PROJECT MANUAL
INCLUDING SPECIFICATIONS

FOR CONSTRUCTION OF THE

Humboldt County District Attorney Victim/Witness and Cast

VOLUME ONE

901 5th Street
Eureka, CA 95501

County Project No. 2018-102
NMR Project No. 18-6452

NICHOLS MELBURG & ROSSETTO
300 Knollcrest Drive
Redding, CA 96002

530.222.3300
FAX 222.3538

JULY 2019

VOLUME ONE

INTRODUCTORY INFORMATION

DIVISION 01 GENERAL REQUIREMENTS

DIVISION 02 EXISTING CONDITIONS

DIVISION 03 CONCRETE

DIVISION 05 METALS

NOTICE TO CONTRACTORS

SECTION 00 00 20

NOTICE IS HEREBY GIVEN that informal sealed bids are invited by the County Administrative Office/Purchasing Agent of Humboldt County, a public body, corporate and politic, for the performance of all the work and the furnishing of all the labor, materials, supplies, tools, and equipment for the following project:

CONSTRUCTION OF
HUMBOLDT COUNTY DISTRICT ATTORNEY, VICTIM/WITNESS AND CAST
COUNTY OF HUMBOLDT
PROJECT NUMBER: 2018-102

Pursuant to the Contract Documents on file with the County Administrative Office of Humboldt County.

A pre-bid meeting is scheduled for 2:00 PM, Pacific Daylight Time, July 23, 2019 at the Humboldt County Courthouse Conf. Room A, 825 5th Street, Eureka, California. Contract Documents, Plans, and Specifications will be available on July 16, 2019.

Each Bid must be contained in a sealed envelope addressed as set forth in said Bid Documents, and filed at the office of the Clerk of the Board of Supervisors of Humboldt County, 825 5th Street, Room 111, Eureka, California at or before 2:00 PM, Pacific Daylight Time, on August 6, 2019. All Bids will be publicly opened and summary amounts read aloud. The officer whose duty it is to open the Bids will decide when the specified time for the opening of Bids has arrived.

Plans and Specifications and other Contract Document forms will be available for examination at the County Administrative Office, Room 112, 825 5th Street, Eureka, CA, Phone: (707) 445-7266. Plans will also be available for viewing at area plan centers. Complete sets may be obtained from Nichols, Melburg & Rossetto, 300 Knollcrest Drive, Redding, CA 96002. Complete sets may be obtained upon advanced payment of $100.00 each, 100 % of which shall be refunded upon the return of such sets unmarked and in good condition within ten (10) days after the bids are opened. Checks should be made payable to County of Humboldt.

Each Bid shall be submitted on the forms furnished by the County within the Bid Documents. All forms must be completed.

Each Bid shall be accompanied by one of the following forms of Bidder's Security to with a certified check or a cashier's check payable to the County, U.S. Government Bonds, or a Bid Bond executed by an admitted insurer authorized to issue surety bonds in the State of California (in the form set forth in said Contract Documents). The Bidder's security shall be in the amount equal to at least ten percent (10%) of the Bid.

The successful Bidder will be required to furnish and pay for a satisfactory faithful performance bond and a satisfactory payment bond in the forms set forth in said Bid Documents.

The County reserves the right to reject any or all Bids or to waive any informalities in any Bid. No Bid shall be withdrawn for a period of one-hundred (100) calendar days subsequent to the opening of Bids without the consent of the County.

All Bidders will be required to certify that they are eligible to submit a Bid on this project and that they are not listed either (1) on the Controller General's List of Ineligible Bidders/Contractors, or (2) on the debarred list of the Labor Commissioner of the State of California.

The successful Bidder shall possess a valid Contractor's license in good standing, with a classification of "B" (General Building Contractor) at the time the contract is awarded.

The successful Bidder will be required to comply with all equal employment opportunity laws and regulations both at the time of award and throughout the duration of the Project.

The Contractor and all Subcontractors are required to be registered with the Department of Industrial Relations pursuant to labor code section 1725.5.This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations. A Contractor or Subcontractor shall not be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of any contract for public work, as defined in this chapter, unless currently registered and qualified to perform pubic work pursuant to Section 1725.5. It is not a violation of this section for an unregistered contractor to submit a bid that is authorized by Section 7029.1 of the Business and Professions Code or by Section 10164 or 20103.5 of the Public Contract Code, provided the Contractor is registered to perform public work pursuant to Section 1725.5 at the time the contract is awarded.

