seams, on horizontal pipe runs, shall be installed on the bottom of pipes.
 2. Aluminum Jacket: 0.016" (minimum) thick sheet, smooth finish, with longitudinal slip joints and 2" laps, die shaped fitting covers with factory attached protective liner.
 3. Stainless Steel Jacket: Type 304 stainless steel, 0.010" minimum smooth finish.
 4. Secure stainless steel or aluminum jackets with 3/8" or 1/2" stainless steel bands on 12" centers.
 5. Manufacturers: Pabco, Childers, RPR, or approved equal.
- I. Removable Covers:
1. Provide removable covers on pumps, valves, air separators, air vent fittings, flanges, strainers, steam traps, etc., where periodic maintenance or removal of insulation may be required.
 2. Use of pre-molded fittings with PVC covers is acceptable, unless noted otherwise.
 3. Cold systems: Provide PVC covers on elbows.
 4. Cold systems: Provide Armaflex elastomeric foam for flanges, valves, pumps and strainers.
 5. Hot systems: provide PVC covers on elbows and flanges.
 6. Hot Systems: provide removable blanket covers on valves, pumps, and strainers.
 7. Removable- type silicon cloth fiberglass filled insulating blankets:

8. Mfg: Fit Tight Covers, GLT products, or equal custom fabrication by Insulation Contractor, 0-350°F service operating temperature:
 - i. Jacket: silicon impregnated fiberglass cloth
 - ii. Liner: silicon impregnated fiberglass cloth
 - iii. Liner reinforcement : sstl mesh cloth
 - iv. Insulation: 1" type E glass matt
 - v. Fastening: 2" nomex Velcro
 - vi. Fastening: 1" straps and stainless steel D-rings
 - vii. Fastening: 12 gage stainless steel hooks and stainless steel wire
 - viii. Thread: Kevlar/stainless steel thread
9. Mfg: Fit Tight Covers, or equal custom fabrication by Insulation Contractor, 351-450°F service operating temperature:
10. Jacket: silicon impregnated fiberglass cloth
11. Liner: silicon impregnated fiberglass cloth
12. Liner reinforcement : sstl mesh cloth
13. Insulation: 2" type E glass matt
14. Fastening: 2" nomex Velcro
15. Fastening: 1" straps and stainless steel D-rings
16. Fastening: 12 gage stainless steel hooks and stainless steel wire
17. Thread: Kevlar/stainless steel thread

2.7 EQUIPMENT INSULATIONS

- A. Flexible Fiberglass Blanket: Johns Manville Microlite Type 75 Flexible Blanket:
 1. 'K' Value: ASTM C518, 0.27 Btu•in./(hr•ft²•°F) at 75°F installed full thickness.
 2. Maximum Service Temperature: 250°F.
 3. Density: 0.75 lb/cu ft.
 4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.
- B. Rigid Fiberglass Board: Johns Manville Spin-Glass 814
 1. 'K' Value: ASTM C518, 0.23 Btu•in./(hr•ft²•°F) at 75°F.
 2. Maximum Service Temperature: 250°F.
 3. Density: 3.0 lb/cu ft.
 4. Vapor Barrier Jacket: FSK (Foil-Scrim-Kraft) aluminum foil faced reinforced with fiberglass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed.

- C. Rigid Fiberglass Board for High Temperature: Johns Manville 1000 Spin-Glas Meeting ASTM C612; Rigid, Noncombustible:
 - 1. 'K' Value: ASTM C518, 0.23 Btu•in./(hr•ft²•°F) at 75°F.
 - 2. Maximum Service Temperature: 850°F.
 - 3. Density: 3.0 lb/cu ft.
 - 4. Facing: 1" galvanized hexagonal wire mesh stitched on one face of insulation. (Optional.)
- D. Cellular Glass: Pittsburgh-Corning Foamglas Meeting ASTM C552; Cellular Glass Thermal Insulation:
 - 1. 'K' Value: 0.35 at 75°F.
 - 2. Density: 8.0 lb/cu. ft.
 - 3. Maximum Service Temperature: 900°F.
- E. Hydrous Calcium Silicate: Johns Manville, IIG Thermo-12/Gold Meeting ASTM C533; Rigid Molded Block; Asbestos-Free Coded Throughout Material Thickness and Maintained Throughout Temperature Range:
 - 1. 'K' Value: 0.40 at 300°F.
 - 2. Maximum Service Temperature: 1,200°F.
 - 3. Compressive Strength (block): Minimum of 200 psi to produce 5% compression, based on 1½" thickness.
 - 4. Securement: Insulation shall be securely banded in place, tightly butted, joints staggered and secured with 16 gauge galvanized or stainless steel wire or ½" x .015" galvanized steel bands on 12" maximum centers for large areas.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that piping and ductwork has been tested for leakage in accordance with specifications before applying insulation materials. All piping and ductwork shall be inspected by Owner's Representative prior to installation of insulation. Any insulation applied prior to inspection shall be removed and new insulation applied at no additional cost to Owner. Notify Owner's Representative five (5) working days prior to insulation installation.
- B. Verify that all surfaces are clean, dry and free of foreign material.

3.2 INSTALLATION

- A. General:
 - 1. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
 - 2. Remove and replace any insulation that has become wet or damaged during the construction process.
 - 3. Continue insulation and vapor barrier at penetrations and duct supports, except where prohibited by code. Instances where this is required include:

4. Ductwork support angle or struts. To prevent crushing of low density insulation, provide separator or high density insulation at point of support. A 12 inch wide strip of Johns Manville Spin-Glass 817 6pcf density fiberglass board, or similar mfg/product, across the bottom side of the duct. Vapor barrier to continue unbroken at point of support.
- B. Ductwork –Insulation on the Duct Exterior:
1. Provide insulated ductwork conveying air below ambient temperature (below room temperature) with vapor retardant jacket.
 2. Seams/joints of duct wrap shall be secured with outward clinching galvanized staples spaced 4” on center. Vapor barrier tape shall not be used as the sole means of securing the insulation.
 3. Seal all vapor retardant jacket seams and penetrations with 3” wide pressure-sensitive vapor barrier tape matching the insulation facing.
 4. Provide insulated ductwork conveying air above ambient temperature (above room temperature) with or without vapor retardant jacket. Where service access is required, bevel and seal ends of insulation.
 5. All exposed exterior metallic ductwork exposed or covered with cladding is to be built with a crown or reverse cross break to shed moisture.
 6. Continue insulation through walls, sleeves, hangers, and other duct penetrations except where prohibited by code.
 7. The insulation shall be firmly wrapped around the ducts with all joints lapped a minimum of 2” and secured with staples spaced 4” on center. The vapor barrier shall be sealed with FSK or metallic pressure sensitive tape. Installed thickness shall not exceed 25% compression. The underside of duct work 24” or greater in width shall be secured with mechanical fasteners and speed clips spaced approximately 18” on center. The protruding ends of the fasteners shall be cut off flush after the speed clips are installed, and then, when required, sealed with the same tape as specified above.
 8. For exterior applications, provide insulation with a weather protection jacket.
 9. For exterior vapor duct applications, install fiberglass insulation with weatherproof jacket.
- C. Duct Liner:
1. Adhere insulation to sheet metal with a UL listed adhesive. Adhesive shall be applied to the sheet metal with a minimum coverage of 90%.
 2. Secure insulation with mechanical liner fasteners as indicated by SMACNA or manufacturer. Pin length should be as recommended by the liner manufacturer.
 3. All exposed edges of the liner must be factory or field coated. Unless factory coated, all transverse edges and longitudinal joints of the duct liner shall be coated. For systems operating at 4,000 fpm or higher, a metal nosing must be installed in all liner leading edges.
 4. Repair liner surface penetrations with UL listed adhesive.
 5. Duct dimensions indicated on plans are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

D. Piping Insulation:

1. Locate insulation and cover seams in least visible locations unless otherwise specified.
2. Neatly finish insulation at supports, protrusions, and interruptions.
3. Provide insulated dual temperature pipes and cold pipes conveying fluids below ambient temperature with vapor retardant jackets with self sealing laps. Insulate complete system. No staples shall be used on pipes conveying fluids below ambient temperatures (cold systems).
4. For insulated pipes conveying fluids above ambient temperature, secure jackets with self sealing lap or outward clinched, expanded staples. Seal ends of insulation at equipment, flanges, and unions.
5. Provide insert between support shield and piping on piping 1½" diameter or larger. Fabricate of Johns Manville Thermo-12, or other heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths:
 - a. 1½" to 2½" pipe size: 10" long
 - b. 3" to 6" pipe size: 12" long
 - c. 8" to 10" pipe size: 16" long
 - d. 12" and over: 22" long
6. Use of metal saddles is acceptable as specified in SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS. Fill interior voids with segments of insulation matching adjoining pipe insulation.
7. Use of pipe hangers designed as an insulation coupling is acceptable in lieu of saddles and other devices. Klo-Shure coupling or equal.
8. For pipe exposed in mechanical equipment rooms or in finished spaces below 7 feet above finished floor, finish with Johns Manville Zeston 2000 PVC jacket and fitting covers.
9. Where pumps, valves, strainers, etc., with insulation require periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.
10. Cold systems: Provide Armaflex elastomeric foam for pumps and strainers.
11. Hot Systems: provide removable blanket covers on valves, pumps, and strainers.
12. For exterior applications:
13. Provide weather protection jacket. Insulated pipe lengths, pumps, fittings, joints, and valves shall be covered with aluminum jacket or stainless steel jacket. Jacket seams shall be located on bottom side of horizontal piping. All lateral joints shall be caulked with a minimum 20-year silicone sealant (clear). All longitudinal joints, except those at the bottom of a horizontal pipe run, shall be caulked with a minimum 20-year silicone sealant (clear).
14. Apply weather-resistant protective finish such as WB Armaflex to flexible elastomeric insulation. Insulation seams shall be located on the bottom side of horizontal piping. All lateral and longitudinal joints to be sealed with low V.O.C., UV inhibitive adhesive, such as Armaflex 520 BLV adhesive.
15. For underground installations, install per manufacturer's written instructions and recommendations.

16. When maintenance or service access for equipment will result in foot traffic over floor mounted insulated piping the contractor is to fabricate a permanent removable walkway to prevent damage to the piping and insulation.
 17. Special Application Requirements for Chilled Water Systems:
 18. Fiberglass insulation is not allowed.
 19. Pipe: Provide closed cell phenolic foam or cellular glass insulation for chilled and low temperature heat recover water piping and fittings.
 20. Non-factory vapor retarded piping and fittings: Spiral wrap insulation with Saran Vapor Retarder tape for fittings and. Cover with PVC jacket.
 21. 90/45/tee fittings: Provide material routed out of bun stock to the shape of the elbow, cut in half and applied to the fitting and spiral wrapped with Saran Vapor retarder tape. Cover with PVC fitting cover.
 22. Installation shall conform to Trymer Supercel or Pittsburg-Corning Foamglas installation guide.
 23. Valves, pipe flanges, pumps, strainers, gage fittings: may use Armaflex closed cell insulation in lieu of phenolic foam.
- E. Equipment Insulation:
1. See Piping Insulation above for additional requirements.
 2. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands, per manufacturer's recommendations.
 3. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retardant cement.
 4. Provide insulated dual temperature equipment or cold equipment containing fluids below ambient temperature with vapor retardant jackets.
 5. For insulated equipment containing fluids above ambient temperature, provide jacket with or without vapor barrier.
 6. Cover insulation with metal mesh and finish with heavy coat of insulating cement, mastic, or aluminum jacket as indicated in the drawings.
 7. For equipment in mechanical equipment rooms or in finished spaces, finish with Johns Manville Zeston 2000 jacketing and fitting covers or aluminum or stainless steel jacketing.
 8. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.
 9. When equipment with insulation requires periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage. Use of silicon cloth fiberglass filled lace-on type insulation blankets is acceptable.

3.3 DUCTWORK INSULATION SCHEDULE

- A. All insulation thicknesses shall meet or exceed state energy code and mechanical code requirements as noted below. Minimum thermal resistance in range of 4.2 to 4.6 per inch of thickness. Insulation thicknesses are based on fiberglass insulation and may be adjusted for equivalent insulation values for materials with superior "K" factors.

- B. All air distribution system ducts and plenums, but not limited to, building cavities, mechanical closets, air handler boxes, and support platforms uses as ducts or plenums, shall be installed, sealed , and insulated to meet the requirements of the code. Portions of supply-air and return-air ducts conveying heated or cooled air located in one or more of the following spaces shall be insulated to a minimum level of R-8.
1. In a space between a non-insulated or below- code minimum insulated roof and an insulated ceiling.
 2. In a space directly under a roof with fixed vents or opening to the outside or unconditioned spaces
 3. In an unconditioned crawlspace.
 4. In other unconditioned spaces.

C. Flexible Duct Wrap:

TABLE 1: DUCT WRAP INSULATION SERVICE, THICKNESS, AND MATERIAL TYPE REQUIRED.

SYSTEM	THICKNESS (inches)	FINISH	REMARKS/MATERIAL OPTIONS
Supply ducts within building envelope	1-1/2	FSK	Type DW-A,B,C
Supply or return duct installed as exposed ductwork in the occupied space.	0		Except where noted on drawings for acoustical reasons.
Supply or return or outside air duct installed as exposed ductwork in the occupied clean rated space.	1-1/2	Mylar	Applies to ISO rated Cleanroom spaces. Type DW-A,B
Return ducts within building envelope	1-1/2	FSK	Type DW-A,B
Exterior/Outside supply and return ductwork sandwiched in double wall sheet metal	2-1/2	FSK	* or a thickness resulting in compressed R value=8
Supply and return ductwork located as described in 3.3.B above.	3		Type DW-A,B,C
Exhaust ducts within 10 ft. of exterior openings	2	FSK	Type DW-A,B,C

- D. Thicknesses in the above table shall have insulation values as follows: 1 1/2" = R=4.2, 2" = R-5.6, 3" = R-8.3. Greater thicknesses are permitted to achieve identical values if space constraints allow.

E. Rigid and Plenum Insulation:

TABLE 2: DUCTWORK RIGID INSULATION AND PLENUM INSULATION SERVICE, THICKNESS, AND INSULATION TYPE REQUIRED.

SYSTEM	THICKNESS (inches)	FINISH	REMARKS/MATERIAL OPTIONS
Outside air intake ducts	2	FSK	Provide aluminum jacket over exterior installations. Type RB-A,B
Interior Plenums	2	FSK	Type RB-A,B
Exterior Plenums	2	FSK	Type RB-A,B
Supply, return and relief ducts in mechanical rooms and parking garages	2	FSK	Type RB-A,B
Vapor/moisture ducts installed exterior to the building envelope.	1-1/2	FSK	Provide jacketing on exterior ducts. Type RB-A,B
Exterior ductwork sandwiched in double wall sheet metal	2	FSK	Type RB-A,B

F. Acoustic Duct Liner (rectangular ductwork):

TABLE 3: ACOUSTIC DUCT LINER SERVICE, THICKNESS, AND INSULATION TYPE REQUIRED.

SYSTEM	THICKNESS (inches)	FINISH	REMARKS/MATERIAL OPTIONS
Where indicated	1" unless otherwise noted on plans	Air stream side coating	Type ADL-A,B,C,D
Exterior ductwork where indicated in double wall sheet metal sandwich construction.	2	Air stream side coating	Type ADL-A,B,C,D
Within 20' of Air Handling Unit in supply and return ducts	1	Air stream side coating	Type ADL-A,B,C,D

G. Thicknesses in the above table shall have insulation values as follows: 1 1/2 " = R=4.2, 2" = R-5.6, 3" = R-8.3. Greater thicknesses are permitted to achieve identical values if space constraints allow.

3.4 PIPING INSULATION SCHEDULE

A. All insulation thicknesses shall meet or exceed state energy code requirements as noted below. Increase thickness 1/2" if exposed to exterior ambient air. Minimum thermal resistance shall comply with building code minimum ranges and may exceed those minimum levels. **Insulation thicknesses may be adjusted for equivalent insulation values for materials with superior "K" factors.**

TABLE 1: PIPING SERVICES, FLUID TEMPERATURE, AND INSULATION TYPE REQUIRED

SERVICE	FLUID TEMPERATURE RANGE (°F)	INSULATION TYPE / ALLOWED OPTIONS	REMARKS
Cooling Coil Condensate drain piping	(40°F -60°F)	Type PI-F	Provide ½” thickness insulation, all pipe sizes
Refrigerant suction and hot-gas piping		Type PI-F	Provide ¾” thickness insulation, all pipe sizes. Provide on all piping concealed in structure and close proximity to likely human contact
Refrigerant liquid piping			Provide aluminum jacket on exterior insulated suction piping / uninsulated liquid piping bundled together.
Chilled water supply and return systems and fittings.	(40°F -60°F)	Type PI- B, E	
Chilled water supply and return systems and fittings.	(39°F and below)	Type PI-B, E	
Heating Water supply and return systems and fittings	(up to 200°F)	Type PI-A, C, D, E, F	
Exterior Condenser water supply and return systems and fittings	(55°F-105°F)	Type PI-A, C, D, E	Exterior installation, all temperatures Provide 1” thickness all pipe sizes.
Interior Condenser water supply and return systems and fittings	(55°F-105°F)	N/A	
Interior and Exterior Geothermal Condenser water supply and return systems and fittings.	(54°F and below)	Type PI-A, B, C, D, E, F	Above grade piping only. Below grade not insulated.
Low pressure steam supply and condensate systems	(250°F and below)	Type PI-A, C, D, E	
Medium and High pressure steam supply and Condensate systems	(greater than 250°F)	Type PI-A, C, D, E	
Steam condensate pump discharge systems	(141°F-200°F)	Type PI-A, C, D, E	
Boiler Feed systems	(201°F-250°F)	Type PI-A, C, D, E	
Boiler Blow down systems		Type PI-A, C, D, E	Provide 1” insulation thickness, all piping sizes.
Steam Safety Valve Vent piping systems		Type PI-A, C, D, E	Provide 1” insulation thickness, all piping sizes. Provide aluminum jacket on exterior insulated piping
Electric Heat Traced systems			Provide aluminum jacket on exterior insulated piping

1. California

TABLE 2: MINIMUM PIPING INSULATION THICKNESS BASED ON FLUID TEMPERATURE AND PIPING SIZE.