The Contractor, and each subcontractor participating in the Project, shall be required to pay the prevailing wages as established by the Department of Industrial Relations, Division of Labor Statistics and Research, P.O. Box 420603, San Francisco, CA, Phone: (415) 703-4780.

The attention of Bidders is directed to the fact that the work proposed herein to be done will be financed in whole or in part with State and County funds, and therefore all of the applicable State and County statutes, rulings and regulations will apply to such work.

In the performance of this contract, the Contractor will not discriminate against any employee or applicant for employment in accordance with the provisions of the California Fair Employment and Housing Act. (Government Code section 12900et seq)

In accordance with the provisions of Section 22300 of the Public Contractor's Code, the Contractor may elect to receive 100% of payments due under the contract from time to time, without retention of any portion of the payment, by entering into an Escrow Agreement for Security Deposits In Lieu of Retention.

INSTRUCTIONS TO BIDDERS

SECTION 00 01 00

Formal Sealed Bids will be received by the Clerk of the Board of Supervisors of the County of Humboldt, Humboldt County Courthouse, 825 5th Street, Room 111, Eureka, California 95501, until 2:00 PM, Pacific Daylight Time, on August 6, 2019 at which time they will be publicly opened by the Clerk of the Board of the County of Humboldt at a public meeting in the Office of the Clerk of the Board, for performance of the following work:

CONSTRUCTION OF
HUMBOLDT COUNTY DISTRICT ATTORNEY, VICTIM/WITNESS AND CAST
PROJECT NUMBER: 2018-102

1. SECURING DOCUMENTS

Plans and Specifications and other Contract Document forms will be available for examination at the County Administrative Office, Room 112, 901 5th Street, Eureka, CA, Phone: (707) 445-7266. Plans will also be available for viewing at area plan centers. Complete sets may be obtained through the Nichols, Melburg & Rossetto, 300 Knollcrest Drive, Redding, CA 96002 upon advanced payment of $100.00 each, 100 % of which shall be refunded upon the return of such sets unmarked and in good condition within ten (10) days after the bids are opened. Checks should be made payable to County of Humboldt.

2. BASIC INFORMATION

These instructions pertain to the work (as hereinafter defined) to be performed under Agreement with the County of Humboldt (hereinafter sometimes called "Owner"):

Owner	Humboldt County Board of Supervisors 825 Fifth Street Eureka, CA 95501
Owner's Lead Agency:	County Administrative Office/Purchasing Agent County of Humboldt 825 5th Street Eureka, California 95501 Phone: (707) 445-7266 Fax: 445-7299
Project Location:	Humboldt County Courthouse 825 5th Street Eureka, CA 95501 Humboldt County, California
Architect:	Nichols, Melburg & Rossetto 300 Knollcrest Drive Redding, California 96002 Phone: (530) 222-3300

3. **RECEIPT OF BIDS.** Each bidder should mark its bid as "Bid for the Construction of Humboldt County District Attorney – Victim/Witness and CAST." Bids shall be deemed to include the written responses to the bidder to any questions or requests for information of County made as part of bid evaluation process after submission of bid. Telephone and telefax proposals will not be accepted. County will reject all bids received after the specified time and will return such bids to bidders unopened.

4. **DETERMINATION OF APPARENT LOW BIDDER.** Apparent low bid will be based on the amount of the base bid listed of the Bid Form.

5. **REQUIRED BID FORM.** All bidders must submit bids on the Section 00 30 00, the "Bid Form." County will reject as non-responsive any bid not submitted on the required form. Bids must be full and complete. Bidders must complete all bid items and supply all information required by the bidding documents and specifications. County reserves the right in its sole discretion to reject any bid as non-responsive as a result of any error or omission in the bid. Bidders may not modify the Bid Form or qualify their bids. Bidders must submit clearly and distinctly written bids. Bidders must clearly make any changes in their bids by crossing out original entries, entering new entries and initialing new entries. County reserves the right to reject any bid not clearly written. The Bid Form shall be signed by the bidder's legal representative as indicated on the Bid Form. If the bid is made by an individual, it shall be signed and his/her full name and his/her address shall be given; if it is made by a partnership, it shall be signed with the co-partnership name by a member of the firm, who shall sign his/her own name and provide the name and address of each member; and if it is by a corporation, the bid shall show the name of the corporation and the state under the laws of which the corporation was chartered. When the bid is signed by the duly authorized officer or officers of the corporation, it shall be attested by the corporate seal, and the names and titles of the principal officers of the corporation shall be given. When a bid is signed by an agent, other than the officer or officers of a corporation authorized to sign contracts on its behalf or a member of a partnership, a "Power of Attorney" must be filed with the County prior to opening bids or shall be submitted with the bid; otherwise, the bid may be rejected as irregular and unauthorized. Bids submitted as joint ventures must so state and be signed by each venturer.