Insulation Based on California T-24 Energy Code Table 123-A Minimum Pipe Insulation Thicknesses or Greater								
FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)					
			Runouts up to 2	1 and less	1-1/4-2	2-1/2-4	5-6	8 and larger
			INSULATION THICKNESS REQUIRED (in inches)					
Space heating systems (steam, steam condensate and hot water)								
Above 350	0.32-0.34	250	1.5	2.5	2.5	3.0	3.5	3.5
251-350	0.29-0.31	200	1.5	2.0	2.0	2.5	3.5	3.5
201-250	0.27-0.30	150	1.0	1.5	1.5	2.0	2.0	3.5
141-200	0.25-0.29	125	1.0	1.5	1.5	1.5	1.5	1.5
105-140	0.24-0.28	100	1.0	1.0	1.0	1.0	1.5	1.5
Service water-heating systems (recirculating sections, all piping in electric trace tape systems, and the first 8 feet of piping from the storage tank for nonrecirculating systems)								
Above 105	0.24-0.28	100	1.0	1.0	1.0	1.5	1.5	1.5
Space cooling systems (chilled water, refrigerant and brine)								
40-60	0.23-0.27	75	1.0	1.0	1.0	1.0	1.0	1.0
Below 40	0.23-0.27	75	1.0	1.0	1.5	1.5	1.5	1.5

3.5 EQUIPMENT INSULATION SCHEDULE

A. Equipment not factory insulated, including but not limited to:

1. Heat exchangers.
2. Generator exhaust systems.

B. Rigid Fiberglass Board:

SERVICE	THICKNESS (inches)	REMARKS
Steam Condensate receivers	2	Provide jacketing
Steam De-aerators	2	Provide jacketing
Steam flash tanks, flash separators, moisture separators, and blow-off tanks	2	Provide jacketing
Air separators	1 ½	Provide jacketing
Expansion/compression tanks	1 ½	Provide jacketing
thermal storage tank	1 ½	Provide jacketing
Water softener mineral tanks	1"	Provide jacketing

C. Flexible Elastomeric Foam (Closed Cell):

SERVICE	THICKNESS (inches)	REMARKS
Cold water storage tank	1 ½	
Chilled water pump bodies	1 ½	
Chilled water, heat recovery water system valves ½" and larger	1 ½	
Chilled water, heat recovery water system gage fittings and air-vents	1 ½	
Condenser water pump bodies	1 ½	Provide only for outdoor installed pumps on insulated heat traced condenser water systems.

SERVICE	THICKNESS (inches)	REMARKS
Heat recovery water pump bodies	1 ½	
Chilled water, heat recovery water air separator	1 ½	
Chilled water, heat recovery water expansion/compression tanks	1 ½	
Outdoor, aboveground, heated, fuel-oil storage tanks	1 ½	Provide jacketing
Removable Chiller water boxes	1 ½	
Water softener mineral tanks	1"	

D. Calcium Silicate:

SERVICE	THICKNESS (inches)	REMARKS
Generator systems: Engine exhaust mufflers and piping	4	Provide jacketing
Steam Condensate Receivers	2	Provide jacketing
Steam De-aerators	2	Provide jacketing
Heat exchangers/converters	1 ½	Provide jacketing
Steam flash tanks, flash separators, moisture separators, and blow-off tanks	2	Provide jacketing

E. Removable Fiberglass Insulated Silicone Cloth Covers with Closure:

SERVICE	THICKNESS (inches)	REMARKS
Heating water air separators	1 ½	
Heating water expansion/compression tanks	1 ½	
Hot system thermal storage tank	1 ½	
Heating water pump bodies	2	
Heating water system valves, 2-1/2" and larger	2	
LP Steam system valves, 2" and larger	2	
MP, HP Steam system valves, 2" and larger	2	
Steam condensate system valves, 2" and larger	2	
Steam Condensate receivers	2	
Steam De-aerators	2	
Steam flash tanks, flash separators, moisture separators, and blow-off tanks	2	
Steam condensate system pump bodies	2	

END SECTION 23 07 00

SECTION 23 09 93 SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

1.3 DEFINITIONS

- A. IDEC: Indirect Evaporative Cooler.

1.4 ABBREVIATIONS

- A. The following abbreviations may be used in graphics, schematics, point names, and other UI applications where space is at a premium.
 1. AC - Air Conditioning
 2. ACU - Air Conditioning Unit
 3. AHU - Air Handling Unit
 4. AI - Analog Input
 5. AO - Analog Output
 6. AUTO – Automatic
 7. AUX – Auxiliary
 8. BI -Binary Input
 9. BO -Binary Output
 10. C –Common
 11. COND – Condenser
 12. DA - Discharge Air
 13. EA - Exhaust Air
 14. EF - Exhaust Fan
 15. EVAP – Evaporators
 16. FCU - Fan Coil Unit
 17. HOA - Hand / Off / Auto
 18. HP - Heat Pump
 19. HRU - Heat Recovery Unit
 20. HTEX - Heat Exchanger
 21. MAX – Maximum

- 22. MIN – Minimum
- 23. MISC – Miscellaneous
- 24. NC - Normally Closed
- 25. NO - Normally Open
- 26. OA - Outdoor Air
- 27. RA - Return Air
- 28. RF - Return Fan
- 29. RH - Relative Humidity
- 30. RTU - Roof-top Unit
- 31. SA - Supply Air
- 32. SF - Supply Fan
- 33. SP - Static Pressure
- 34. TEMP – Temperature
- 35. W/ - with
- 36. W/O – without

PART 2 - PRODUCTS (NOT APPLICABLE – REFER TO 23 09 00)

PART 3 - EXECUTION

3.1 SINGLE ZONE PACKAGED UNIT – GAS HEATING AND DX COOLING

A. Features

- 1. Single package unitary unit
- 2. Direct expansion cooling with compressor(s)
- 3. Propane gas furnace heating
- 4. Integral manufacturer controller
- 5. All setpoints shall be user adjustable

B. Run Conditions – Scheduled:

- 1. The unit shall run according to a user definable time schedule in the following modes:
- 2. Occupied Mode Temperatures:
 - a. Cooling setpoint - 75°F cooling setpoint to maintain 5°F deadband above heating setpoint
 - b. Heating setpoint - 70°F
- 3. Unoccupied Mode Temperatures (night setback) and IDEC zones:
 - a. Cooling setpoint - 85°F
 - b. Heating setpoint - 55°F

4. Standby Mode Temperatures (after morning warmup and prior to occupancy sensed): (Verify if applicable. Only applicable if you have occupancy sensor control and optimum start capability. This is primarily a California issue, but should be considered on all projects.)
 - a. Cooling setpoint - 78⁰F
 - b. Heating setpoint - 66⁰F
 5. Zone Unoccupied Override:
 - a. A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for 4 hours. At the expiration of this time, control of the unit shall automatically return to the schedule.
 6. Zone Setpoint Adjustment:
 - a. The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
 7. Alarms shall be provided as follows:
 - a. High Zone Temp: If the zone temperature is greater than the cooling setpoint by 5⁰F.
 - b. Low Zone Temp: If the zone temperature is less than the heating setpoint by 5⁰F.
- C. Emergency Shutdown:
1. The unit shall shut down and generate an alarm upon receiving an emergency shutdown signal.
 2. Supply Air Smoke Detection:
 - a. The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.
- D. Supply Fan:
1. The supply fan shall run continuously during occupied periods, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable minimum runtime.
 2. Alarms shall be provided as follows:
 - a. Supply Fan Failure: Commanded on, but the status is off.
 - b. Supply Fan in Hand: Commanded off, but the status is on.
 - c. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit.
- E. Cooling:
1. The controller shall measure the zone temperature and stage the cooling to maintain its cooling setpoint. To prevent short cycling, there shall be a user definable delay between stages, and each stage shall have a user definable minimum runtime.
 2. The cooling shall be enabled whenever:
 - a. There is a call for cooling.
 - b. AND the zone temperature is above cooling setpoint.

- c. AND the supply fan status is on.
 - d. AND the heating is not active.
- F. Heating
- 1. The controller shall measure the zone temperature and stage the heating to maintain its heating setpoint. To prevent short cycling, there shall be a user definable delay between stages, and each stage shall have a user definable minimum runtime.
 - 2. The heating shall be enabled whenever:
 - a. There is a call for heating.
 - b. AND the zone temperature is below heating setpoint.
 - c. AND the supply fan status is on.
 - d. AND the cooling is not active.
- G. Mixed Air Temperature:
- 1. The controller shall monitor the mixed air temperature and use as required for economizer control.
 - 2. Alarms shall be provided as follows:
 - a. High Mixed Air Temp: If the mixed air temperature is greater than 90⁰F.
 - b. Low Mixed Air Temp: If the mixed air temperature is less than 45⁰F.
- H. Return Air Temperature:
- 1. The controller shall monitor the return air temperature and use as required for economizer control.
 - 2. Alarms shall be provided as follows:
 - a. High Return Air Temp: If the return air temperature is greater than 90⁰F.
- I. Low Return Air Temp: If the return air temperature is less than 45⁰F.
- 1. The controller shall measure the mixed air temperature and modulate the economizer dampers in sequence to maintain a setpoint 2⁰F less than the zone cooling setpoint. The outside air dampers shall maintain a minimum adjustable position of whenever occupied to meet minimum required ventilation rate.
 - 2. The economizer shall be enabled whenever:
 - a. Outside air temperature is less than 70⁰F.
 - b. AND the outside air temperature is less than the return air temperature.
 - c. AND the supply fan status is on.
 - 3. The economizer shall close whenever:
 - a. Mixed air temperature drops from 45⁰F to 40⁰F.
 - b. OR on loss of supply fan status.
 - c. OR the freezestat is on.

4. The outside and exhaust air dampers shall close and the return air damper shall open when the unit is off.

3.2 EXHAUST FAN - ON/OFF

- A. Run Conditions - Interlocked: The fan(s) shall be interlocked to run whenever the air handling unit runs unless shutdown on safeties.
- B. Fan Status: The controller shall monitor the fan status.
 1. Alarms shall be provided as follows:
 - a. Fan Failure: Commanded on, but the status is off.
 - b. Fan in Hand: Commanded off, but the status is on.

3.3 EVAPORATIVE COOLER

- A. Run Conditions - Scheduled: The unit shall run according to a user definable time schedule in the following modes:
 1. Occupied Mode: The unit shall maintain
 - a. A 74⁰F (adjustable) cooling setpoint
 - b. A 70⁰F (adjustable) heating setpoint.
 2. Unoccupied Mode (night setback): The unit shall maintain
 - a. A 85⁰F (adjustable) cooling setpoint.
 - b. A 55⁰F (adjustable) heating setpoint.
 3. Alarms shall be provided as follows:
 - a. High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adjustable).
 - b. Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adjustable).
 - c. Zone Setpoint Adjust: The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
 - d. Zone Unoccupied Override: A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
- B. Outside Air Damper: The outside air damper shall open anytime the unit runs and shall close anytime the unit stops. The supply fan shall start only after the damper status has proven the damper is open. The outside air damper shall close 4sec (adjustable) after the supply fan stops.
 1. Alarms shall be provided as follows:
 - a. Outside Air Damper Failure: Commanded open, but the status is closed.
 - b. Outside Air Damper in Hand: Commanded closed, but the status is open.
- C. Supply Fan: The supply fan shall run anytime the unit is commanded to run. The supply fan shall have a user definable (adjustable) minimum runtime, unless shutdown on safeties. The supply fan

shall have a 600 sec (adjustable) delay on stop in order to dry out the direct evaporative media (if present).

1. Alarms shall be provided as follows:
 - a. Supply Fan Failure: Commanded on, but the status is off.
 - b. Supply Fan in Hand: Commanded off, but the status is on.
 - c. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adjustable).
- D. Direct Evaporative Cooling Section: The controller shall measure the zone temperature and stage on the spray pump on rising temperature to maintain its cooling setpoint. The supply fan shall run for a user definable time (adjustable) after the spray pump is disabled on unit shutdown in order to dry out the evaporative media.
 1. The evaporative cooling shall be enabled whenever:
 - a. Outside air temperature is greater than 60⁰F (adjustable)
 - b. AND outside air wetbulb is less than 58⁰F (adjustable).
 - c. AND the zone temperature is above cooling setpoint.
 - d. AND the zone humidity is less than 60% (adjustable).
 - e. AND the supply fan status is on.
- E. Sump Control: The controller shall drain and fill the sump as follows:
 1. Freeze Protection: If the outside air temperature drops below 40⁰F (adj), the evaporative cooler sump shall open the drain valve and close the fill valve. If the outside air temperature rises back above 55⁰F (adjustable), the controller shall activate the fill valve and close the drain valve.
 2. Scheduled Flush and Fill: A flush cycle shall occur every 48hr (adjustable) at a user definable time (adjustable) of day. At this time, the spray pump shall stop, the fill valve shall close, and the drain valve shall open for 600 sec (adjustable). After the cycle time is complete, the drain valve shall close, the fill valve shall open, and the spray pump shall be enabled.
 3. Alarms shall be provided as follows:
 - a. Spray Pump Failure: Commanded on, but the status is off.
 - b. Spray Pump in Hand: Commanded off, but the status is on.
 - c. Spray Pump Runtime Exceeded: Status runtime exceeds a user definable limit (adjustable).
- F. Zone Humidity: The controller shall monitor the zone humidity.
 1. Alarms shall be provided as follows:
 - a. High Zone Humidity: If the zone humidity is greater than 70% (adjustable).
 - b. Low Zone Humidity: If the zone humidity is less than 35% (adjustable).
- G. Environmental Index: When the zone is occupied, the controller will monitor the deviation of the zone temperature from the heating or cooling setpoint and calculate a 0 - 100% Environmental Index which gives an indication of how well the zone is maintaining comfort. The controller will also

calculate the percentage of time since occupancy began that the Environmental Index is 70% or higher. Optionally, a weighting factor can be configured to adjust the contribution of the zone to the rollup average index based upon the floor area of the zone, importance of the zone, or other static criteria.

3.4 MAKEUP AIR UNIT - SUPPLY AIR TEMP

- A. Run Conditions - Interlocked: The unit MAU --- shall be interlocked to run whenever Air Handling Unit ---- runs unless shutdown on safeties.
- B. Freeze Protection: The unit shall shut down and generate an alarm upon receiving a freezestat status.
- C. Outside Air Damper: The outside air damper shall open anytime the unit runs and shall close anytime the unit stops. The supply fan shall start only after the damper status has proven the damper is open. The outside air damper shall close 4 sec (adjustable) after the supply fan stops.
 - 1. Alarms shall be provided as follows:
 - a. Outside Air Damper Failure: Commanded open, but the status is closed.
 - b. Outside Air Damper in Hand: Commanded closed, but the status is open.
- D. Supply Fan: The supply fan shall run anytime the unit is commanded to run. To prevent short cycling, the supply fan shall have a user definable (adjustable) minimum runtime, unless shutdown on safeties.
 - 1. Alarms shall be provided as follows:
 - a. Supply Fan Failure: Commanded on, but the status is off.
 - b. Supply Fan in Hand: Commanded off, but the status is on.
 - c. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adjustable).
- E. Supply Air Temperature Setpoint - Fixed: The controller shall monitor the supply air temperature and shall maintain a fixed supply air temperature setpoint of 55⁰F (adjustable).
- F. Cooling Coil Valve: The controller shall measure the supply air temperature and modulate the cooling coil valve to maintain its cooling setpoint.
 - 1. The cooling shall be enabled whenever:
 - a. Outside air temperature is greater than 60⁰F (adjustable).
 - b. AND the supply air temperature is above cooling setpoint.
 - c. AND the fan status is on.
 - 2. The cooling coil valve shall open to 50% (adjustable) whenever the freezestat is on.
- G. Heating Coil Valve: The controller shall measure the supply air temperature and modulate the heating coil valve to maintain its heating setpoint.
 - 1. The heating shall be enabled whenever:
 - a. Outside air temperature is less than 65⁰F (adjustable).
 - b. AND the supply air temperature is below heating setpoint.

- c. AND the fan status is on.
- 2. The heating coil valve shall open to 100% (adjustable) whenever the freezestat is on.
- H. Prefilter Differential Pressure Monitor: The controller shall monitor the differential pressure across the prefilter.
 - 1. Alarms shall be provided as follows: Prefilter Change Required: Prefilter differential pressure exceeds a user definable limit (adjustable).
- I. Supply Air Temperature: The controller shall monitor the supply air temperature.
 - 1. Alarms shall be provided as follows:
 - a. High Supply Air Temp: If the supply air temperature is greater than 120⁰F (adjustable).
 - b. Low Supply Air Temp: If the supply air temperature is less than 45⁰F (adjustable).

3.5 SINGLE ZONE UNIT

- A. Run Conditions - Scheduled: The unit shall run according to a user definable time schedule in the following modes:
 - 1. Occupied Mode: The unit shall maintain
 - a. A 74⁰F (adjustable) cooling setpoint
 - b. A 70⁰F (adjustable) heating setpoint.
 - 2. Unoccupied Mode (night setback): The unit shall maintain
 - a. A 85⁰F (adjustable) cooling setpoint.
 - b. A 55⁰F (adjustable) heating setpoint.
 - 3. Alarms shall be provided as follows:
 - a. High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adjustable).
 - b. Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adjustable).
 - c. Zone Setpoint Adjust: The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
 - d. Zone Optimal Start: The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
 - e. Zone Unoccupied Override: A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
 - f. Freeze Protection: The unit shall shut down and generate an alarm upon receiving a freezestat status.
 - g. Supply Air Smoke Detection: The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.

- B. Supply Fan: The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adjustable) minimum runtime.
1. Alarms shall be provided as follows:
 - a. Supply Fan Failure: Commanded on, but the status is off.
 - b. Supply Fan in Hand: Commanded off, but the status is on.
 - c. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adjustable).
- C. Minimum Outside Air Ventilation - Fixed Percentage: The outside air dampers shall maintain a minimum position (adjustable) during building occupied hours and be closed during unoccupied hours.
- D. Prefilter Differential Pressure Monitor: The controller shall monitor the differential pressure across the prefilter.
1. Alarms shall be provided as follows: Prefilter Change Required: Prefilter differential pressure exceeds a user definable limit (adjustable).
- E. Mixed Air Temperature: The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present).
1. Alarms shall be provided as follows:
 - a. High Mixed Air Temp: If the mixed air temperature is greater than 90⁰F (adjustable).
 - b. Low Mixed Air Temp: If the mixed air temperature is less than 45⁰F (adjustable).
- F. Return Air Temperature: The controller shall monitor the return air temperature and use as required for economizer control (if present).
1. Alarms shall be provided as follows:
 - a. High Return Air Temp: If the return air temperature is greater than 90⁰F (adjustable).
 - b. Low Return Air Temp: If the return air temperature is less than 45⁰F (adjustable).
- G. Environmental Index: When the zone is occupied, the controller will monitor the deviation of the zone temperature from the heating or cooling setpoint and calculate a 0 - 100% Environmental Index which gives an indication of how well the zone is maintaining comfort. The controller will also calculate the percentage of time since occupancy began that the Environmental Index is 70% or higher. Optionally, a weighting factor can be configured to adjust the contribution of the zone to the rollup average index based upon the floor area of the zone, importance of the zone, or other static criteria.
- H. Variable Frequency Drive (VFD) Interface Monitor: Current VFD status and operating conditions shall be monitored through its communications interface port. The interface shall monitor and trend the points as shown on the Points List.

END SECTION 23 09 93

SECTION 23 23 00 REFRIGERANT PIPING SYSTEMS

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS, and other Sections in DIVISION 23 specified herein.

1.2 SCOPE

- A. Includes, but not limited to:
 - 1. Furnish and install piping and piping specialties for refrigeration systems serving split system air conditioning units.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 23 05 00 -BASIC HVAC MATERIALS AND METHODS
- B. SECTION 23 07 00 - HVAC INSULATION
- C. DIVISION 26 – ELECTRICAL

1.4 QUALITY ASSURANCE

- A. Qualifications: A refrigeration contractor licensed by the State shall install refrigerant piping.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

- A. Meet requirements of ASTM B 280-88, "Specification for Seamless Copper Tube for Air Conditioning & Refrigeration Field Service", hard drawn straight lengths. Reflok aluminum piping and mechanical fittings may be considered with prior approval.
- B. Do not use pre-charged refrigerant lines more than 50 feet in length..

2.2 REFRIGERANT FITTINGS

- A. Wrought copper with long radius elbows.
- B. Approved Manufacturers:
 - 1. Mueller Streamline
 - 2. Nibco, Inc.
 - 3. Grinnell
 - 4. Elkhart Products Corp.

2.3 SUCTION LINE TRAPS

- A. Manufactured standard one-piece traps.

2.4 CONNECTION MATERIAL

A. Brazing Rods:

1. Copper to Copper Connections:
 - a. AWS Classification BCuP-4 Copper Phosphorus (6% silver).
 - b. AWS Classification BCuP-5 Copper Phosphorus (15% silver).
2. Copper to Brass or Copper to Steel Connections
 - a. AWS Classification BAg-5 Silver (45% silver)
3. Do not use rods containing Cadmium.

2.5 FLUX

A. Approved Manufacturers

1. "Stay-Silv white brazing flux" by J.W. Harris Co.
2. High quality silver solder flux by Handy & Harmon.

2.6 EXPANSION VALVES

- A. For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
- B. Size valves to provide full rated capacity of cooling coil served. Coordinate selection with evaporator coil and condensing unit.
- C. Approved Manufacturers:
 1. Alco
 2. Henry
 3. Mueller
 4. Parker
 5. Singer
 6. Sporlan

2.7 FILTER-DRIER

- A. On lines 3/4 inch outside diameter and larger, filter-drier shall be replaceable core type with non-ferrous casing and Schraeder type valve.
- B. On lines smaller than 3/4 inch outside diameter, filter-drier shall be sealed type using flared copper fittings.
- C. Size shall be full line size.
- D. Approved Manufacturers:
 1. Alco
 2. Mueller
 3. Parker

4. Sporlan
5. Virginia

2.8 SIGHT GLASS

- A. Combination moisture and liquid indicator with protection cap.
- B. Sight glass shall be full line size.
- C. Sight glass connections shall be solid copper or brass, no copper-coated steel sight glasses allowed.
- D. Approved Manufacturers:
 1. Alco
 2. Asco
 3. Mueller
 4. Parker
 5. Sporlan

2.9 MANUAL REFRIGERANT SHUT-OFF VALVE

- A. Ball valves designed for refrigeration service and full line size.
- B. Valve shall have cap seals.
- C. Valves with hand wheels are not acceptable.
- D. Provide service valve on each liquid and suction line at compressor.
- E. If service valves come as integral part of condensing unit, additional service valves shall not be required.
- F. Approved Manufacturers:
 1. CoBraCo (Apollo)
 2. Henry
 3. Mueller
 4. Superior
 5. Virginia

2.10 FLEXIBLE CONNECTORS

- A. Provide each liquid line and suction line at both condensing unit and evaporator on systems larger than five tons.
- B. Anchor pipe near each flexible connector.
- C. Connectors shall be for refrigerant service with bronze seamless corrugated hose and bronze braiding.
- D. Approved Manufacturers:
 1. Anaconda "Vibration Eliminators" by Anamet
 2. Vibration Absorber Model VAF by Packless Industries

3. Vibration Absorbers by Superior Valve Co.
4. Style "BF" Spring-flex refrigerant connectors by Vibration Mountings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Slope suction lines down toward compressor or one inch/10 feet. Locate traps at vertical rises against flow in suction lines.
- B. Refrigeration system connections shall be copper-to-copper, copper-to-brass, or copper-to-steel type properly cleaned and brazed with specified rods. Use flux only where necessary.
 1. No soft solder (tin, lead, antimony) connections will be allowed in system.
 2. Braze valve, sight glass, and flexible connections.
 3. Circulate dry nitrogen through tubes being brazed to eliminate formation of copper oxide during brazing operation.
- C. Insulate all suction and hot gas lines. Insulate liquid lines where pipe may be in close contact to humans.

3.2 FIELD QUALITY CONTROL

- A. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping system. Positive pressure test will not suffice for procedure outlined below:
 1. Draw vacuum on each entire system with vacuum pump to 200 microns using vacuum gauge calibrated in microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum. Isolate compressor from system piping using shut-off valves prior to pulling vacuum.
 2. Break vacuum with refrigerant to be used and re-establish vacuum test. Vacuum shall hold for 24 hours at 200 microns without compressor running.
 3. Conduct test at 70°F ambient temperature minimum.
 4. Do not use systems until tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
 5. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
 6. Install valves and specialties in accessible locations. Install refrigeration distributors and suction outlets at same end of coil

END SECTION 23 23 00

SECTION 23 31 13 AIR DISTRIBUTION

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this Section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS, and other Sections in DIVISION 23 specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this Section shall comply with all the requirements of DIVISION 1, and shall include, but not necessarily be limited to, the following:
 - 1. Ductwork - Rigid, Flexible and Fabric
 - 2. Chimneys, Stacks and Flue Vents
 - 3. Ductwork Specialties
 - 4. Flexible Connections
 - 5. Sealants, Adhesives and Tapes
 - 6. Flashings
 - 7. Bird Screens
 - 8. Backdraft Dampers
 - 9. Louvers
 - 10. Diffusers, Grilles, and Registers

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS
- B. SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING
- C. SECTION 23 07 00 - HVAC INSULATION
- D. SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS
- E. DIVISION 26 – ELECTRICAL

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Provide products conforming to the requirements of the following:
 - 1. ARI 885-98 "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminal and Air Outlets."
 - 2. AMCA-210 - Laboratory Methods of Testing Fans for Rating Purposes.
 - 3. ANSI S1.23 - Designation of Sound Power Emitted by Machinery and Equipment.
 - 4. ASC-A7001 - Standard for Duct Sealants.
 - 5. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip. Type 304 or 304 stainless steel.

6. ASTM A525 - Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) Hot-Dip Process. G90 zinc-coated.
 7. ASTM A527/A527M - Standard Specification for Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
 8. TIMA AAC-101 - Standard for fiberglass duct liner with erosion proof facing.
 9. UL 181 - Factory-Made Air Ducts and Connections, Class 1.
- B. Conform to NFPA 90A "Standards for the Installation of Air Conditioning and Ventilating Systems".
- C. Provide and construct ductwork systems in conformance with the latest editions of the following documents:
1. SMACNA "HVAC Duct Construction Standards-Metal and Flexible - 2005"
 2. SMACNA "Accepted Industry Practice for Industrial Duct Construction" for duct pressures above +5" W.G. positive pressure or below -5" W.G. negative pressure. Where differences exist between SMACNA and the prevailing building code, the gauge or construction method of the submitted ductwork shall be the more stringent of the two standards
 3. ASHRAE Systems and Equipment Handbook "Duct Construction" chapter
 4. ASHRAE Fundamentals Handbook "Duct Design" chapter
- D. Alternatives: The SMACNA standards and publications referenced in this Section of the specifications establish ductwork construction requirements.
1. Alternatives to these standards and publications may be submitted. Approval will be based on demonstration that such alternatives are equivalent and satisfy the functional requirements described in the referenced standards.
 2. Such demonstration shall include evidence that the alternatives proposed were tested in accordance with SMACNA procedures and with test results certified by an independent testing laboratory.
- E. All ductwork and equipment shall be seismically supported and braced per the SMACNA "Seismic Restraint Manual: Guidelines for Mechanical Systems".
- F. Flame/Smoke Rating: All materials, including sealants and adhesives, exposed within plenum shall have a flame-spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.

1.5 SUBMITTALS

- A. Prior to construction, submit for approval on all materials and equipment:
1. Ductwork - Rigid, Flexible and Fabric
 2. Ductwork Specialties
 3. Flexible Connections
 4. Sealants, Adhesives and Tapes
 5. Flashings
 6. Bird Screens
 7. Backdraft Dampers

8. Diffusers, Grilles, and Registers
 9. SMACNA "HVAC Duct Construction Standards - Metal and Flexible"
- B. Shop Drawings: Provide shop drawings of sheet metal ductwork and plenums as follows:
1. Draw to a scale not less than $\frac{1}{8}$ " to one foot, with sheet sizes equal to Contract Drawings.
 2. Show duct sizes, where possible use even duct sizes.
 3. Show fitting details.
 4. Show coordination with lighting fixtures, fire dampers, smoke dampers, piping, diffusers, grilles, registers, fans, major electrical runs, cable trays and bus ducts.
- C. Shop Drawings: Provide shop drawings for field erected mechanical equipment:
1. Draw to a scale of $\frac{1}{2}$ " to one foot, with sheet sizes equal to Contract Drawings.
 2. Show plan, sections, elevations and details of all joints and enclosures.
 3. Detail access doors and hardware.
 4. Detail coil, damper, humidifier, filter and fan installations.
 5. Show access space for electrical components that are part of the equipment provided and/or installed such as power and control panels on humidifiers. This shall be coordinated with DIVISION 26 and NEC.
- D. Certifications: Provide a duct schedule, certified by an officer of the sheet metal fabrication subcontractor, that the ductwork conforms to SMACNA standards, and for each sheet metal system furnished on the project include:
1. System name.
 2. Duct material.
 3. Duct gauge.
 4. SMACNA rectangular reinforcement number.
 5. SMACNA intermediate reinforcement number.
 6. SMACNA transverse reinforcement number.
 7. Rod diameter and type.
 8. Sealant type.
 9. Attachment method.
 10. Duct system design pressure.
- E. Construction IAQ Management Plan: Collaborate with the general contractor to submit and implement an IAQ Management Plan for the construction process meeting the requirements of the SMACNA IAQ Guidelines. This plan should address the protection of the ventilation system components during construction and cleanup of contaminated components after construction is complete. SMACNA IAQ Guideline recommends control measures in five areas. The IAQ Management Plan should address how compliance has been achieved in these required five areas as follows:

1. HVAC Protection
 - a. Shutdown of return side of existing HVAC system in areas affected by heavy construction.
 - b. Provision of temporary filters if existing or new systems must remain operational during construction.
 - c. Dampering of supply and returns and sealing of openings in areas subject to construction dust.
2. Source Control
 - a. How will reduction of contaminants be reduced at the source?
 - b. What steps will be taken to employ low emitting products and sealants.
 - c. How will air handling equipment be cycled off when not needed?
3. Pathway Interruption
 - a. Describe how the construction space will be ventilated as required to dilute contaminants.
 - b. Describe how occupied spaces adjacent to construction areas will be kept at positive pressure relative to spaces under construction.
4. Housekeeping:
 - a. Reduction of dust generated by work will be suppressed.
 - b. Maintaining a frequent cleaning frequency for dust and particulates.
 - c. Remove spills or excess applications of solvent-containing products as soon as possible.
 - d. Remove accumulated water and keep work areas as dry as possible.
 - e. Protect insulation materials from exposure to moisture.
5. Scheduling: Describe how overlap of construction activity and ongoing building occupancy activities will be minimized.
- F. Field Manual: Submit one copy of the SMACNA "HVAC Duct Construction Standards - Metal and Flexible". Maintain a second copy on the project site.
- G. Any ductwork installed without prior approval by the specifier, shall be replaced at the expense of the contractor.
- H. The contractor must comply with the enclosed specification in its entirety. If on inspections, the specifier finds changes have been made without prior approval, the contractor will make the applicable changes to comply with this specification, at the contractor's expense.
- I. At the discretion of the specifier, sheet metal gauges, and reinforcing may be checked at various times to verify all duct construction is in compliance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site in containers with manufacturer's stamp or label affixed.
- B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged components. Remove damaged products from project site.

PART 2 - PRODUCTS

2.1 DUCTWORK

- A. Construct all ducts and plenum of gauges, and with joints, bracing, reinforcing, and other construction details in accordance with the latest construction standards previously listed. Metals shall be manufactured by United States Steel, Kaiser, Rolok or equal.
- B. Duct dimensions indicated on drawings are net, inside, clear dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.
- C. Ducts shall be constructed of material gauges and reinforcement per SMACNA pressurization classifications to meet 150% of the pressure requirements for external static pressure scheduled on drawings for the fans serving each system. Where differences exist between SMACNA and the prevailing building code, the gauge or construction method of the submitted ductwork shall be the more stringent of the two standards. See also Part III Execution for matrix of materials and pressure requirements.

2.2 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - a. Galvanized Coating Designation: G60.
 - b. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils (0.10 mm) thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil (0.025 mm) thick on opposite surface.
 - 3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL181, Class 1.
- D. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.
- E. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- F. Aluminum Sheets: Comply with ASTM B209 (ASTM B209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- G. Factory- or Shop-Applied Antimicrobial Coating:
 - 1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.

2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D3363.
 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 5. Shop-Applied Coating Color: Black or white.
 6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
- H. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- I. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 DUCTWORK FABRICATION

- A. Joints – Sealing
1. Duct tape is not allowed. Rolled elastomeric duct sealants are not allowed.
 2. Solvent-based and oil-based sealants are not allowed indoors.
 3. Seal all transverse joints - this includes mechanical joints similar to Ductmate on all supply, return, exhaust and outside air intake ducts.
 4. All sealant systems for outdoor application to be suitable for use in exposure to water.
 5. All sealant systems for indoor application to be meet VOC limits as specified in South Coast Air Quality Management District (SCAQMD) Rule #1168 limiting VOC's to 80 gram/Liter for ductliner adhesives and 250 grams/Liter for duct sealants.
 6. Manufacturers: Tremco, Dure Dyne, Hardcast, Ductmate, Mon-Eco Industries, McGill AirSeal LLC, or equal, as recommended for ductwork application.
 7. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, suitable for high velocity and high pressure applications, UL 181B-M listed, UL 723 classified, and complying with NFPA requirements for Class 1 ducts.
 - a. Outdoor Application: Not permitted where subject to moisture exposure.
 - b. Indoor Application: Hardcast Iron Grip, Ductmate PROseal, Mon-Eco EZ Seal 44-44, or equal.
 8. Two-Part Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermally with tape to form hard, durable airtight seal. Hardcast Two Part II, McGill Uni-Cast, or equal.
- B. Joints - Rectangular Ducts
1. Slip drive joints, standard seams, flanges or welding as required by SMACNA HVAC Duct Construction Standards for system static pressure. Ductmate, MEZ Industries, or equal are

acceptable joint methods, but must be sealed as described previously. Transverse joints shall be constructed per Figure 2-1 for types T-8 through T-25. T-1 and T-5 slip joints are NOT allowed. Joint T-2, T-3, T-6 and T-7 reinforced slip joints are allowed below 2" static pressures.

C. Joints - Round

1. Exposed Ductwork: Slip drive and sheet metal screws.
2. Concealed Ductwork: Sheet metal screws.

D. Elbows

1. Radius: Construct round, oval and rectangular radius elbows with centerline not less than 1.5 times the duct width. Rectangular elbows with inside radius heel are NOT allowed as these create excessive pressure drop and are not per SMACNA.
2. Elbows: Provide single thickness turning vanes on all rectangular elbows less than 25" wide with vane spacing of 1.5". Provide double thickness turning vanes for rectangular radius elbows 25" wide and greater with vane spacing of 2.125" to 2.5". Number of vanes per SMACNA.

E. Transitions

1. Construct transitions with minimum slope of 1 to 5 ratio and in conformance to SMACNA.

F. Branch Connections

1. Provide 45° entry boots or radius taps for rectangular duct take-offs and conical or bellmouth taps for round duct take-offs. Straight 90° taps are not allowed, except where round take-off duct size equals round branch duct size. Provide volume dampers at take-offs for balancing if not specifically noted as provided at outlet or inlet. Provide insulation guards at transitions to lined ductwork.

2.4 RECTANGULAR DUCTWORK

- A. Construct rectangular ductwork to meet all functional criteria defined in Section VII, of the SMACNA "HVAC Duct Construction Standards Metal and Flexible" 1995 Edition. This shall be subsequently referred to as the SMACNA Manual. All ductwork must comply with all local, code requirements. Ductwork shall be constructed of galvanized steel. Diagonally cross break all panels on ducts 30 inches wide and larger, or bead using automatic bead machine with beads at 12 inches on center or less. All connections shall utilize 45° boot take-offs. Bullhead tees and straight taps are not permitted.