6. **CONTENTS OF BID ENVELOPE.** The bid envelope shall contain all of the following:
   Section 00 30 00 - Bid Form
   Section 00 41 00 - Bid Security Form (Bid Bond)
   Section 00 43 00 - Subcontractor List
   Section 00 44 00 - Non-collusion Affidavit
   Section 00 45 00 - Responsibility/Non-responsibility
   Section 00 46 00 - Public Contract Code 10232 Statement
   Section 00 47 00 - Workers' Compensation Certification
   Section 00 48 00 - Debarment and Suspension Certification

7. **BID OPENING.** The County will stamp bids with the date and time of receipt. Bids will be opened and read publicly at the time and place indicated in Section 1 above. Bidders or their authorized agents may be present. After opening of bids, the County will review all bids for accuracy and reserves the right to correct obvious errors. Upon completion of review, the bids will be ranked by the bid amount and the apparent low bidder will be determined and notified.

8. **FAILURE TO EXECUTE AND DELIVER DOCUMENTS.** IF the bidder to whom the Contract is awarded shall fail or neglect , with ten (10) calendar days from the date of the receipt of a notice of award, to execute and deliver all required Contract Documents and file all required bonds, insurance certificates and other documents, County may, in its sole discretion, deposit bidder's surety bond, cashier's check or certified check for collection, and retain the proceeds thereof as liquidated damages for bidder's failure to enter into the Contract Documents. Bidder agrees that calculating the damages County may suffer as a result of bidder's failure to execute and deliver all required Contract Documents would be extremely difficult and impractical and that the amount of bidder's required bid security shall be the agreed and presumed amount of County's damages.

9. **BIDDER'S BOND, PERFORMANCE BOND AND PAYMENT BOND.** Bid security must be submitted with the bid. The successful bidder, prior to execution of the Contract, must submit a Performance Bond in the full amount of the Contract. The successful bidder, prior to execution of the Contract, must submit a Payment Bond in the full amount of the Contract.

10. **INSURANCE.** It is highly recommended that bidders confer with their respective insurance carriers or brokers to determine in advance of bid submission the availability of the insurance certificates and endorsements required. A bidder, who executes the Contract and thereafter fails to comply strictly with the insurance requirements, will be deemed to be in breach of Contract.

11. **RESERVATION OF RIGHTS:** County specifically reserves the right, in its sole discretion, to reject any or all bids, or re-bid, or to waive minor irregularities from bid requirements. If no bids are received, the County reserves the right to identify interested contractor(s) and negotiate directly without re-bidding.

12. **SECURITIES IN LIEU OF RETENTION:** Public Contract Code Section 22300 gives the Contractor for option to deposit securities with an escrow agent as a substitute for retention earnings to be withheld by the County.

13. **PRE-BID MEETING:** The Pre-Bid Meeting is scheduled for 2:00 PM, Pacific Daylight Time, July 23, 2019 at the Humboldt County **Courthouse Conference Room A**, 825 5th Street, Eureka, California**.**

14. **WITHDRAWAL OF BIDS.** Any bidder may withdraw his/her bid, either personally or by written request, any time prior to the scheduled closing time for receipt of bids.

15. **QUESTIONS AND CLARIFICATIONS.** In order to avoid any misinterpretation or misrepresentation between the Bidder, the Architect and the County as regards the plans and specifications for the Project, neither the County nor Architect will respond to any verbal or telephone inquiries, however Bidders may submit written inquiries for clarifications or questions by email to the attention of Deven Carter, Project Architect. Nichols Melburg & Rossetto. Email: carter@nmrdesign.com. Any responses to written Bidder inquiries will be at the full discretion of the County, and any responses will be in writing in the form of an Addendum to these Contract Documents, which will be sent to all Bidders.

16. **ADDENDA OR BULLETINS.** Any Addenda or Bulletins issued during the time of bidding or forming a part of the Documents loaned to the Bidder, for the preparation of his Bid, shall be covered in the Bid, and shall be made a part of the Contract.