2.5 ROUND AND OVAL DUCTWORK

- A. Round and oval ductwork shall be constructed to SMACNA round ductwork requirements of galvanized sheet steel. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Chapter 3, "Round, Oval, and Flexible Duct", based on indicated static-pressure class unless otherwise indicated. Longitudinal seams shall be spiral lock seams or continuous welded. Flat oval shall be utilized in space-restricted areas. Elbows shall be 5-piece mitered and welded. All elbows shall be long radius type with centerline radius to duct diameter of 1.5, exceptions will only be allowed at restricted space locations.
- B. Round or oval duct and fitting manufacturers:
1. McGill Airflow Corporation

2. Lindab
 3. Semco
 4. Sheet Metal Connectors
 5. Spiral Manufacturing
 6. Or equal.
- C. Transverse Joints: Fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 3-1, "Round Duct Transverse Joints", for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All transverse joints to be externally sealed at all joints.
1. Exception: internal manufactured single or dual EPDM rubber gasket fittings do not require external sealant.
 2. Transverse joints in ducts larger than 50" diameter require flanged joints.
 3. Lap or snap lock seams are not permitted for round ductwork of any size.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal joints shall be sealed air tight with sealant or continuous welding.
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 3-5, "45 Degree Tees and Laterals", and Figure 3-6, "Conical Tees" and "45 Degree Boot Tees" for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Spin-in type or other types of butt tees, bullhead tees or straight taps are not permitted.

2.6 FLEXIBLE DUCTWORK

- A. Flexible one-inch thick insulated round ductwork may be utilized where shown on the Drawings. Elbows in flex ductwork are to be supported using Flexmaster Item #41650 duct support. No intermediate joints are allowed. Connect each end with stainless steel screw operated drawbands. Support duct to maintain smooth shape without sagging. All connections shall utilize welded conical tees, aluminum conical fitting, Flexmaster #CB, or 45° boot take-offs by Flexmaster #STO. Spin-in type or other types of butt tees, bullhead tees or straight taps are not permitted. Dampers are to be Ventlok dampers with end bearings.
- B. Flexible ductwork for low pressure systems with positive static pressure at or below 2" w.g. positive pressure shall be a trilaminate of aluminized foil, fiberglass insulation, and aluminized polyester, mechanically locked to galvanized steel helix without adhesives, exterior 1" fiberglass insulation and fire retardant plastic outer jacket. Flexmaster #Type 5B, Thermaflex Model M-KC or approved equal.

- C. Flexible ductwork for medium and high pressure systems with static pressures above 2" w.g. through 10" w.g. positive pressure shall be a heavy coated fiberglass cloth fabric mechanically locked to galvanized steel helix without adhesives, exterior 1" fiberglass insulation and fire retardant plastic outer jacket. Flexmaster #Type 4B, Thermaflex Model M-KC or approved equal.
- D. Flexible aluminum ductwork for use in magnetic/electrically sensitive room environments, such as MRI rooms, in low pressure systems with static pressure at or below 2" w.g. positive pressure shall be a trilaminate of aluminized foil with aluminum helix with exterior 1" aluminum jacket fiberglass insulation. Flexmaster #TL-B or approved equal.

2.7 ACOUSTICAL DUCT LINER

- A. Acoustic Duct Lining shall be installed where shown on the drawings and as specified for low velocity supply, return and exhaust ductwork. Liner is to be utilized to line vertical supply duct risers conveying return air, and other horizontal duct runs where shown on drawings. Dimensions of lined ducts given on the drawings indicate the inside dimensions of duct after the lining has been installed. Black-coated (vinyl, acrylic or neoprene) duct lining shall be adhered by 100% covering of a fire retardant adhesive (3M EC-1128, Benjamin-Foster 85-20, or equal). When width of duct exceeds 12" and also on sides when height exceeds 24", use non-ferrous mechanical fasteners such as welded pins and speed clips, 12" on center maximum lateral spacing and 18" on center maximum longitudinal spacing. Start fastening within 3" of upstream transverse edge of the liner and within 3" of the longitudinal joint. Mechanical fasteners shall not pierce the duct walls. The pins shall be cut off flush, washers shall be used and installation made so that no gaps or loose edges occur in the insulation. Apply a brushcoat of Benjamin-Foster 30-36 to washers, extending onto lining surface a minimum of 2". Top pieces shall be supported by the side pieces. Provide insulated build out frames for attaching dampers at running vanes where required.
- B. All transverse and longitudinal abutting edges of duct lining shall be sealed and lapped 3" with a heavy coat of Foster 30-36, in accordance with the manufacturer's recommendations. All exposed edges shall be installed with sheet metal nosings. At all openings in the ductwork there shall be a galvanized metal flange, equal in depth to adjacent lining and having a 1½" lip to hold lining in place. All bolt holes shall be sealed airtight.
- C. Internal Duct lining shall be installed in complete accordance with the Sheet Metal and Air-Conditioning Contractors National Association (SMACNA) Duct Lining Application Standard. Mechanical fasteners shall conform to Mechanical Fastener Standard MF-1 from SMACNA. Adhesive shall be water-based and conform to Adhesive and Sealant Council Standards for Adhesives for Duct Liner ASC-A-7001C.
- D. Internal Duct Lining shall be 1" unless otherwise called out, matte-faced, 1.5 lb/ft³ minimum density and shall meet the requirements of NFPA90-A.
- E. Acoustical duct liners shall comply with the following requirements and standards:
 - 1. ASTM C 1071, Type 1.
 - 2. NFPA 90A and 90B.
 - 3. Resist fungal growth.
 - 4. Support air velocities up to 5,000 fpm.
 - 5. Per UL 723 test method, flame spread shall not exceed 25, and smoke developed shall not exceed 50.

6. Per test method ASTM C423 using Type A mounting, minimum allowable NRC shall be 0.45.
- F. The following are acceptable, subject to the above:
1. Internal Duct Lining:
 - a. Aeroflex Type 150 from Owens-Corning Fiberglass, Toledo, OH.
 - b. Linacoustic/Spiracoustic Type 150 from Manville Products Corp., Denver, CO.
 - c. Ultralite Type 150 from Certain Teed Corp., Valley Forge, PA.
 - d. Pre-approved equal to above.
 2. Mechanical Fasteners:
 - a. Gemco TYPE IH-A from Goodloe E. Moore, Inc., Danville, IL.
 - b. Eckoustic-Klip from Eckel Industries, Inc., Cambridge or MA.
 - c. Pre-approved equal to above.

2.8 PLENUMS AND EQUIPMENT CASINGS

- A. Construct casings and plenums in conformance with SMACNA.
- B. Minimum Pressure Class: Unless otherwise indicated construct plenums and casings to withstand either a negative or positive static pressure of 4" W.G.
- C. Single-Wall: Provide single-wall, casings and plenums where indicated on the drawings.
 1. Construct in accordance with SMACNA Standards.
 2. Use steel-angle-reinforced standing-seam construction.
 3. Locate intermediate bracing angles bolted to the casing 24 inches on centers.
 4. Construct for static pressure indicated or for the maximum fan static pressure whichever is less.
 5. Bolt to 3" high concrete pads using 1½" x 1½" x ¼" thick galvanized steel structural sections.

2.9 DUCTWORK SPECIALTIES

- A. General: Where specifically called for, materials for use in fabricating ductwork specialties shall be identical to that used to fabricate ductwork. See drawings and Part 3, Execution for schedule.
- B. Volume and Splitter Dampers: Galvanized sheet metal blade and frame with Ventfabrics Inc., Ventlok operating hardware. For accessible dampers, provide #641 self-locking dial regulators and #644 self-locking dial regulators for insulated ductwork, #637 square end bearing, and #635 spring end bearing, as applicable. For inaccessible dampers, provide #666 or #677 concealed locking damper regulator with bearings as above. For static pressures above 3" W.G., provide #640 HiVel dial regulator and #609 HiVel end bearing for accessible dampers. Regulators shall extend to and through ceiling with neatly installed hardware at the finished ceiling. For inaccessible dampers requiring adjustment through diffusers use Young Regulator, Bowden cable control system.
- C. Multi-louver Volume Dampers: 16 gauge galvanized steel frame. Opposed, 6" wide, 16 gauge galvanized steel blades. Concealed linkage in frame. Ruskin #CD35/OBD or equal.
- D. Flexible Connections: Provide flexible connectors at the discharge and inlet of fans, air handlers, rotating mechanical equipment, and where shown on the Drawings for proper vibration isolation.

Neoprene impregnated glass cloth with 24 gauge galvanized metal frame. Neoprene-only connectors are **not** allowed. Minimum dimensions - 3" metal, 3" fabric, 3" metal. Ventfabrics #Ventglas or approved equal by Duro Dyne, Q Industries, consolidated Kinetics, Ductmate Proflex or Elgen.

- E. Ducts through roof shall be 16 gauge (or minimum of 2 gauges heavier than attaching ductwork), flashed and counterflashed, and provided with storm collars to secure a watertight construction.
- F. Bird Screens: 14 gauge, ½", galvanized wire mesh, set in a galvanized steel frame, screw set.

2.10 DUCT ACCESS PANELS AND DOORS

- A. In sheet metal work, hollow core double construction of same or heavier gauge material as duct in which installed. Use no door smaller than 12" by 12" for simple manual access or smaller than 24" by 24" where personnel must pass through infrequently. Use 24" by 60" minimum for filters and more frequent maintenance. Use Ventlok or approved hinges and latches on all doors; 100 Series hinges and latches on low pressure system doors up to 18 " maximum dimension, 200 Series on larger low pressure system doors and 333 Series on high pressure systems. Construct doors up to 18 " maximum dimension with one inch overlap fit and gasket with ¾" by ⅛" sponge rubber, fit larger doors against 1½" by ⅛" flat stock or angle frame and gasket with ¾" by ⅛" sponge rubber or felt. Door swing to be opposite airflow. CESCO, Vent Products, Air Balance, Ductmate Sandwich or equal. Access doors smaller than 12" x 12" can be used for visual inspection of dampers, etc. on small ductwork less than 12" wide but must be of maximum size that will fit on duct with 6" x 6" as minimum size. All access doors smaller than 12" x 12" must be approved by Engineer for the specific application prior to ordering.

2.11 BACKDRAFT DAMPERS

- A. Damper Types:
 - 1. Heavy Duty Backdraft Dampers: Provide counterweight type complete with frame, end bearings, counterbalance assembly, blades, and linkage. Pressure drop to be no more than 0.24" w.g. at 1000 fpm. Install at outside air intakes, exhaust outlets, and where shown on Drawings. Pacific Air Products #PRD-100AL, Ruskin #CBD2, NCA, or equal by Swartout, American Warming or Vent Products.
 - 2. Nonmetallic Backdraft Damper: Provide complete with 16ga frame, neoprene coated fiberglass blades, galvanized expanded metal grill. Ruskin NMS2.
- B. Application Requirements:
 - 1. Generator Discharge Damper: Heavy Duty Backdraft Damper. Size at no more than 1000 fpm velocity.
 - 2. Outside Air Intakes except where a control damper is required – Heavy Duty Backdraft Damper.

2.12 DIFFUSERS, GRILLES AND REGISTERS

- A. All diffusers, grilles, and registers shall be selected to provide proper air distribution for the intended occupant application. All supply air devices shall be selected to provide a maximum air velocity of 50 fpm at three feet above the floor, unless otherwise noted. Manufacturer's representative shall carefully review Architectural and Mechanical drawings and ensure diffuser/grille/register selections will provide proper air distribution at NC 25 or less. Manufacturer

at no additional expense to the Owner shall replace diffusers, grilles, and registers not providing proper distribution or excessive noise at scheduled airflow.

- B. All frames shall be selected to fit the ceiling type. Verify with Architectural Drawing. Each diffuser, grille and register shall be individually capable of balancing via duct mounted balancing dampers or attached opposed blade dampers. Provide unit opposed blade damper where individual duct mounted balancing dampers are not provided.
- C. Sizes, capacities and patterns shall be as shown on the Drawings. Manufacturer: Metal Aire, Titus, Krueger, Anemostat, Carnes, Price or Tuttle&Bailey.

2.13 DUCT SMOKE DETECTORS (DSD)

- A. Duct mounted photoelectric smoke detector. One required for each heating or cooling system supplying air in excess of 2,000 cfm, for systems serving more than one occupancy type, and for control of each combination fire/smoke damper when not controlled by Div. 26 area wide detection system. Coordinate with Div 16. work and electrical installer for power to smoke detector. Detector shall be mounted in the supply air ductwork downstream of the air handler and filters, or upstream of combination dampers. Coordinate with control installer to assure that detector shall shut down the air-moving equipment when smoke is detected and close associated damper actuator(s). Sensor shall be selected to operate with air velocity rating from 100 to 4000 fpm. Provide with metal sampling tube. Provide remote test and reset station at ceiling or as otherwise indicated. Duct smoke detector shall be installed in compliance with the applicable mechanical or building code. Coordinate with SECTION 23 09 93 – SEQUENCE OF OPERATIONS FOR HVAC CONTROLS and SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING work. System Sensor #D2 series or approved equal.

PART 3 - EXECUTION

3.1 DUCTWORK MATERIAL APPLICATION SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.

3.2 DUCTWORK AND SPECIALTIES INSTALLATION

- A. Ductwork is generally diagrammatically indicated and shall be generally installed as indicated. Do not scale Drawings for exact location of ducts. Install ducts to best suit field conditions and cooperate with other trades. Do not penetrate Structural members without consent of Architect or Structural Engineer. Check with Structural drawings prior to locating any penetrations. Duct sizes are indicated as net inside dimensions on the Drawings. The indicated dimensions shall be altered at the job site for the purpose of avoiding interferences and clearance difficulties to other dimensions producing the same air handling characteristics, provided such altered dimensions are approved by the Architect. Ducts shall be constructed in accordance with the latest edition of codes and standards identified in Part 1 and as shown on the Drawings.
 - 1. Clean and pretreat surfaces before application of sealant. Conform to the manufacturer's cleaning procedures. Install sealants in conformance with manufacturer's instructions.
 - 2. Except where noted, vertical ducts or horizontal ductwork penetrating fire rated ceilings, roofs, walls and floors shall be fire separated with UL listed and labeled fire dampers installed per UL tested assembly including sleeves and retaining angles. Provide additional fire dampers indicated on the Drawings and as otherwise required by the IBC and building inspector. Provide approved firestopping between damper frames and firewalls. Install fire

dampers in accordance with NFPA Standards, requirements of the State Fire Marshal, and applicable codes. Ensure that fire dampers are installed in the open position.

3. For penetration of fire rated partitions which meet the IBC Chapter Seven requirements of non-Group H occupancy penetration of tenant separation and corridor walls in buildings with fire sprinklers provide metal sleeves as follows: A minimum 12 inch-long (0.30 m) by 0.060 inch thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 1 1/2" inch by 1 1/2 inch by 0.060 inch steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 screws. The annular space between the steel sleeve and wall opening shall be filled with rock wool batting on all sides
 4. Grilles, Registers and Diffusers: Install flush, squared, tightly sealed, and entirely covering sheet metal ductwork and gaskets. Thread sheet metal mounting screws tightly into sheet metal. All frames shall be selected to fit the ceiling type. Verify with Architectural Drawing. Each diffuser, grille and register shall be individually capable of balancing via duct mounted balancing dampers or attached opposed blade dampers. Provide unit opposed blade damper only where individual duct mounted balancing dampers are specifically noted as not provided. Duct connections shall fit securely to necks or collars behind face area. Provide all necessary transition pieces and duct collars to make connections from ductwork to neck sizes. Where ducts connect directly to necks or collars provide a minimum straight duct section of two times the duct diameter to the last elbow. Where minimum straight duct sections are not physically possible provide sheet metal plenum sized for approximately 500 fpm air velocity with duct tapped directly to side of plenum. Where building walls, floors and ceilings form portions of duct or plenum, provide gasketed angles or channels at junction points, securely bolted and sealed to building structure.
 5. Install turning vanes in all mitered elbows in all ducts, so that tips are parallel with the sides of the ducts. Vanes shall be single thickness type. Tips of acoustical turning vanes on outside radius shall be flush with acoustical lining.
 6. Provide flexible connections to completely isolate fans from direct contact with all sheet metal work.
 7. Provide access panels or doors, as required, for access to valves, controllers, fire dampers and humidifier dispersion tubes. Access doors required in Product Conveying Vapor/Moisture Ductwork (see applicable paragraph above) shall not be installed in the bottom of the duct or in a manner to allow leaks.
 8. Volume Dampers: Provide manual volume dampers in all low pressure supply, return and exhaust branch ductwork to grilles, diffusers, inlet and outlet openings to facilitate balancing of systems. These are to be provided as part of contract whether shown on plans or not. Where ceilings are not accessible, provide access door or remote damper operator.
 9. Splitters and splitter dampers shall not be installed in medium or low pressure supply ductwork to VAV systems.
- B. Hangers and Supports: Securely fasten all ductwork to the building construction by means of hangers, supports, guides, anchors, and sway braces to maintain duct alignment, to prevent sagging, and to prevent noise and excessive strain on ductwork due to movement under operating conditions.
1. Maximum spacing between hangers shall not exceed eight (8) feet.

2. Adequately mount and anchor all material and equipment as required. Include lateral bracing as required to prevent horizontal, seismic movement. Refer to IBC and architectural Drawings for seismic requirements.
3. Do not support ductwork from fans or any other pieces of equipment.
4. Powder driver fasteners shall not be used to support rectangular ducts of 40" maximum dimension. Powder driven fasteners shall not be allowed in existing facilities where electronic equipment is located.
5. Support round duct, 30" and larger, with two hangers at each support point.
6. Hangers and supports shall conform to SMACNA section "Hangers and Supports". Nail inserts, hangers and supports to formwork before slabs are poured. Cut off or remove nails, strap-ends and other projections, flush with concrete after forms are removed.
7. Support vertical ducts, passing through floors with two continuous angles screwed to the duct and bearing to the floor and conforming to SMACNA section "Riser Support-From Floor". Blocking or shimming ducts will not be permitted.

C. Other:

1. Fans: Align fans, motors, and drives. Install fans to render bearings accessible for lubrication without dismantling fans or ducts. Provide extended bearing oilers as required. Mount all fans on vibration isolators as specified.
2. Insulation: Properly and neatly apply insulation on all material and equipment and apparatus, as specified, including all fittings. Apply insulation over clean, dry surfaces, with adjoining sections firmly butted together and canvas smoothly pasted over. When vapor barriers are specified, install continuous overall external surfaces of the entire system.
3. Duct Sizing: Where duct sizes are not specifically shown on the plans or must be modified due to physical limitations, supply ducts may be sized at a maximum velocity of 1,500 fpm or 0.08" sp friction per 100 feet, whichever provides the larger duct, and return/exhaust/intake ducts may be sized at a maximum velocity of 1,000 fpm or 0.06" sp friction per 100 feet, whichever provides the larger duct.
4. Humidifiers: Humidifier installation shall be approved by manufacturer and coordinated with all other systems. Condensate piping shall include p-traps as recommended by the humidifier manufacturer. Insulate exposed piping as required by the code
5. Access Floor Diffusers: The mounting ring for floor mounted diffusers are to be affixed to the floor tiles using a clamp insert or other method approved for use with the floor diffuser.

3.3 CONSTRUCTION AND SEALING CRITERIA

A. The default leakage classification of ductwork is as follows:

<u>Duct working press. class:</u>	<u>Low pressure less than +/-0.5"wc</u>	<u>+/-0.5" to +/-2.99"</u>	<u>+/-3" to +/-10" wc</u>
SMACNA Seal Class	C	B	A
Sealing Applicable	Transverse joints only	Transverse and longitudinal Joints	Joints, seams, and all wall penetrations
Rectangular sheet metal SMACNA Leakage Class	24	12	6
Round sheet metal SMACNA Leakage Class	12	6	3

3.4 MANDATORY DUCTWORK TESTING

A. All duct systems shall be sealed to a leakage rate not to exceed 6% of the fan flow if the duct systems are:

1. Connected to a constant volume, single zone system, air conditioners, heat pumps or furnaces, and
2. Serve less than 5,000 square feet of floor area, and
3. Have more than 25% duct surface area located in one or more of the following places:
 - a. Outdoors, or
 - b. In a space directly under a floor where the U-factor of the roof is greater than the U-factor of the ceiling, or
 - c. In a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces, or
 - d. In an unconditioned crawlspace, or
 - e. In other unconditioned spaces.
4. The leakage rate shall be confirmed through field verification and diagnostic testing in accordance with procedures defined by Oriflow Air Leakage Test, or equivalent procedure.

3.5 SEISMIC REQUIREMENTS

- A. All HVAC equipment and machinery shall be anchored to withstand forces generated by earthquake motions. As a minimum, equipment and equipment frames shall be designed to withstand a force of 100% of the weight of the equipment and frame acting at its center of gravity. Anchorage of the equipment and/or frame to the structure shall be for a force of four times gravity also acting at the center of gravity.
- B. The seismic calculations shall be the responsibility of contractor.

3.6 EQUIPMENT

- A. Install equipment as shown on plans and in accordance with manufacturer's installation recommendations.

3.7 SUPPLY DIFFUSER AND REGISTER LOCATIONS

- A. Coordinate location of supply outlets with ceiling mounted smoke detectors. Locate outlets or outlet distribution so as to prevent airflow from inhibiting the operation of smoke detectors. Locate ceiling outlets a minimum of 3'-0" from smoke detectors.

3.8 PAINTING

- A. Where the interior surfaces of ductwork are visible through the blades of supply outlets, return inlets, and exhaust inlets - paint the interior visible surfaces with one coat of flat black paint.

3.9 FIELD QUALITY CONTROL

- A. Do not insulate or conceal ductwork before inspection by Owner's Representative, Architect or Engineer. If ductwork is insulated and concealed prior this inspection the Contractor shall remove insulation and ceiling to permit inspection at no additional cost to the Owner. The Contractor shall replace the insulation and ceiling after final inspection at no additional cost to the Owner.
- B. Ductwork Deflection Criteria:
 - 1. Maximum inward and/or outward deflection at sheet metal panels shall be 3/4" under maximum static pressure operating conditions. Additional intermediate stiffening angles shall be installed where deflections exceed 3/4".
 - 2. Maximum inward and/or outward deflection at sheet metal elbows and joints shall be 1/4" under maximum static pressure operating conditions. Additional stiffening angles shall be installed where deflections exceed 1/4".
- C. Acceptance of duct systems shall be contingent upon conformance with the requirements specified in SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING.

3.10 ADJUSTING AND CLEANING

- A. Clean the inside of plenums, casings, enclosures, fans, and accessible ductwork before starting fans. Blowout coils and condensate piping with compressed air. Install a clean set of filters in each system prior to testing and balancing. Proceed with testing and balancing. All dampers shall be locked in place.

END SECTION 23 31 13

SECTION 23 34 13 FANS AND VENTS

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS, and other Sections in DIVISION 23 specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this Section shall comply with all the requirements of DIVISION 1, and shall include, but not necessarily be limited to, the following:
 - 1. Spun Aluminum and Steel Housed Centrifugal Exhaust Fans
 - a. General Duty Spun Aluminum Exhaust fan
 - b. Upblast Spun Aluminum Exhaust Fan for roof or sidewall mount
 - 2. Large Belt Driven Cabinet Fans
 - 3. Housed Centrifugal Fans
 - a. Utility Set
 - b. Industrial duty high temperature exhaust fan

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS
- B. SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING
- C. SECTION 23 07 00 - HVAC INSULATION
- D. SECTION 23 09 93 – SEQUENCE OF OPERATIONS FOR HVAC CONTROLS
- E. SECTION 23 31 13 - AIR DISTRIBUTION
- F. DIVISION 26 – ELECTRICAL

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Provide air handling units that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be fabricated by the Contractor.
- B. Certifications: Provide certified ratings of units based on tests performed in accordance with ARI 430, "Central-Station Air Handling Units."
- C. Codes and Standards: Provide air handling units conforming to the requirements of the latest addition of the following:
 - 1. Air Movement and Control Association (AMCA):
 - a. 99 standards Handbook
 - b. 210 Laboratory Methods of Testing Fans for Rating Unit shall bear AMCA Certified Rating Seal

- c. 300 Reverberant Room Method for Sound Testing of Fans Unit shall bear AMCA Certified Rating Seal
 - d. 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data
 - e. 500 Test Method for Louvers, Dampers, and Shutters
2. American National Standards Institute (ANSI):
 - a. 9 Load Ratings and Fatigue Life for Ball Bearings
 - b. 11 Load Ratings and Fatigue Life for Roller Bearings
 - c. 900 Test Performance of Air Filter Units
 3. Air-Conditioning and Refrigeration Institute (ARI):
 - a. 350 Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
 - b. 410 Forced-Circulation Air-Cooling and Air-Heating Coils
 - c. 430 Central-Station Air-Handling Units
 - d. 440 Room Fan-Coil Air-Conditioners
 4. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - a. 15 Safety Code for Mechanical Refrigeration
 5. National Electrical Manufacturers Association (NEMA): Except for motors, provide electrical components required as part of air handling units, which comply with NEMA Standards.
 6. National Fire Protection Association (NFPA): Provide air handling unit internal insulation having flame spread rating not higher than 25 and smoke developed rating not higher than 50:
 - a. 70 National electrical Code
 - b. 90A Standard for the Installation of Air Conditioning and Ventilating Systems
 - c. 90B Standard for the Installation of Warm Air Heating and Air Conditioning Systems
 7. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA): Comply with applicable SMACNA standards including "HVAC Duct Construction Standards - Metal and Flexible."
 8. Underwriters Laboratories, Inc. (UL): Except for motors, provide electrical components required as part of air handling units, which have been listed and labeled by UL.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for air handling units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, and finishes of materials, installation instructions, sound and vibration test report, and bearing life calculations.
- B. Shop Drawings: Submit shop drawings showing unit dimensions, weight loadings, required clearances, field connection details and methods of support. Draw to a scale of 1/4" per one foot. Include field fabricated mixing boxes, dampers and duct connections.

- C. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in operating and maintenance manuals.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver unit to the site in containers with manufacturer's stamp or label affixed.
- B. Store and protect equipment and products against dirt, water, chemical, and mechanical damage. Do not install damaged unit - remove from project site.

1.8 WARRANTY

- A. Provide one-year (12 months) warranty. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

1.9 SAFETY PROVISIONS

- A. Provide all open drives and fan wheels subject to maintenance and potential entanglement with protective guards or screens meeting OSHA requirements.

PART 2 - PRODUCTS

2.1 GENERAL FAN REQUIREMENTS

- A. Construction, Rating and Testing: Provide fans constructed and factory tested in accordance with the Air Moving and Conditioning Association (AMCA). All fan wheels shall be statically and dynamically balanced. Size and capacity as indicated on the Drawings. Provide extended bearing lubrication fittings where necessary to assure accessibility of all lubrication points.
- B. Motors and Drives: Provide premium efficiency drip-proof motors with temperature rise not greater than 40 degrees C above ambient temperature. Provide belt drive assembly capable of 150% of the motor rated horsepower on one less than the total number of belts, for belt drives with two or more belts. All drives shall have adjustable sheaves to allow adjustment of $\pm 20\%$. Provide two speed, two winding motors where indicated on schedules.
- C. Accessories: Provide, as indicated on the Drawings and specified in other paragraphs of this Section, all related accessories to match the fan section, including access sections, diffusion sections, transition sections, flexible connections, vibration eliminators, and belt guards.
- D. Submissions: For shop drawings include complete dimensional and physical data, CFM, SP, HP, discharge arrangement, rotation, class, base details, and fan curves.

2.2 SPUN ALUMINUM AND STEEL HOUSED CENTRIFUGAL EXHAUST FANS

- A. Manufacturer: Models as scheduled manufactured by Greenheck, Carnes, Cook, Penn, Twin City or approved equal.

B. General Duty Spun Aluminum Exhaust Fan

1. Direct Drive: Spun aluminum exhaust fans shall be direct drive type.
 - a. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure and a birdscreen.
 - b. Motors shall be mounted out of the airstream on vibration isolators. Fresh air for motor cooling shall be drawn into the motor compartment through a large space between the fan shroud and the motor cover. Motors shall be readily accessible for maintenance. A disconnect switch shall be factory installed and wired from the fan motor to a junction box within the motor compartment.
 - i. Variable speed capability: For all direct drive fans with motors through ¾" hp, the fan shall be equipped with a DC electronic commutation type motor (ECM). Motor shall be speed controllable to 20% of full speed (80% turndown). Speed shall be controlled by a potentiometer dial mounted at the motor or by a 0-10 vdc signal. Motor shall be 85% efficient at all speeds.
 - c. A conduit chase shall be provided through the curb cap to the motor compartment for ease of electrical wiring.
 - d. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number for future identification.
2. Belt-drive: Spun aluminum exhaust fans shall be belt driven type.
 - a. Fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure and a birdscreen.
 - b. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Drive frame assembly shall be constructed of heavy gauge steel. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment through a large space between the fan shroud and the motor cover. Motors and drives shall be readily accessible for maintenance.
 - c. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum L10 life in excess of 100,000 hours (L50 life of 500,000 hours) at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the cast type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final system balancing.
 - d. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment. A conduit chase shall be provided through the base to the motor compartment for ease of electrical wiring.

- e. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.
 - f. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number for future identification.
- C. Upblast Spun Aluminum Exhaust Fan for Roof or Sidewall Mount
- 1. Direct Drive:
 - a. Spun aluminum exhaust fans shall be upblast centrifugal direct drive type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure.
 - b. Motors shall be mounted out of the airstream on vibration isolators. Fresh air for motor cooling shall be drawn into the motor compartment free of discharge contaminants. Motors shall be readily accessible for maintenance. A disconnect switch shall be factory installed and wired from the fan motor to a junction box within the motor compartment. A conduit chase shall be provided through the curb cap to the motor compartment for ease of electrical wiring.
 - i. Variable speed capability: For all direct drive fans with motors through ¾" hp, the fan shall be equipped with a DC electronic commutation type motor (ECM). Motor shall be speed controllable to 20% of full speed (80% turndown). Speed shall be controlled by a potentiometer dial mounted at the motor or by a 0-10 vdc signal. Motor shall be 85% efficient at all speeds.
 - c. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.
 - d. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number for future identification.
 - e. Fan Arrangement:
 - i. Roof Mounted Upblast Exhaust Fans A leakproof fan housing shall be constructed with a one piece windband with an integral rolled bead for added strength.
 - ii. Sidewall Mounted Exhaust Fans A leakproof fan housing shall be constructed with a one piece windband with an integral rolled bead for added strength. Fan shall be provided with a mounting plate, which is attached and sealed to the wall prior to locating the entire unit.
 - 2. Belt-drive: Spun aluminum exhaust fans shall be belt driven type.
 - a. Fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. The windband shall be welded to the one-piece curb cap and on all sizes with UL/CUL-762.
 - b. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Drive frame assembly shall be constructed of heavy gauge steel. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor

compartment through a tube sized for sufficient fresh air to provide motor cooling. Motors and drives shall be readily accessible for maintenance.

- c. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum L10 life in excess of 100,000 hours (L50 life of 500,000 hours) at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the cast type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final system balancing. Third pulley to be included for ease of adjusting drive belt tension and to enhance belt life.
- d. A NEMA 3R disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment. A conduit chase shall be provided through the base to the motor compartment for ease of electrical wiring.
- e. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.
- f. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number for future identification.

2.3 HOUSED CENTRIFUGAL FANS

A. Utility Set

- 1. Manufacturer: Trane, Loren Cook, Carnes, Industrial Air, Peerless-Winsmith, Aerovent, Twin City, or approved equal.
- 2. Belt Drive Utility Fans:
 - a. Exhaust air fans shall be of the belt driven utility fan type in AMCA Arrangement 10 with a single width, single inlet housing, in CW or CCW rotation as specified. The housing shall be constructed of heavy gauge steel with air tightlock formed seams. The housing shall be easily rotated in the field to any of the eight standard discharge positions. Housing and bearing supports shall be constructed of welded steel members to prevent vibration and to rigidly support the shaft and bearings.
 - b. Fan wheels shall be of the forward curved type, constructed of heavy gauge steel with uniform stamped steel blades. Wheels shall be statically and dynamically balanced. The wheel cone and fan inlet cone shall be carefully matched for maximum performance and operating efficiency.
 - c. Motors shall be heavy duty, ball bearing type, matched to the fan load and furnished at the specified voltage, phase and enclosure. The fan shaft shall be ground and polished solid steel mounted in heavy duty, permanently sealed, pillow block ball bearings. Bearings shall be selected for a minimum L50 life in excess of 200,000 hours of maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulley shall be adjustable for final system balancing.
- 3. All fans shall bear the AMCA Certified Ratings Seal for air performance.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate motor starters with Div. 26 and control contractor.
- B. Install in accordance with manufacturer's instructions.
- C. Examine site to verify if site is ready to receive work. Provide layout drawings of air handlers and fan locations to electrical installer.
- D. Install 3" flexible duct connection at inlets and outlets of units.
- E. Control installers shall install all wiring associated with control signals into the fan starters.
- F. Electrical installer shall install all line voltage power wiring and conduit. Coordinate with DIVISION 26 work.

3.2 MANUFACTURER'S START-UP SERVICES

- A. The manufacturer shall provide start-up service in the form of a factory trained service technician. The service technician shall verify correct installation, verify unit mounting, verify fan rotation, verify spring isolator adjustments, verify control wiring, verify power wiring, start-up the fans, and check for proper operation. The service technician shall provide final adjustments to meet the specified performance requirements. Fully staffed parts and service personnel shall be within four hours travel from the job site.

END SECTION 23 34 13

SECTION 23 73 33 MAKE-UP AIR UNITS

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS, and other Sections in DIVISION 23 specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this Section shall comply with all the requirements of DIVISION 1, and shall include, but not necessarily be limited to, the following:
 - 1. Packaged unit
 - 2. Controls and control connections
 - 3. Electrical power connections
 - 4. Mounting frame and base

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS
- B. SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING
- C. SECTION 23 07 00 - HVAC INSULATION
- D. SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS
- E. SECTION 23 31 13 - AIR DISTRIBUTION
- F. DIVISION 26 – ELECTRICAL

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Provide packaged units that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be fabricated by the Contractor.
- B. Codes and Standards: Provide air handling units conforming to the requirements of the latest addition of the following:
 - 1. Air Movement and Control Association (AMCA):
 - a. 99 Standards Handbook
 - b. 210 Laboratory Methods of Testing Fans for Rating Unit shall bear AMCA Certified Rating Seal
 - c. 300 Reverberant Room Method for Sound Testing of Fans Unit shall bear AMCA Certified Rating Seal
 - d. 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data
 - e. 500 Test Method for Louvers, Dampers, and Shutters

2. American National Standards Institute (ANSI):
 - a. 9Load Ratings and Fatigue Life for Ball Bearings
 - b. 11Load Ratings and Fatigue Life for Roller Bearings
 - c. 900Test Performance of Air Filter Units
3. National Electrical Manufacturers Association (NEMA): Except for motors, provide electrical components required as part of air handling units, which comply with NEMA Standards.
4. National Fire Protection Association (NFPA): Provide unit internal insulation having flame spread rating not higher than 25 and smoke developed rating not higher than 50:
 - a. 70National electrical Code
 - b. 90AStandard for the Installation of Air Conditioning and Ventilating Systems
 - c. 90BStandard for the Installation of Warm Air Heating and Air Conditioning Systems
5. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA): Comply with applicable SMACNA standards including "HVAC Duct Construction Standards - Metal and Flexible."
6. Underwriters Laboratories, Inc. (UL): Except for motors, provide electrical components required as part of units, which have been listed and labeled by UL.

1.5 PRODUCT SUBSTITUTIONS

- A. The Contractor shall certify the following items are correct when using substituted products other than those scheduled or shown on the drawings as a basis of design:
 1. The proposed substitution does not affect dimensions shown on drawings.
 2. The Contractor shall pay for changes to building design, including engineering design, detailing, structural supports, and construction costs caused by proposed substitution.
 3. The proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
 4. Maintenance and service parts available locally are readily obtainable for the proposed substitute.
- B. The Contractor further certifies function, appearance, and quality of proposed substitution are equivalent or superior to specified item.
- C. The Contractor agrees that the terms and conditions for the substituted product that are found in the contract documents apply to this proposed substitution.

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for packaged units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, finishes of materials, installation instructions, sound and vibration test report, and bearing life calculations.
- B. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in operating and maintenance manuals; in accordance with requirements of DIVISION 1.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of DIVISION 1. Deliver units to the site in containers with manufacturer's stamp or label affixed.
- B. Store/protect products under provisions of DIVISION 1. Protect units against dirt, water, chemical, and mechanical damage. Do not install damaged units - remove from project site.