17. **BIDDERS INTERESTED IN MORE THAN ONE BID.**
No person, firm, or corporation shall be allowed to make or file, or be interested in more than one bid for the same work, unless alternate bids are called for. A person, firm, or corporation, who has submitted a subproposal to a bidder, is not thereby disqualified from submitting a subproposal or quoting prices to the other bidders.

18. **VISITING THE SITE & KNOWLEDGE OF PLANS & SPECIFICATIONS**
Before submitting a bid for the work, it is recommended that the Bidder inspect the sites and inform himself as to the conditions under which he will be obligated to execute the work. A Pre-Bid meeting and walk-through are scheduled for this project. See Paragraph "13" above.

No allowance will be subsequently made for failure to inspect, and the Bidder will be solely responsible for the consequences of his negligence or lack of diligence. Before submitting any proposal, each Bidder shall examine the General Conditions, Plans, Specifications, as well as these Instructions to Bidders, and the forms appended hereto and made a part hereof.

END OF SECTION

SPECIAL CONDITIONS

SECTION 00 01 10

1. PROJECT DESCRIPTION

This project is located in Humboldt County in the City of Eureka. It consists of remodeling the 5th floor of Courthouse, replacement of portions of the roof and mechanical systems. The Courthouse will remain in operation during the entire project.

A. Project Location:
Humboldt County Courthouse
825 5th Street
Eureka, CA 95501
Humboldt County, California

2. ENGINEER'S ESTIMATE:

The engineer's estimate for the base bid is $1,900,000. This is an estimate only and bidders should not rely upon this figure when preparing or submitting their bids.

3. TIME FOR COMPLETION

The Contractor shall complete the entire project within 200 calendar days from the County's issuance of the "Notice to Proceed".

4. LIQUIDATED DAMAGES

As actual damages for any delay in completion are impossible to determine, the Contractor and their sureties shall be liable for and shall pay to the County of Humboldt the sum of $500.00 as fixed, agreed and liquidated damages for each calendar day of delay beyond the overall contract completion date until the work is completed and accepted.

5. SUBSTITUTIONS

A. All pre-bid substitution requests for "equal" products or systems shall be submitted to the Owners Representative. 10 days prior to the contract bid opening date. All pre-bid substitution requests shall be submitted on the PRE-BID SUBSTITUTION REQUEST FORM - SECTION 00158, see Section 00 70 00, GC 27,B.

B. Product substitution requests for products that are "equal" to specified products but not produced by an "Acceptable Manufacturer", per each technical specification shall be submitted within 35 days after the contract is awarded. All product substitution requests shall be submitted on the PRODUCT SUBSTITUTION REQUEST FORM; see Section 01 60 00, "Product Requirements."

6. ADDENDA

No addenda shall be issued within 48 hours of the designated Bid opening time. Any addenda resulting in material changes, addition, or deletion shall be issued at least 72 hours before the designated Bid opening time, otherwise the Bid time shall be extended by not less than 72 hours.

7. COMMUNICATIONS

A. All notices, demands, requests, instructions, approvals, proposals, and claims must be in writing.
B. Any notice to or demand upon the Contractor shall be sufficiently given if delivered at the office of the Contractor stated on the signature page of the Contract or at such other office as Contractor may from time to time designate in writing to the County of Humboldt or deposited in the United States mail in a sealed postage-prepaid envelope, or if delivered with charges prepaid to any delivery company for transmission, in each case addressed to such office.
C. All papers required to be delivered to the County shall, unless otherwise specified in writing to the Contractor, be delivered to the County and any notice to or demand upon the County of Humboldt shall be mailed in a sealed, postage-prepaid envelope, or delivered with charges prepaid to any delivery company for transmission to the County of Humboldt at such address, or to such other representatives of the County of Humboldt or to such other address as the County may subsequently specify in writing to the Contractor for such purpose.
D. Any such notice shall be deemed to have been given as of the time of actual delivery; or, in the case of mailing, when the same should have been received in due course of post; or, in case of any delivery company, at the time of actual receipt.

8. MINIMUM RATES OF PAY

A schedule of the minimum rates of pay applicable to this Contract is on file at the principal office of Humboldt County Public Works at 1106 Second Street, Eureka, California, and shall be made available to any interested party on request.