1.9 WARRANTY

- A. Provide general one year (12 months) warranty with five (5) year warranty on compressors under provisions of DIVISION 1. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

PART 2 - PRODUCTS

2.1 GENERAL APPLICATION INDIRECT FIRED FURNACE UNIT, INDIRECT EVAPORATIVE COOLING AND HEAT RECOVERY

- A. Manufacturers: Western Aire, Munters, Modine, Gaylord, Reznor or approved equal.
- B. General
 - 1. Furnish Multipurpose Room Furnace Unit. The unit shall handle the multipurpose room and associated area heating and ventilating needs. The unit configuration shall include indirect gas fired furnace.
- C. Blower Section
 - 1. The blower section shall be provided completely factory assembled to the duct furnace section and mounted on a base ready for installation. The section shall have full 1" insulation and shall include a blower and drive assembly sized for the makeup air requirements as determined for the application.
 - 2. Motor shall be totally enclosed and shall have thermal overload protection built in if single phase.
 - 3. Required additional blower section components:
 - a. 2" filter rack and filters.
 - b. Fresh air and return air dampers with modulating damper motor.
 - c. Fusible disconnect switch.
 - d. Motor starter.
 - e. Auxiliary contacts on motor starter for remote starting on interlock with grease exhaust fan.
 - f. Convenience outlet.

D. Furnace

1. Induced draft combustion type with energy saving direct spark ignition system and redundant main gas valve.
2. The heat exchanger shall be of the tubular section type constructed of a minimum of 20 gauge type 409 stainless steel. Unit shall be completely heliarc machine-welded and shall have smoothly contoured stress-free tubes. Tubes and headers shall be made of the same material. Tubes shall be direct fired.
3. Burners shall be same material as the heat exchanger with a material thickness not less than 28 gauge. Burner shall have non-clogging, slotted ports designed for good lighting characteristics without noise of extinction. The burner box shall be completely removable from the side of the unit for service. Burner manifold piping shall include a ground joint union to facilitate removal of the burner box assembly.
4. Venting shall be via a power-exhausted system using an integral 115volt power venter, ball-bearing type motor and centrifugal switch for positive interlock with gas valve.
5. All gas piping shall enter the unit cabinet at a single location.
6. Heating section shall be provided with the following minimum protections:
 - a. High temperature limit switch.
 - b. Induced draft motor centrifugal switch.
 - c. Flame rollout switch (manual reset).
 - d. Flame proving controls.
 - e. The burner controls shall be modulating control between 50% and 100% fire controlled from room stat.
7. Other controls: In addition to those described above the unit shall also be equipped with a firestat, thermostat subbases, thermostat guards, and gas pressure regulator.

E. Electrical

1. The unit to be furnished with an electrical control panel which shall contain fan starter with overload resets, control transformer, fuse blocks, relay switches and other control components for completely automatic operation of the unit interlocking the unit to the grease exhaust fan. A safety type disconnect switch (rainproof is located out of doors shall be factory installed in the electrical control panel, wired to starters and motors. Unit to be prewired and ready for connection to the building service. All electrical components shall be U.L. listed.

F. Filters

1. 30% efficient throwaway type supply air filters shall be provided and sized for no higher than 500 FPM face velocity. Filters to be mounted to facilitate convenient inspection and replacement.

G. Construction

1. Unit casing shall be fabricated of no less than 20 ga. minimum aluminized steel painted with weatherproof enamel. Interior surfaces and ductwork sprayed with undercoating material for protection and sound deadening. To include hinged access doors at main components for

inspection and service. Unit to be supported on heavy duty steel channels designed for either roof slab or curb mounting depending on the application.

2. Duct collar and internal ductwork on exhaust side shall be 16 ga. galvanized iron with continuous external weld in compliance with NFPA 96 standard for grease ducts.

H. Controls

1. General: Unit is to be provided with the following controls: Gas furnace firing and safety controls, all starters, and auxiliary contacts.
2. Sequence of Operation required:
 - a. On-off operation: Unit operation shall be 24 hours per day, 7 days per week, 365 days per year:
 - b. Heating: The burner is controlled by the modulating room thermostat. Upon call for heat, the stat will energize the gas modulating regulator and fire the burner at 40% of full rated input. If the initial firing rate is insufficient to maintain setpoint, the thermostat will modulate the burner fire until the setpoint is satisfied.
 - c. Cooling: The indirect evaporative cooler pump is controlled by the modulating room thermostat. Upon call for cooling, the thermostat will energize the pump. If the space temperature drops below setpoint, the thermostat will de-energize the pump. If the space temperature continues to drop, a call for heating will be initiated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that mounting surface, e.g. roof, is ready to receive work.
- B. Verify that proper power supply is available.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide layout drawings of units, locations and power requirements to electrical installer.
- C. Install minimum 30% efficiency air filters in unit during installation phase. Do not operate the unit without filters in place.
- D. Mount rooftop unit on factory built roof mounting frame. Install roof mounting frame level.
- E. Install 3" flexible duct connection at outlet of units.
- F. Install water supply and drain piping in accordance with manufacturer's instructions and as shown on the Drawings.
- G. Control installers shall install thermostat and all wiring associated with control signals into the units.
- H. Electrical installer shall install all line voltage power wiring and conduit. Coordinate with DIVISION 26 work.
- I. Install a new set of filters prior to final air balance and substantial completion.

3.3 MANUFACTURER'S START-UP SERVICES

- A. The manufacturer shall provide start-up service in the form of a factory trained service technician. The service technician shall verify correct installation, verify unit mounting, verify fan rotation, verify spring isolator adjustments, verify control wiring, verify power wiring, start-up the fans, and check for proper operation. The service technician shall provide final adjustments to meet the specified performance requirements. Fully staffed parts and service personnel shall be within four hours travel from the job site.

END SECTION 23 73 33

SECTION 23 74 34 SMALL PACKAGED HVAC UNITS

PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

- A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, DIVISION 1 – GENERAL REQUIREMENTS, SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS, and other Sections in DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) specified herein.

1.2 SCOPE

- A. All work to be furnished and installed under this Section shall comply with all the requirements of DIVISION 1, and shall include, but not necessarily be limited to, the following:
 - 1. Packaged unit.
 - 2. Controls and control connections.
 - 3. Electrical power connections.
 - 4. Roof mounting frame and base.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. SECTION 23 05 00 - BASIC HVAC MATERIALS AND METHODS
- B. SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING
- C. SECTION 23 07 00 - HVAC INSULATION
- D. SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS
- E. SECTION 23 31 13 - AIR DISTRIBUTION
- F. DIVISION 26 – ELECTRICAL

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Provide packaged units that are the standard product of an equipment manufacturer regularly engaged in the production of such units who issues complete catalog information on such products. Units shall not be fabricated by the Contractor.
- B. Codes and Standards: Provide air handling units conforming to the requirements of the latest addition of the following:
 - 1. Air Movement and Control Association (AMCA):
 - a. 99 Standards Handbook
 - b. 210 Laboratory Methods of Testing Fans for Rating Unit shall bear AMCA Certified Rating Seal
 - c. 300 Reverberant Room Method for Sound Testing of Fans Unit shall bear AMCA Certified Rating Seal
 - d. 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data
 - e. 500 Test Method for Louvers, Dampers, and Shutters

2. American National Standards Institute (ANSI):
 - a. 9 Load Ratings and Fatigue Life for Ball Bearings
 - b. 11 Load Ratings and Fatigue Life for Roller Bearings
 - c. 900 Test Performance of Air Filter Units
3. Air-Conditioning and Refrigeration Institute (ARI):
 - a. 210 Unitary Air Conditioning Equipment
 - b. 270 Sound Rating of Outdoor Unitary Equipment
4. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - a. 15 Safety Code for Mechanical Refrigeration
5. National Electrical Manufacturers Association (NEMA): Except for motors, provide electrical components required as part of air handling units, which comply with NEMA Standards.
6. National Fire Protection Association (NFPA): Provide unit internal insulation having flame spread rating not higher than 25 and smoke developed rating not higher than 50:
 - a. 70 National electrical Code
 - b. 90A Standard for the Installation of Air Conditioning and Ventilating Systems
 - c. 90B Standard for the Installation of Warm Air Heating and Air Conditioning Systems
7. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA): Comply with applicable SMACNA standards including "HVAC Duct Construction Standards - Metal and Flexible."
8. Underwriters Laboratories, Inc. (UL): Except for motors, provide electrical components required as part of units, which have been listed and labeled by UL.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for packaged units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, finishes of materials, installation instructions, sound and vibration test report, and bearing life calculations.
- B. Maintenance Data: Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in operating and maintenance manuals; in accordance with requirements of DIVISION 1.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver units to the site in containers with manufacturer's stamp or label affixed.
- B. Store and protect units against dirt, water, chemical, and mechanical damage. Do not install damaged units - remove from project site.

1.8 WARRANTY

- A. Provide general one-year (12 months) parts and labor warranty with five (5) year warranty on compressors. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory authorized service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Carrier, Lennox, Trane, York, or approved equal.

2.2 MANUFACTURED UNITS

- A. Provide roof-mounted, vertical discharge unit having natural gas heating and electric refrigeration capabilities.
- B. Unit shall be self-contained, packaged, factory assembled and pre-wired, consisting of supply fan, heat exchanger, burner, controls, air filters, evaporator coil, compressor, condenser coil, condenser fan, and R-410A refrigerant.
- C. Unit fabrication shall meet following requirements:
 - 1. Cabinet: Steel with baked or powdered enamel finish and access doors or removable access panels. Structural members, access doors, and removable panels shall be minimum 20 gage.
 - 2. Insulation: One-inch thick neoprene coated or black matted glass fiber on surfaces in contact with conditioned air. Protect edges from erosion.
 - 3. Heat Exchanger: Aluminized steel, of welded construction.
 - 4. Supply Fan: Forward-curved centrifugal type, resiliently mounted with V-belt drive, and rubber isolated hinge mounted motor.
 - 5. Air Filters: One-inch thick glass fiber. Two-inch filters shall be provided in units designed handle this filter size.
 - 6. Roof Mounting Frame: 8 inches high (minimum), 16-gauge (minimum) galvanized steel, channel frame with gaskets, nailer strips.

2.3 BURNER

- A. Induced draft type burner with pressure regulator, gas valves, manual shut-off, intermittent spark ignition, flame sensing device and automatic 100 percent shut-off pilot.
- B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay allow gas valve to open.
- C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.
- D. Supply Fan Control: Bonnet temperature sensor independent of burner controls, or adjustable time delay relays with switch for continuous fan operation.

2.4 EVAPORATOR COIL

- A. Provide copper tube/aluminum fin coil assembly with stainless drain pan and connection.
- B. Provide thermostatic expansion device.

2.5 COMPRESSOR

- A. Provide hermetic or semi-hermetic, 3600 RPM maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gage ports, and filter drier.
- B. Five minute timed off circuit shall delay compressor start.

2.6 CONDENSER

- A. Provide copper tube/aluminum fin coil assembly.
- B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.

2.7 SUPPLY/RETURN

- A. Dampers: Outside air damper shall fail to closed position on shutdown.
- B. Gaskets: Provide tight fitting dampers with edge gaskets.
- C. Damper Operator: 24-volt operation.
- D. Mixed Air Controls (Economizers as specified): Maintain selected supply air temperature and return dampers to minimum position when ambient air temperature exceeds return air temperature.

2.8 THERMOSTATS

- A. Electronic thermostat with subbase. Seven-day programming with minimum of 2 occupied/unoccupied periods per day. Individual temperature setpoints for heat and cool. Automatic heat/cool changeover. Intelligent recovery to automatically optimize start time depending on building load and setpoints. Locking setpoints and schedules to eliminate tampering. Subbase shall have a fan operation switch (On/Auto) and a conditioning switch (Auto/Cool/Off/Heat).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that mounting surface, e.g. roof, is ready to receive work.
- B. Verify that proper power supply is available.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide layout drawings of units, locations and power requirements to electrical installer.
- C. Install minimum 30% efficiency air filters in unit during installation phase. Do not operate the unit without filters in place.
- D. Mount rooftop unit on factory built roof mounting frame. Install roof mounting frame level.
- E. Install 3" flexible duct connection at inlets and outlets of units.

- F. Install condensate drain piping and traps in accordance with manufacturer's instructions and as shown on the Drawings.
- G. Control installers shall install thermostat and all wiring associated with control signals into the units.
- H. Electrical installer shall install all line voltage power wiring and conduit. Coordinate with DIVISION 26 work.
- I. Install a new set of filters prior to final air balance and substantial completion.

3.3 MANUFACTURER'S START-UP SERVICES

- A. The manufacturer shall provide start-up service in the form of a factory trained service technician. The service technician shall verify correct installation, verify unit mounting, verify fan rotation, verify spring isolator adjustments, verify control wiring, verify power wiring, start-up the fans, and check for proper operation. The service technician shall provide final adjustments to meet the specified performance requirements. Fully staffed parts and service personnel shall be within four hours travel from the job site.

END SECTION 23 74 34

END DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

DIVISION 25 – INTEGRATED AUTOMATION

NOT USED AT THIS TIME

DIVISION 26 – ELECTRICAL

SECTION 26 05 00 BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 1. Adjust list below to suit Project.
 2. Electrical equipment coordination and installation.
 3. Sleeves for raceways and cables.
 4. Sleeve seals.
 5. Common electrical installation requirements.

1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.6 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 3. To allow right of way for piping and conduit installed at required slope.
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in DIVISION 8 – OPENINGS, SECTION 08 31 00 - ACCESS DOORS AND PANELS.
- D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in DIVISION 7 – THERMAL AND MOISTURE PROTECTION, SECTION - FIRESTOPPING.

2.3 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

Comply with NECA 1.

- A. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- B. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Coordinate sleeve selection and application with selection and application of firestopping.
- C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- E. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- G. Cut sleeves to length for mounting flush with both surfaces of walls.
- H. Extend sleeves installed in floors 2 inches above finished floor level.
- I. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require a different clearance.
- J. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to SECTION 07 92 - JOINT SEALANTS for materials and installation.
- L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with DIVISION 7 – THERMAL AND MOISTURE PROTECTION, SECTION – FIRESTOPPING.

- M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.5 FIELD QUALITY CONTROL

- A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END SECTION 26 05 00

SECTION 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 1. Building wires and cables rated 600 V and less.
 2. Connectors, splices, and terminations rated 600 V and less.
 3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with CEC.

1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- B. Coordinate conduits and electrical devices installation at CMU walls.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- C. Copper Conductors: Comply with NEMA WC 70.
- D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and SO.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052-inch or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in SECTION 07 84 00 - FIRESTOPPING.

2.4 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Aluminum stranded.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS.
- F. Identify and color-code conductors and cables according to SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS.

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in SECTION 07 84 00 - FIRESTOPPING.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
- E. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
- F. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- G. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- H. Cut sleeves to length for mounting flush with both wall surfaces.
- I. Extend sleeves installed in floors 2 inches above finished floor level.
- J. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- K. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- L. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to SECTION 07 92 00 - JOINT SEALANTS.
- M. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to SECTION 07 84 00 - FIRESTOPPING
- N. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- O. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- P. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to SECTION 07 84 00 - FIRESTOPPING.

END SECTION 26 05 19

SECTION 26 05 26 GROUNDING AND BONDING ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.
 - 1. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - 1. Grounding arrangements and connections for separately derived systems.
 - 2. Grounding for sensitive electronic equipment.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Bare Grounding Conductor and Conductor Protector for Wood Poles:
 - 1. No. 4 AWG minimum, soft-drawn copper.
 - 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

- D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm) in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

END SECTION 26 05 26

SECTION 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 1. Hangers and supports for electrical equipment and systems.
 2. Construction requirements for concrete bases.
 3. Installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For the following:
 1. Steel slotted support systems.
 2. Nonmetallic slotted support systems.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in DIVISION 3.

- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 6. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 - 3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.

4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 5. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
 - D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
 - E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
 - F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - i. Hilti Inc.
 - ii. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - iii. MKT Fastening, LLC.
 - iv. Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - i. Cooper B-Line, Inc.; a division of Cooper Industries.
 - ii. Empire Tool and Manufacturing Co., Inc.
 - iii. Hilti Inc.
 - iv. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - v. MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.
- 8.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in SECTION 05 50 00 - METAL FABRICATIONS for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in SECTION 05 50 00 - METAL FABRICATIONS for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in DIVISION 09 – FINISHES, SECTION 09 90 00 - PAINTING AND COATING for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END SECTION 26 05 29

SECTION 26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
 - 2. For handholes and boxes for underground wiring, including the following:
 - a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 5. Electri-Flex Co.
 - 6. Manhattan/CDT/Cole-Flex.
 - 7. Maverick Tube Corporation.
 - 8. O-Z Gedney; a unit of General Signal.
 - 9. Wheatland Tube Company.
- C. Rigid Steel Conduit: ANSI C80.1.
- D. Aluminum Rigid Conduit: ANSI C80.5.
- E. IMC: ANSI C80.6.
- F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- G. EMT: ANSI C80.3.
- H. FMC: Zinc-coated steel.
- I. LFMC: Flexible steel conduit with PVC jacket.
- J. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel, set-screw type.
 - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- K. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Arnco Corporation.
 - 4. CANTEX Inc.
 - 5. CertainTeed Corp.; Pipe & Plastics Group.
 - 6. Condux International, Inc.
 - 7. ElecSYS, Inc.
 - 8. Electri-Flex Co.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Manhattan/CDT/Cole-Flex.
 - 11. RACO; a Hubbell Company.
 - 12. Thomas & Betts Corporation.
- C. ENT: NEMA TC 13.
- D. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- E. LFNC: UL 1660.
- F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- G. Fittings for LFNC: UL 514B.

2.3 NONMETALLIC WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hoffman.
 - 2. Lamson & Sessions; Carlon Electrical Products.
- C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- E. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Butler Manufacturing Company; Walker Division.
 - b. Enduro Systems, Inc.; Composite Products Division.
 - c. Hubbell Incorporated; Wiring Device-Kellems Division.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. Panduit Corp.
 - f. Walker Systems, Inc.; Wiremold Company (The).
 - g. Wiremold Company (The); Electrical Sales Division.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.

8. Robroy Industries, Inc.; Enclosure Division.
 9. Scott Fetzer Co.; Adalet Division.
 10. Spring City Electrical Manufacturing Company.
 11. Thomas & Betts Corporation.
 12. Walker Systems, Inc.; Wiremold Company (The).
 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- F. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.
- G. Nonmetallic Floor Boxes: Nonadjustable, round.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures: Plastic.
- K. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.