9. JOB OFFICES

A. The Contractor must designate an area to serve the posting requirements of this contract. On this board will be posted EEO and wage information in compliance with the General Conditions of this contract.
B. The Contractor and their subcontractors may maintain such office and storage facilities on the site as may be necessary for the proper conduct of the work. These shall be located so as to cause no interference with any work to be performed on the site. The Owner's Representative shall be consulted with regard to locations.
C. Upon completion of the project, or as directed by the County of Humboldt, Owner's Representative, the Contractor shall remove all such temporary structures and facilities from the site, same to become their property, and leave the premises in the condition required by the County.
D. The Contractor shall furnish and maintain, during construction of the project, adequate facilities at the site to be designated by the County of Humboldt for the use of the County of Humboldt and the Architect.

10. PERFORMANCE AND PAYMENT BONDS

The company providing the required performance and payment bonds must be listed in U.S. Treasury Circular No. 570 as a surety approved to issue bonds securing Government contracts in the State of California.

11. NOISE ABATEMENT PROVISIONS

A. Noise Affecting Existing Courthouse:

1. The ground and second floor of the building contains an active courthouse including courtrooms, judge's offices and court operations. These areas are operated by the Superior Court of California, not by Humboldt County. Contractor's work shall not impact the court's operations. For all work that may impact the court's operations,

including excessive noise and vibration, the contractor shall coordinate and schedule in advance with the Owner's Representative and receive approval from the Owner's Representative.

2. The Owner's Representative and the Owner shall be the sole judges of permissible noise and vibration levels and they have the right to designate times when specific items of equipment may be used.

C. Vibration Control: Provide ten (10) working days notice before conducting construction activities that might cause vibration, such as, but not limited to, drilling, demolition, compaction, etc.

D. Noise Levels: Do not exceed an average continuous sound level of 72 dBA, measured at the perimeter of the work area, and do not exceed an impact noise level of 100 dBA measured at the perimeter of the work area, and only two impact occurrences between 72 dBA and 100 dBA are permitted in a one-hour period.

E. Objectionable discernible noise transmitting is prohibited during normal Courthouse hours.

END OF SECTION

BID CHECKLIST

SECTION 00 01 40

The following documents shall be submitted by each Bidder, as part of their complete Bid:

1. Section 00300 - Bid Form
2. Section 00410 - Bid Security Form (Bid Bond)
3. Section 00430 - Subcontractor List
4. Section 00440 - Non-collusion Affidavit
5. Section 00450 - Responsibility/Non-responsibility
6. Section 00460 - Public Contract Code 10232 Statement
7. Section 00470 - Workers' Compensation Certification
8. Section 00480 - Debarment and Suspension Certification

END OF SECTION

PRE-BID SUBSTITUTION FORM

SECTION 00 15 80

PROJECT: Humboldt County District Attorney, Victim/Witness and Cast DATE:_____
Project Number: 2018-102

Note to Contractor: All substitution requests for "equal" products or systems shall be submitted to the Owner's Representative, (10) ten days prior to the contract bid date.

We hereby submit for your consideration the following product in lieu of the specified item for the above project.

SECTION:_____ Paragraph:_____

Specified Item: _____

Proposed Substitution:_____

Attach completed technical data, including laboratory tests, if applicable.

Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

Does the substitution affect dimensions shown on Drawings? _____(Yes) _____(No)

Will the undersigned pay for changes to the building design, including detailing costs caused by the requested substitution? _____(Yes) _____(No)

What effect does substitution have on other trades? _____

_____

_____

_____

Differences between proposed substitution and specified item? _____

_____

_____

_____

Manufacturer's guarantees of the proposed and specified items are:

Same _____ Different (Explain on attachment) _____

The undersigned states that the function, appearance and quality are equivalent or superior to the specified item.

Submitted By: _____

Signature: _____

Firm: _____

Address: _____

Telephone: _____

FOR USE BY ARCHITECT:

_____ Accepted _____ Accepted as Noted

_____ Not Accepted _____ Received Too Late

By: _____ Date: _____

Remarks: _____

_____

END OF SECTION

BID FORM

SECTION 00 30 00

TO
THE COUNTY OF HUMBOLDT

CONSTRUCTION OF HUMBOLDT COUNTY DISTRICT ATTORNEY, VICTIM/WITNESS AND CAST

CONTRACT NUMBER 2018-102

Name of Bidder: _____

Business Address: _____

_____

Telephone Number: _____

Residence Address: _____

The work to be done shall be constructed in accordance with the Contract Documents, prepared by NMR Architects, Dated 6/28/2019 , the Agreement annexed hereto and the General Prevailing Wage provisions as specified in the "Notice to Contractors".

Bids are submitted for the entire work. The amount of "The Bid" for comparison purposes will be the determination of the apparent low bid as specified in Section 00 01 00, "Instructions to Bidders".
The Bidder shall set forth for the Base Bid and each Alternate, if any, in clearly legible figures, a written lump sum price and a numeric lump sum price.

In case of a discrepancy between the two notated prices, the written price shall prevail, unless, however, if the amount set forth in writing is ambiguous, unintelligible or uncertain for any cause, or is omitted, then the amount set forth in the numeric column for the item shall prevail.

If this proposal shall be accepted and the undersigned shall fail to enter into the Contract and to give the two required bonds in the sums to be determined as aforesaid, with surety satisfactory to the Department of Public Works, within seven (7) days, not including Sundays and legal Holidays, after the Bidder has received notice from the Department that the contract has been awarded, the County 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 Humboldt.

The undersigned, as Bidder, declares 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 Bidder has carefully examined the location of the proposed work, the annexed proposed form of contract, and the plans therein referred to; and proposes and agrees if this proposal is accepted, that Bidder will contract with the County of Humboldt, in the form of the copy of the contract annexed hereto, to provide all necessary machinery, tools, apparatus and other means of construction, and to do all the work and furnish all the material specified in the contract, in the manner and time therein prescribed, and according to the requirements of the Architect as therein set forth, and that he will take in full payment therefor the following item prices to wit:

Receipt and compliance with the following Addenda to the Contract Documents is acknowledged:

1. Addendum No.____ Dated_____
2. Addendum No.____ Dated_____
3. Addendum No.____ Dated_____
4. Addendum No.____ Dated_____
5. Addendum No.____ Dated_____

I, _____, as an agent for

_____, declare under penalty of perjury under the laws of the State of California, that the information contained in this Bid is true and correct.

Executed at _____, California, on _____, 2019

The project shall be complete within the time limits specified in Section 00 01 10, “Special Conditions.” The undersigned is aware the Contract includes provisions for liquidated damages as specified in Section 00 01 10, “Special Conditions,” if the Project is not completed within the agreed time of completion.

THE UNDERSIGNED, as Bidder, proposes the following:

BASE BID:

To furnish and complete the entire work as shown on the drawings and listed in the specifications, including required contract bonds and insurance, without additions or subtractions on account of specified alternates, for the sum of:

Base Bid (Lump Sum):	
_____	$ _____
Total Amount in Words	Total

Proposal Signature Page

Accompanying this proposal is _____

(Insert the words "Cash ($)", "Cashier's Check", "Certified Check", or "Bidder's Bond", as the case may be)

in the amount of at least ten percent (10%) of the total Bid Price submitted. The names of all persons interested in the foregoing proposal as Principals are as follows:

_____

_____

_____

(NOTE: If a Bidder or other interested person is a Corporation, state the legal name of the corporation, also names of the president, secretary, treasurer, and manager thereof; if a Co-partnership, state the true name of the firm, also state the names of all individual co-partners composing the firm; if the Bidder or other interested person is an Individual, state the first and last names in full.)

Licensed in accordance with an Act providing for the registration of Contractors:

License No.: _____ Expiration Date:_____

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 Section 10162, and 10232, are true and correct and that the bidder has complied with the requirements of Section 8102 of the Fair Employment and Housing Commission Regulations (Chapter 5, Title 2 of the California Administrative Code). 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; and the Title 49 Code of Federal Regulation, Part 29 Debarment and Suspension Certification are true and correct.

_____ _____

Signature of Bidder Date

If a Bidder is a Corporation or a Co-partnership:

_____

Name of Corporation or Firm Name of Co-partnership

Signatures of officer(s) or partners authorized to sign contracts on behalf of the Corporation or Co-partnership, Corporations require signature by 2 (two) corporate officers:

_____	_____
Name	Title
_____	_____
Name	Title

If Signature is by an agent, other than an officer of a corporation or a member of a partnership, a Power of Attorney must be on file with the Department prior to opening Bids or may be submitted with the Bid; otherwise the Bid will be disregarded as irregular and unauthorized.