2.6 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in DIVISION 7 – THERMAL AND MOISTURE PROTECTION, SECTION - FIRESTOPPING.

2.7 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by a independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: IMC.
 - 2. Concealed Conduit, Aboveground: EMT.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

- a. Loading dock.
- b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
- c. Mechanical rooms.
- 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
- 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
- 6. Damp or Wet Locations: Rigid steel conduit.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS.
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
 - 1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
 - 2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).
 - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C).
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
 - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
 - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

- O. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- Q. Set metal floor boxes level and flush with finished floor surface.
- R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in DIVISION 7 – THERMAL AND MOISTURE PROTECTION, SECTION - FIRESTOPPING.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed, or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to SECTION 07 92 00 - JOINT SEALANTS for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with DIVISION 7 – THERMAL AND MOISTURE PROTECTION, SECTION - FIRESTOPPING.
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.4 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in DIVISION 7 – THERMAL AND MOISTURE PROTECTION, SECTION - FIRESTOPPING.

3.6 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END SECTION 26 05 33

SECTION 26 05 44 SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. DIVISION 7 – THERMAL AND MOISTURE PROTECTION, SECTION - FIRESTOPPING for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.

2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following.
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 2. Sealing Elements: Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel
 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Presealed Systems.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in SECTION 07 92 00 - JOINT SEALANTS.
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END SECTION 26 05 44

SECTION 26 05 33 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 1. Identification for raceways.
 2. Identification of power and control cables.
 3. Identification for conductors.
 4. Underground-line warning tape.
 5. Warning labels and signs.
 6. Instruction signs.
 7. Equipment identification labels.
 8. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with CEC.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Colors for Raceways Carrying Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high letters on 20-inch centers.
- D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- wide black stripes on 10-inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.
- H. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- I. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Colors for Raceways Carrying Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high letters on 20-inch centers.
- D. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- E. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- D. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

- D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- F. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 WARNING LABELS AND SIGNS

- A. Comply with CEC and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs:
 - 1. Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.6 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
- C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- E. Stenciled Legend: In non-fading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.8 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 - 5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in DIVISION 9 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.2 IDENTIFICATION SCHEDULE

- A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:
 - 1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to raceways concealed within wall.
 - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

- B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Snap-around labels. Install labels at 30-foot maximum intervals.
- C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage.

END SECTION 26 05 53

SECTION 26 09 23 LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Time switches.
 - 2. Indoor photoelectric switches.
 - 3. Indoor occupancy sensors.
 - 4. Lighting contactors.
 - 5. Emergency shunt relays.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Area Lighting Research, Inc.; Tyco Electronics.
 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
 3. Intermatic, Inc.
 4. Leviton Mfg. Company Inc.
 5. Lightolier Controls; a Genlyte Company.
 6. Lithonia Lighting; Acuity Lighting Group, Inc.
 7. Paragon Electric Co.; Invensys Climate Controls.
 8. Square D; Schneider Electric.
 9. TORK.
 10. Touch-Plate, Inc.
 11. Watt Stopper (The).
- D. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
1. Contact Configuration: SPST.
 2. Contact Rating: 20-A ballast load, 120/240-V ac.
 3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.

2.2 INDOOR PHOTOELECTRIC SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Allen-Bradley/Rockwell Automation.
 2. Area Lighting Research, Inc.; Tyco Electronics.
 3. Eaton Electrical Inc; Cutler-Hammer Products.
 4. Grasslin Controls Corporation; a GE Industrial Systems Company.
 5. Intermatic, Inc.
 6. Lithonia Lighting; Acuity Lighting Group, Inc.
 7. MicroLite Lighting Control Systems.
 8. Novitas, Inc.
 9. Paragon Electric Co.; Invensys Climate Controls.
 10. Square D; Schneider Electric.

11. TORK.
 12. Touch-Plate, Inc.
 13. Watt Stopper (The).
- D. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit mounted on luminaire, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 3. Light-Level Monitoring Range: 10 to 200 fc (108 to 2152 lx) 100 to 1000 fc (1080 to 10 800 lx), with an adjustment for turn-on and turn-off levels within that range.
 4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
 5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

2.3 INDOOR OCCUPANCY SENSORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 1. Hubbell Lighting.
 2. Leviton Mfg. Company Inc.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 4. Novitas, Inc.
 5. RAB Lighting, Inc.
 6. Sensor Switch, Inc.
 7. TORK.
 8. Watt Stopper (The).
- D. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.
- E. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.
- F. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet.
- G. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.

2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.4 LIGHTING CONTACTORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 1. Allen-Bradley/Rockwell Automation.
 2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 4. GE Industrial Systems; Total Lighting Control.
 5. Grasslin Controls Corporation; a GE Industrial Systems Company.
 6. Hubbell Lighting.
 7. Lithonia Lighting; Acuity Lighting Group, Inc.
 8. MicroLite Lighting Control Systems.
 9. Square D; Schneider Electric.
 10. TORK.
 11. Touch-Plate, Inc.
 12. Watt Stopper (The).
- D. Description: Electrically operated and electrically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.5 EMERGENCY SHUNT RELAY

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Lighting Control and Design, Inc.
- D. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
 - 1. Coil Rating: 120 V.

2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 22 AWG. Comply with requirements in SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS.
 - 1. Identify controlled circuits in lighting contactors.

2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.6 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in DIVISION 26 – ELECTRICAL, SECTION 26 09 23 – LIGHTING CONTROL DEVICES.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END SECTION 26 09 23

SECTION 26 24 16 PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 1. Distribution panelboards.
 2. Lighting and appliance branch-circuit panelboards.
 3. Load centers.
 4. Electronic-grade panelboards.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 3. Detail bus configuration, current, and voltage ratings.
 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 5. Include evidence of NRTL listing for series rating of installed devices.
 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 7. Include wiring diagrams for power, signal, and control wiring.
 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

- C. Qualification Data: For qualified testing agency.
- D. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces, include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals, include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 1.
- F. Comply with CEC.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407 and NEMA PB 1.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Construction Manager, and Owner no fewer than ten days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's, Construction Manager's, and Owner's written permission.
3. Comply with NFPA 70E.

1.8 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in DIVISION 3.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.
 - 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
 - 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.
- B. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 6. Finishes:
 - a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
 - 7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

- C. Incoming Mains Location: Top and bottom.
- D. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 - 4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 - 5. Split Bus: Vertical buses divided into individual vertical sections.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - 6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - 7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
- I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 4. Siemens Energy & Automation, Inc.
- C. Panelboards: NEMA PB 1, power and feeder distribution type.
- D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.
- E. Mains: Circuit breaker and Lugs only.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- H. Branch Overcurrent Protective Devices: Fused switches.
- I. Contactors in Main Bus: NEMA ICS 2, Class A, electrically or mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 2. External Control-Power Source: 120-V branch circuit.
- J. Lighting And Appliance Branch-Circuit Panelboards:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Square D; a brand of Schneider Electric
 - b. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - c. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - d. Siemens Energy & Automation, Inc.
 3. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
 4. Mains: Circuit breaker or lugs only.
 5. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
 6. Contactors in Main Bus: NEMA ICS 2, Class A, electrically or mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 - a. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 - b. External Control-Power Source: 120-V branch circuit.
 7. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

8. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Square D; a brand of Schneider Electric
 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 4. Siemens Energy & Automation, Inc.
- C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I_{2t} response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

- d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in DIVISION 26 – ELECTRICAL, SECTION 26 09 23 - LIGHTING CONTROL DEVICES."
 - f. Shunt Trip: 120 or 24-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
 - h. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - i. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
 - j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - k. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
 - l. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
 - m. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in position.
 - n. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- 1. Fuses, and Spare-Fuse Cabinet.
 - 2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
 - 3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.4 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407 and NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.
- B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in DIVISION 3 – CONCRETE, SECTION 03 00 00 - CONCRETE.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 - 2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to panelboards.
 - 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Comply with mounting and anchoring requirements.
- E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- H. Install filler plates in unused spaces.
- I. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- K. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with DIVISION 26, SECTION - IDENTIFICATION FOR ELECTRICAL SYSTEMS.
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in DIVISION 26, SECTION - IDENTIFICATION FOR ELECTRICAL SYSTEMS."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in DIVISION 26, SECTION - IDENTIFICATION FOR ELECTRICAL SYSTEMS."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- E. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - i. Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- F. Panelboards will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 26 27 26 WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 2. Twist-locking receptacles.
 3. Receptacles with integral surge suppression units.
 4. Wall-box motion sensors.
 5. Isolated-ground receptacles.
 6. Snap switches and wall-box dimmers.
 7. Solid-state fan speed controls.
 8. Wall-switch and exterior occupancy sensors.
 9. Communications outlets.
 10. Pendant cord-connector devices.
 11. Cord and plug sets.
 12. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with CEC.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper; 8300 (duplex).
 - b. Hubbell; HBL8310 (single), HBL8300H (duplex).
 - c. Leviton; 8310 (single), 8300 (duplex).
 - d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).
- C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; CR 5253IG.
 - b. Leviton; 5362-IG.
 - c. Pass & Seymour; IG6300.
 - 3. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- D. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; TR8300.
 - b. Hubbell; HBL8300SG.
 - c. Leviton; 8300-SGG.
 - d. Pass & Seymour; 63H.
 - 3. Description: Labeled to comply with CEC, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.

2.4 TVSS RECEPTACLES

- A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
 2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
- B. Duplex TVSS Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5362BLS.
 - b. Hubbell; HBL5362SA.
 - c. Leviton; 5380.
 3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- C. Isolated-Ground, Duplex Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; IG5362BLS.
 - b. Hubbell; IG5362SA.
 - c. Leviton; 5380-IG.
 3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- D. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; IG8300HGBLS.
 - b. Hubbell; IG8362SA.
 - c. Leviton; 8380-IG.
 3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting

strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; L520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; IG2310.
 - b. Leviton; 2310-IG.
 - 3. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
 - 1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 - 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.8 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221PL for 120 V and 277 V.
 - b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - d. Pass & Seymour; PS20AC1-PLR for 120 V.
 - 3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 - 3. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995.

- b. Hubbell; HBL1557.
 - c. Leviton; 1257.
 - d. Pass & Seymour; 1251.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995L.
 - b. Hubbell; HBL1557L.
 - c. Leviton; 1257L.
 - d. Pass & Seymour; 1251L.

2.9 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
 - 1. 600 W; dimmers shall require no derating when ganged with other devices. Illuminated when "OFF."
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.10 FAN SPEED CONTROLS

- A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
 - 1. Continuously adjustable rotary knob, 5 A, 1.5 A.
 - 2. Three-speed adjustable rotary knob, 1.5 A.

2.11 OCCUPANCY SENSORS

- A. Wall-Switch Sensors:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 6111 for 120 V, 6117 for 277 V.
 - b. Hubbell; WS1277.

- c. Leviton; ODS 10-ID.
 - d. Pass & Seymour; WS3000.
 - e. Watt Stopper (The); WS-200.
3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.
- B. Wall-Switch Sensors:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; AT120 for 120 V, AT277 for 277 V.
 - b. Leviton; ODS 15-ID.
 - 3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
- C. Long-Range Wall-Switch Sensors:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP1600WRP.
 - b. Leviton; ODWWV-IRW.
 - c. Pass & Seymour; WA1001.
 - d. Watt Stopper (The); CX-100.
 - 3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft.
- D. Long-Range Wall-Switch Sensors:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATD1600WRP.
 - b. Leviton; ODW12-MRW.
 - c. Watt Stopper (The); DT-200.
 - 3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).
- E. Wide-Range Wall-Switch Sensors:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP120HBRP.
 - b. Leviton; ODWHB-IRW.
 - c. Pass & Seymour; HS1001.
 - d. Watt Stopper (The); CX-100-3.
 3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft.
- F. Exterior Occupancy Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Leviton; PS200-10.
 - b. Watt Stopper (The); EW-100-120.
 3. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.12 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: satin-finished stainless steel 0.04-inch-thick.
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant die-cast aluminum with lockable cover.

2.13 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Round, solid brass with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Three modular, keyed, color-coded, RJ-45 Category 6A connectors where applicable for UTP cable.

2.14 POKE-THROUGH ASSEMBLIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Hubbell Incorporated; Wiring Device-Kellems.
 2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
 3. Square D/ Schneider Electric.
 4. Thomas & Betts Corporation.
- C. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
 1. Service Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.
 2. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
 3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 4. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.
 5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of two, 4-pair, Category 5e voice and data communication cables.

2.15 MULTIOUTLET ASSEMBLIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Hubbell Incorporated; Wiring Device-Kellems.
 2. Wiremold Company (The).
- C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- D. Raceway Material: Metal, with manufacturer's standard finish.
- E. Wire: No. 12 AWG.

2.16 SERVICE POLES

- A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
 1. Poles: Nominal 2.5-inch-square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
 2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
 3. Finishes: Manufacturer's standard painted finish and trim combination.
 4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.

5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.
6. Voice and Data Communication Outlets: Three RJ-45 Category 6A connectors where applicable.

2.17 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by CEC or device listing.
 2. Wiring Devices Connected to Emergency Power System: Red.
 3. TVSS Devices: Blue.
 4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of CEC, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
 2. Verify that dimmers used for fan speed control are listed for that application.
 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS.
1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 2. Test Instruments: Use instruments that comply with UL 1436.

3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END SECTION 26 27 26

SECTION 26 51 00 INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. Related Sections:
 - 1. SECTION 26 09 23 - LIGHTING CONTROL DEVICES for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. DIVISION 26 – ELECTRICAL, SECTION - 26 09 23 LIGHTING CONTROL DEVICES" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
 - 3. SECTION 26 27 26 - WIRING DEVICES for manual wall-box dimmers for LED/incandescent lamps.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Ballast, including BF.
 - 4. Energy-efficiency data.

5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Lighting fixtures.
 2. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Access panels.
- B. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 3. Fluorescent-fixture-mounted, emergency battery pack: One for every 20 emergency lighting unit.

4. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

1.9 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
 2. Warranty Period for Emergency Fluorescent Ballast and Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- C. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- D. Metal Parts: Free of burrs and sharp corners and edges.
- E. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

- G. Diffusers and Globes:
1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
 - b. UV stabilized.
 2. Glass: Annealed crystal glass unless otherwise indicated.
- H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp and ballast characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
 - c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
 - e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
 - f. CCT and CRI for all luminaires.
 - I. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. General Requirements for Electronic Ballasts:
1. Comply with UL 935 and with ANSI C82.11.
 2. Designed for type and quantity of lamps served.
 3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
 4. Sound Rating: Class A.
 5. Total Harmonic Distortion Rating: Less than 10 percent.
 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 7. Operating Frequency: 42 kHz or higher.
 8. Lamp Current Crest Factor: 1.7 or less.
 9. BF: 0.88 or higher.
 10. Power Factor: 0.95 or higher.

11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
- B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.
- C. Electronic Programmed-Start Ballasts for T8 Lamps: Comply with ANSI C82.11 and the following:
 1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
 2. Automatic lamp starting after lamp replacement.
- D. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
 1. Ballast Manufacturer Certification: Indicated by label.
- E. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
- F. Ballasts for Low-Temperature Environments:
 1. Temperatures 0 Deg F and Higher: Electronic type rated for 0 deg F starting and operating temperature with indicated lamp types.
- G. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.
- H. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
 1. Dimming Range: 100 to 5 percent of rated lamp lumens.
 2. Ballast Input Watts: Can be reduced to 20 percent of normal.
 3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
 4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.
- I. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
 1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - i. High-Level Operation: 100 percent of rated lamp lumens.
 - ii. Low-Level Operation: 30 percent of rated lamp lumens.
 2. Ballast shall provide equal current to each lamp in each operating mode.
 3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.
- J. Ballasts for Tri-Level Controlled Lighting Fixtures: Electronic type.
 1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 30 and 50 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific tri-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: Less than 20 percent.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. BF: 0.95 or higher unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Nightlight Connection: Operate one fluorescent lamp continuously.
 3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

- B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.
1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Nightlight Connection: Operate one fluorescent lamp in a remote fixture continuously.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type.
 5. Housing: NEMA 250, Type 1 enclosure.
 6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 3. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
1. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
 2. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
 3. Lamp end-of-life detection and shutdown circuit.
 4. Sound Rating: Class A.
 5. Total Harmonic Distortion Rating: Less than 20 percent.
 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 7. Lamp Current Crest Factor: 1.5 or less.
 8. Power Factor: 0.90 or higher.
 9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

10. Protection: Class P thermal cutout.
- C. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
 1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 2. Minimum Starting Temperature: Minus 40 deg F.

2.7 QUARTZ LAMP LIGHTING CONTROLLER

- A. General Requirements for Controllers: Factory installed by lighting fixture manufacturer. Comply with UL 1598.
- B. Standby (Quartz Restrike): Automatically switches quartz lamp on when a HID lamp in the fixture is initially energized and during the HID lamp restrike period after brief power outages.
- C. Connections: Designed for a single branch -circuit connection.
- D. Switching Off: Automatically switches quartz lamp off when HID lamp strikes.
- E. Switching Off: Automatically switches quartz lamp off when HID lamp reaches approximately 60 percent light output.

2.8 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
 2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.9 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.10 FLUORESCENT LAMPS

- A. T8 rapid-start lamps, rated 32 W maximum, Low Mercury, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.
- B. T8 rapid-start lamps, rated 17 W maximum, Low Mercury, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.
- C. T5 rapid-start lamps, rated 28 W maximum, Low Mercury, nominal length of 45.2 inches, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3000 K, and average rated life of 20,000 hours unless otherwise indicated.
- D. T5HO rapid-start, high-output lamps, rated 54 W maximum, Low Mercury, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated.
- E. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), Low Mercury, color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 - 6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
 - 7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.11 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
- B. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000 K.
- C. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.
- D. Low-Pressure Sodium Lamps: ANSI 78.41, CRI 0, and color temperature 1800 K.

2.12 LEDS

- A. Light Emitting Diodes: White light output with minimum CRI 65, and color temperature 4000 K, and rated life (70% of light output) of 40,000 hours, minimum. Color light output, state specific spectral power distribution, rated life (70% of light output) of 60,000 hours, minimum. Light output (lumen/watt) to be stated for a complete luminaire (power supply, light source, fixture) not on lab bench momentary test but under normal project-specific operating conditions (temperature, humidity, orientation) and for a published duration of the photometry test after the system has stabilized its light output and heat management. Capability to dim shall be published. Color constancy amongst LEDs shall be published in # of MacAdam ellipses of variation. Photometry for all LED products to follow IES recommendations for testing. All LED products must have a 5 year warranty. Recycling program provided by manufacturer, and availability of spare parts at expected end of life must be stated by manufacturer.