Bidder's Business Address: _____

Place of Residence: _____

Date: _____

END OF SECTI0N 00 30 00

BID SECURITY FORM

SECTION 00 41 00

LET THE FOLLOWING BE KNOWN:

That _____, as Principal, and _____, a corporation, organized and existing under and by virtue of the laws of the State of _____ and authorized to do surety business in the State of California, as Surety, are held and firmly bound unto the _____, State of California, as Obligee, in the sum of _____, Dollars ($ _____), for the payment of which sum well and truly to be made, we, and each of us, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted a bid to the County of Humboldt, State of California, for all work specifically described in the accompanying bid;

NOW, THEREFORE, if the aforesaid Principal is awarded the contract, and within the time and manner required under the specifications, after the prescribed forms are presented to Principal for signature, enters into a written contract in the prescribed form, in accordance with the bid, and files the two bonds, one guaranteeing faithful performance and the other guaranteeing payment for labor and materials as required by law, or if the said Principal shall fully reimburse and save harmless the Obligee from any damage sustained by the Obligee through failure of the Principal to enter into the written contract and to file the required performance and labor and material bonds, then this obligation shall be null and void; otherwise, it shall be and remain in full force and effect.

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 hereunto set our hands and seals this _____ day of _____, 20_____.

_____

By:_____ By:

Principal (Seal) Surety (Seal)

NOTE: (1) Signature of those executing for the surety must be properly acknowledged.
(2) This bond must be in an amount equal to as least ten (10%) percent of the amount bid.
(3) Bidders must use this form unless the surety company form is substantially the same.

END OF SECTION

SUBCONTRACTOR LIST

SECTION 00 43 00

LIST OF SUBCONTRACTORS
PROJECT NAME: HUMBOLDT COUNTY DISTRICT ATTORNEY, VICTIM/WITNESS AND CAST
PROJECT NUMBER: 2018-102

The Bidder shall list all Subcontractors in accordance with Article 18 of the Supplementary General Conditions. All Subcontractors shall be listed with the Department of Industrial Relations to work on public works projects.

Name of Subcontractor, CA Contractor License Number.	**Address**	**Description of Work to be Performed**

Name of Subcontractor, CA Contractor License Number & Dir. Reg. Number	**Address**	**Description of Work to be Performed**

END OF SECTION

NONCOLLUSION AFFIDAVIT

SECTION 00 44 00

TO THE COUNTY OF HUMBOLDT, DEPARTMENT OF PUBLIC WORKS

Non-Collusion 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 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 a false or sham bid, and they have 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 their 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 of agent thereof to effectuate a collusive or sham bid.

_____
Signature of Bidder

_____
Date

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

END OF SECTION

RESPONSIBILITY/NONRESPONSIBILITY

SECTION 00 45 00

1. DETERMINATION OF BIDDER RESPONSIBILITY

   A. A responsible bidder is a bidder who has demonstrated the attribute of trustworthiness, as well as quality, fitness, capacity and experience to satisfactorily perform the contract. It is the County's policy to conduct business only with responsible contractors. (Ord. 2291, § 1, 01/07/2003)

   B. Bidders are hereby notified that the County may determine whether the bidder is responsible based on a review of the bidder's performance on any contracts, including but not limited to County contracts. Particular attention will be given to violations of labor laws related to employee compensation and benefits, and evidence of false claims made by the bidder against public entities. This will include subcontractors and their employees as well.(Ord. 2291, § 1, 01/07/2003)

   C. The County may declare a bidder to be non-responsible for the purpose of this contract, if the Board of Supervisors, in its discretion, finds that the bidder has done any of the following: (1) committed any act or omission which negatively reflects on the bidder's quality, fitness or capacity to perform this contract with the County or a contract with any other public entity, or engaged in a pattern or practice which negatively reflects on same; (2) committed an act or omission which indicates a lack of business integrity or business honesty; or (3) made or submitted a false claim against the County or any other public entity. (Ord. 2291, § 1, 01/07/2003)

   D. If there is evidence that the apparent low bidder may not be responsible, the department shall notify the bidder in writing of the evidence relating to the bidder's responsibility, and its intention to recommend to the Board of Supervisors that the bidder be found not responsible. The department shall provide the bidder and/or the bidder's representative with an opportunity to present evidence as to why the bidder should be found to be responsible and to rebut evidence which is the basis for the department's recommendation. If the bidder fails to avail itself of the opportunity to rebut the department's evidence, the bidder may be deemed to have waived all rights of appeal. (Ord. 2291, § 1, 01/07/2003)

   E. If the bidder presents evidence in rebuttal to the department, the department shall evaluate the merits of such evidence, and based on that evaluation, make a recommendation to the Board of Supervisors. The final decision concerning the responsibility of the bidder shall reside with the Board of Supervisors. (Ord. 2291, § 1, 01/07/2003)

   F. These terms shall also apply to proposed [subcontracts/ subconsultants] of bidders on County contracts. (Ord. 2291, § 1, 01/07/2003)