2.13 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:
 - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 - 2. Install lamps in each luminaire.
- B. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
 - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.

2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- C. Suspended Lighting Fixture Support:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- D. Connect wiring according to SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS.

3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aim able luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
1. Adjust aimable luminaires in the presence of Architect.

END SECTION 26 51 00

END DIVISION 26 – ELECTRICAL

DIVISION 27 – COMMUNICATIONS

NOT USED AT THIS TIME

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

NOT USED AT THIS TIME

DIVISION 31 – EARTHWORK

SECTION 31 00 00 EARTHWORK AND TRENCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes earthwork and related work as shown and specified.

1.3 SUBMITTALS

- A. Samples: If specifically requested.
- B. Test Reports: Refer to SECTION 01 45 29 - TESTING LABORATORY SERVICES
- C. Closeout Submittals:

1.4 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. Local Jurisdictions: Perform work in accordance with municipal agency and utility company standards and requirements.
 - 2. American Association of State Highway and Transportation Officials (AASHTO): Standards.
 - 3. American National Standards Institute (ANSI): Standards.
 - 4. American Society of Testing Materials (ASTM):
 - a. General: Materials and testing standards as identified throughout this Section.
 - b. ASTM D2487: Classification of Soils for Engineering Purposes.
 - 5. State of California, Department of Transportation: Standard Specifications.
 - 6. California Occupational Safety and Health Administration (CalOSHA): Construction Safety Orders.
 - 7. California State Industrial Accident Commission (CSIAC): Trench Construction Safety Orders.
 - 8. U.S. Occupational Safety and Health Administration (OSHA): Standards - 29 CFR, PART 1926 Safety and Health Regulations for Construction, Subpart P - Excavations.
 - 9. California Environmental Protection Agency Department of Toxic Substances Control (DTSC): Information Advisory Clean Imported Fill.
- B. Testing: Refer to SECTION 01 45 29 - TESTING LABORATORY SERVICES.
 - 1. Geotechnical Engineer: A Geotechnical Engineer will be retained by the Owner to observe performance of and determine compliance with excavation, trenching, soil treatment, filling, backfilling and grading requirements; and perform testing.
 - 2. Retesting: Paid for by School District and deducted from cost of Contract.

PART 2 - PRODUCTS

2.1 FILL MATERIALS:

- A. Engineered Fill: Approved native on-site materials supplemented with approved import material as needed. Imported soil must meet the guidelines established in the "Information Advisory for Clean Imported Fill" published by the DTSC. Approval of soil to be imported must be obtained prior to delivery to site.
1. Imported Non-Expansive Fill: Granular, compactable soil subject to approval of geotechnical engineer with plastic index less than 15, expansion index less than 20, maximum particle size of 3 inches, and shall have less than 5 percent of the material greater than 1 inch in greatest dimension. Inorganic R value of 25, liquid limit less than 30, plastic index 5 to 15, with the following gradations:

<u>Sieve Size</u>	<u>Percentage Passing</u>
a. 3 inch	100 percent
b. 3/4 inch	70-100 percent
c. No. 4	50-100 percent
d. No. 200	0 - 40 percent]
 2. On-Site Fill: On-site native soil; free of organic or deleterious material; no rocks or lumps larger than 3 inches in any dimension.
- B. Trench Backfill: On-site native soil; free of organic or deleterious material; no rocks or lumps larger than 3 inches in any dimension. No more than 15 percent of material shall be larger than 1 inch in any dimension.
- C. Aggregate Fill:
1. General: Materials free of silt, clay, loam, shale, friable or soluble materials, debris, vegetation and foreign matter.
 2. Sand: ASTM C144.
 3. Drain Rock: Crushed rock, natural rock, or pea gravel. Grading: ½ inch minimum, 2 inches maximum.
 4. Aggregate Base: CalTrans Standard Specifications, Section 26, Class 2 aggregate base; 3/4 inch maximum.
 5. Permeable: Class 2 permeable material per CalTrans Section 68 or mixture of coarse and fine aggregates as routinely proportioned for concrete mix design with 1 inch maximum aggregate per ASTM C33.
- D. Trench Bedding Materials: Refer to SECTION 31 00 00 – EARTHWORK AND TRENCHING, DIVISION 22 – PLUMBING, DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING, or DIVISION 26 – ELECTRICAL GENERAL REQUIREMENTS for bedding materials required for buried materials specified in their respective sections.
- E. Concrete Fill: Refer to SECTION 03 30 00 – CONCRETE.

- F. Topsoil:
 - 1. Native: Stripped or excavated material containing organics, free of roots, rocks larger than 1½ inch in least dimension, debris, vegetation and foreign matter. Top 6 inches of soil below existing grade is defined as native topsoil.
 - 2. Imported: Friable loam; free of roots, rocks larger than ½ inch, subsoil, debris, vegetation, and foreign matter, with an acidity range (pH) of 5.5 to 7.5, containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.

2.2 WATER

- A. Potable; free of deleterious materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General: Verify site conditions shown, report all unidentified conditions to the Architect.
- B. Utilities: Verify locations of existing utilities by pot-holing. Examine site for unidentified utilities. Should such utilities be discovered, do not proceed until identified and instructions are received from responsible utility company.
- C. Archaeological Artifacts: Should any objects of possible historic interest be encountered during operations, halt work in area of discovery and immediately contact the Architect for notification of appropriate authorities.

3.2 PREPARATION

- A. Environmental Requirements: Do not place, spread or compact fill material during unfavorable weather conditions. When work is interrupted by rain, do not proceed with fill operations until field tests indicate that moisture content and density of previously placed fill is satisfactory.
- B. Coordination: Keep Owner, Inspector, Architect, Testing Lab, and Geotechnical Engineer informed of progress of work and changes in schedule in order to facilitate Owner's verification engineered fill construction and unit price excavation.
- C. Layout:
 - 1. General: Establish lines, levels and grades; locate work, including existing underground utilities; set markers and stakes. Construction staking to be performed by civil engineer or land surveyor licensed by the State of California.
 - 2. Trees and Shrubs: Tag or identify existing plant life designated to remain.
- D. Protection:
 - 1. General: Erect and maintain barricades and protection facilities, as required.
 - 2. Bench Marks: Protect survey control points from damage or displacement.
 - 3. Utilities:
 - a. General: Maintain and protect existing utilities to remain. Schedule interruption of service required by work of this Section.

- b. Location of Utilities: Should the location of existing utilities differ from location shown or are found to interfere with permanent facilities being constructed under this Section, immediately notify the Architect. Do not proceed until written instructions are received from the Architect.
 - c. Unknown Active Utility Lines: Should unknown active utilities be encountered during work, halt operation, take such action required to assure that service is not interrupted, and promptly notify the Architect.
4. Underpinning: Underpin adjacent structures, including service utilities and pipe chases, as required to prevent damage or erosion by excavation work.
 5. Shoring, Sheeting, Lagging and Bracing: Provide as required to maintain excavations and banks in a safe and stable condition and resist erosion.
 6. Plant protection: Carefully protect existing trees and shrubs identified to remain. Replace existing trees and shrubs outside construction area damaged by operations.
 7. Explosives: Do not use explosives. Do not blast unless excavation by conventional means is impractical. Obtain written permission from authorities having jurisdiction before bringing explosives to the site. Take all precautions necessary to prevent damage to existing and adjacent improvements and facilities and to prevent weakening of bearing capacity of rock to remain.
 8. Drainage: Conduct grading operations in such a manner as to prevent surface water run-off from ponding in areas to be worked or from flowing into excavation or on to adjacent properties. Keep excavations and sub-grade area free from water during process of work, regardless of cause, source or nature of water. Direct or pump drainage to temporary drainage or collection system. Excess water interfering with progress of work shall be disposed of off site.
 9. Dust Control: Wet as required.

3.3 PERFORMANCE

- A. General: Clear and grub site. Excavate, fill, compact, and grade to achieve finish grades, lines, levels and contours shown.
 1. Subgrade Elevations: Subgrade is defined as the top surface of subsoil immediately below any topsoil or aggregate fill. Determine subgrade elevations by subtracting the thickness of pavement section, topsoil, or slab and aggregate fill from the finish elevations shown.
 2. Compaction: ASTM D1557 Compaction Test method; value of optimum moisture content and density will be determined by Geotechnical Engineer, unless otherwise noted.
 3. Moisture Condition: Wet and mix soil to uniform moisture content of between 2 and 5 percent above the optimum moisture content or as required by Geotechnical Engineer on site. When moisture content is too high to achieve compaction, aerate by blading or other methods until moisture content is satisfactory.
- B. Demolition:
 1. General: Per SECTION 02 41 00 - DEMOLITION.
 2. Existing Paving: Remove concrete and asphalt concrete paving from site unless designated to remain.

3. Other Obstructions: Remove abandoned utility lines, concrete foundations, etc. Backfill resulting holes as specified.
- C. Clearing and Grubbing:
1. General: Remove surface vegetation, debris, and other deleterious materials in areas designated for construction.
 2. Trees and Shrubs: Remove as indicated, including stumps, main root ball and root system as required.
 3. Organic Soils: Soils high in organics shall be stockpiled for use as top soil or removed from site.
- D. Excavation:
1. General: Excavate, fill, compact, and grade to achieve finish grades, lines, levels and contours shown.
 2. Subsoil: Excavate subsoil required for building foundations, slabs, construction operations and other work. Stockpile subsoil in designated area on site; remove excess subsoil not being reused from site. Protect stockpiled subsoil from erosion until removed for final placement
 3. Topsoil:
 - a. Stripping: Excavate topsoil to condition specified, free of rocks and organic debris, from areas to be further excavated, re-landscaped, or re-graded; do not mix with foreign materials.
 - b. Stockpiling: Stockpile in area designated on site to depth not exceeding 8 feet; protect from erosion. Provide quantity great enough to provide minimum 8 inch layer of material at areas designated for planting; supplement with imported topsoil, if required. Remove excess topsoil not intended for reuse, from site.
 4. Overexcavation:
 - a. General: Overexcavate as necessary to provide depth of engineered fill required. Extend excavation a minimum of 5'-0" beyond building limits and 2'-0" beyond paving limits.
 - b. Accidental Overexcavation: Report to geotechnical engineer and repair as directed.
 - c. Unsuitable Ground: Report soft ground or other unsuitable soil found when excavating to the geotechnical engineer; do not build on any soft or unsuitable surface. Repair as directed by the geotechnical.
 5. Original Ground Surface Preparation:
 - a. General: At areas to received pavement or structures, scarify and recompact existing ground as described below. Scarification and recompactation not required at areas to receive landscaping or shallow top soil fill.
 - b. Scarification: Subgrade soils exposed by excavation of previously processes soils or excavation below the depth of processing, or subgrade soils that have been allowed to desiccate prior to placement of fill, slabs or pavements, shall be disked or plowed to depth of 6 inches.

- c. **Moisture Conditioning:** After scarification and prior to compaction, the soils on which fill will be placed, and soil subgrade areas achieved by excavation or left at existing grade, shall be moisture conditioned to a depth of at least six inches, or to the full depth of processing as described in Section 3.3 D5, whichever is deeper.
 - d. **General Compaction:** Once the soils have been moisture conditioned to the satisfaction of the Geotechnical Engineer's representative, the soil shall be compacted to at least 90 percent of the ASTM D1557 maximum dry density.
 - e. **Compaction at Pavement:** In pavement areas, the upper six inches of subgrade soils shall be compacted to at least 95 percent of the maximum dry density, regardless of whether the subgrade surface is achieved by excavation, filling or is near the original site grade.
6. **Trenches:**
- a. **General:** Excavate to achieve required levels. Comply with requirements of jurisdictional agencies.
 - b. **Utility Trenching:** Excavate straight and true to line and grade and sufficiently wide to enable installation and allow for inspection. Excavate to depth required to for utility installation at grades shown allowing for minimum cover, installation of crossing utilities, and required depth of bedding below utilities. Refer to DIVISION 22 – PLUMBING, DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC), and DIVISION 26 – ELECTRICAL for additional requirements affecting trenching.
 - c. **Footings:** Excavate to adequate width to allow for installation of formwork. Where earth is sufficiently stable to retain its position during concreting and concrete will be poured directly into excavation, cut trench a minimum of 2 inches larger than shown.
- E. **Bedding:** Install as specified for buried material. Refer to DIVISION 22 – PLUMBING, DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC), or DIVISION 26 – ELECTRICAL for respective requirements.
- F. **Filling and Backfilling:**
- 1. **General:** Perform fill and backfill operations in the presence of the Geotechnical Engineer who will make field density tests to check compaction of fill material. Remove shoring, sheeting, lagging and bracing prior to commencing operations. Fill to subgrades established by finish contours and elevations shown.
 - 2. **Soil:**
 - a. **General:** Use On-Site Engineered Fill under buildings and paving areas except where Imported Non-Expansive Engineered Fill is called for on Drawings. Place in layers not exceed 8 inches in loose thickness; rocks larger 1 inch not permitted in the upper 12 inches of fill.
 - b. **Moisture Condition:** Moisture condition, uniformly mix, and evenly spread each layer.
 - c. **Compaction:** After each layer has been placed, mixed and spread, compact to the following percentages of maximum dry density:
 - i. 90 Percent: All fills unless specified otherwise.
 - ii. 95 Percent: Upper six inches of fill or existing soils below pavement.

- iii. 85 Percent: Trench backfill in landscaped areas
 - iv. Fill in Trenches and Adjacent to Walls: Backfill with material excavated, unless otherwise shown. Moisture condition place in 6 inch layers and compact each layer to density specified for adjacent material. In trenching through native soil compact to 90 percent relative compaction. Backfill simultaneously on each side of un-braced foundation walls, or utility pipes, conduits or structures.
- 3. Aggregate Fill:
 - a. General: Do not place fill on soft, muddy, or frozen surfaces.
 - b. Base: Spread aggregate over prepared substrate to a total compacted thickness as shown. Compact to 95 90 percent of maximum dry density.
 - c. Drain Rock: Place after underground work and foundations are in place; Compaction is required under buildings or paved areas where depth of free-draining aggregate exceeds one foot. Place fill in one foot lifts and make one pass with vibratory type compaction equipment at each lift.
 - d. Permeable: Place as shown.
- G. Grading:
 - 1. General: Uniformly grade to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines and elevations shown. Cut out soft spots, fill low spots, and trim high spots.
 - 2. Adjacent Grades: Provide smooth transition between adjacent existing grades and new grades.
 - 3. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations established by finish grades and contours to within the following tolerances:
 - a. Landscaped or unpaved areas: Plus or minus .01 feet.
 - b. Walks: Plus or minus .01 feet.
 - c. Pavements: Plus or minus ½ inch.
 - d. Under buildings: Plus or minus ½ inch.

3.4 FIELD QUALITY CONTROL

- A. Field Testing: Refer to SECTION 01 45 29 - TESTING LABORATORY SERVICES.
- B. Retesting: Make necessary corrections to non-conforming work; retest at Contractor's expense.

3.5 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove surplus materials and debris. Do not bury or burn rubbish on the site.

END SECTION 31 00 00

END DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

NOT USED AT THIS TIME

DIVISION 33 – UTILITIES

SECTION 33 13 00 DISINFECTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes disinfecting and related work as shown and specified.

1.3 SUBMITTALS

- A. Test Reports:
 - 1. Disinfection:
 - a. Disinfectant: Type and form used.
 - b. Disinfectant Injection: Date, start and completion time.
 - c. Test Locations: Identify on Site Plan.
 - d. Flushing: Date, start and completion time.
 - e. Disinfectant Residuals:
 - i. General: Initial and 24 hour quantity in treated water in parts per million for each outlet tested.
 - ii. After Flushing: Parts per million for each outlet tested.
 - 2. Bacteriological:
 - a. General: Date issued, project name, and testing laboratory name, address, telephone number and name of person collecting samples.
 - b. Water Sample Collection: Time and date.
 - c. Test Locations: Identify on Site Plan.
 - d. Disinfectant Residuals: Initial and 24 hours in parts per million for each outlet tested.
 - e. Coliform Bacteria: Test results for each outlet tested.
- B. Certificates:
 - 1. General: Submit statement from testing agency, bearing bacteriologist's signature, certifying that the cleanliness of water distribution system meets or exceeds local and state jurisdictional requirements.
 - 2. Certificate of Compliance: Provide from authority having jurisdiction indicating acceptance and approval of water system.
- C. Installer Qualifications: If requested, provide evidence that installers meet the requirements of Article 1.4.

- D. Closeout Submittals:
 - 1. O & M Manuals: Maintenance instructions.

1.4 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Water Works Association (AWWA): Standards.
 - a. AWWA B300: Standard for Hypochlorites.
 - b. AWWA B301: Standard for Liquid Chlorine.
 - c. AWWA B302: Standard for Ammonium Sulfate.
 - d. AWWA B303: Standard for Sodium Chlorite.
 - e. AWWA C651: Standards for Disinfecting Water Mains.
- B. Installer Qualifications: Minimum of 3 years of experience on similar work; knowledge and understanding of standards referenced herein; skill necessary to perform in compliance with this specification. Installers failing to demonstrate the required experience, knowledge, or skill shall be removed from the project.
- C. Testing Firm: Company specializing in testing potable water systems, approved by the State of California.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Disinfection Chemicals: AWWA type as required by local jurisdictions; AWWA B300, Hypochlorite; AWWA B301, Liquid Chlorine; AWWA B302, Ammonium Sulfate; and AWWA B303, Sodium Chlorite.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that piping system has been cleaned, inspected, and pressure tested before beginning work; report defects.

3.2 INSTALLATION

- A. Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Disinfection: Provide and attach required equipment to site water lines to perform the work of this Section. Introduce treatment into system and maintain disinfectant in system for 24 hours. Flush, circulate, and clean until cleanliness required by jurisdiction is achieved. Replace permanent system devices removed for disinfection.

3.3 FIELD QUALITY CONTROL

- A. Test field samples in accordance with AWWA C651 and jurisdictional criteria as required.

END SECTION 33 13 00

END DIVISION 33 – UTILITIES

END TECHNICAL SPECIFICATIONS