2. DETERMINATION OF BIDDER DEBARMENT

   A. The bidder is hereby notified that the County may debar the bidder from bidding on other County contracts for a specified period of time, not to exceed three (3) years, and the County may terminate any or all of the bidder's existing contracts with the County, if the Board of Supervisors finds, in its discretion, that the bidder has done any of the following: (1) violated any term of a contract with the County; (2) committed any act or omission which negatively reflects on the bidder's quality, fitness, or capacity to perform a contract with the County or any other public entity, or engaged in a pattern or practice which negatively reflects on same; (3) committed an act or offense which indicates a lack of business integrity or business honesty; or (4) made or submitted a false claim against the County or any other public entity. (Ord. 2291, § 1, 01/07/2003)

B. If there is evidence that the apparent low bidder may be subject to debarment, the department shall notify the bidder in writing of the evidence which is the basis for the proposed debarment, and shall advise the bidder of the scheduled date for a debarment hearing before the Contractor Hearing Board (CHB). (Ord. 2291, § 1, 01/07/2003)

C. The CHB shall conduct a hearing where evidence on the proposed debarment is presented. The bidder and/or the bidder's representative shall be given an opportunity to submit evidence at that hearing. After the hearing, the CHB shall prepare a proposed decision, which shall contain a recommendation regarding whether the bidder should be debarred, and, if so, the appropriate length of time of the debarment. If the bidder fails to avail itself of the opportunity to submit evidence to the CHB, the bidder may be deemed to have waived all rights of appeal. (Ord. 2291, § 1, 01/07/2003)

D. A record of the hearing, the proposed decision and any other recommendation of the CHB shall be presented to the Board of Supervisors, by the department head. The Board of Supervisors shall have the right to modify, deny or adopt the proposed decision and recommendation of the hearing board.(Ord. 2291, § 1, 01/07/2003)

E. These terms shall also apply to proposed [subcontractors/ subconsultants] of bidder's on County contracts.(Ord. 2291, § 1, 01/07/2003)

EVIDENCE OF RESPONSIBILITY / NONRESPONSIBILITY

(Humboldt County Code Sections 2141 et seq.)

The bidder shall, under penalty of perjury, answer each of the questions below and provide supporting documentation. The term “bidder” shall include any person associated with the bidder in the capacity of owner, partner, director, officer or manager.

1. Is the bidder under suspension, debarment, or determination of ineligibility by any federal, state or local agency? ___No ___Yes (explain)

2. Has the bidder been suspended, debarred, or determined ineligible by any federal, state or local agency within the preceding 5 years: ___No ___Yes (explain)

3. Is there pending against the bidder any proposed debarment or suspension proceeding? ___No ___Yes (explain)

4. Has the bidder been indicted, charged with, or convicted, or assessed civil or administrative penalties, or had a civil judgment rendered against it, in any matter involving:
   (a) fraud, false claims, or dishonesty;
   (b) any serious or wilful violation of the California Occupational Safety and Health Act of 1973 (Labor Code Sections 6300 et seq) or the Federal Occupational Safety and Health Act of 1970;
   (c) violation of the state workers’ compensation laws;
   (d) violation of the Contractor’s State License Law (Bus & Prof Code Sections 7000 et seq.)
   (e) violation of prevailing wage laws;
   (f) violation of state or federal environmental laws;
   (g) violation of local laws related to permits, land use, or waste disposal?

   ___No ___Yes (explain)

5. Has the bidder defaulted on a construction contract within the preceding 10 years?

___No ___Yes (explain)

6. Provide information concerning any bankruptcy or receivership of bidder, and information regarding all legal claims, disputes, or lawsuits (including administrative matters) arising from any construction project performed within the preceding 5 years, including information regarding any work completed by a surety.

NOTE: This information will not necessarily result in denial of award, but will be considered in determining bidder responsibility. Bidders are cautioned that making a false certification may subject the bidder to criminal prosecution.

_____
Signature of Bidder

_____
Date

END OF SECTION

PUBLIC CONTRACT CODE SECTION 10232 STATEMENT

SECTION 00 46 00

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

_____
Signature of Bidder

_____
Date

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

END OF SECTION

WORKERS' COMPENSATION CERTIFICATE

SECTION 00 47 00

Labor Code Section 3700.

"Every employer except the State shall secure the payment of compensation in one or more of the foregoing ways:

(a) By being insured against liability to pay compensation in one or more insurers duly authorized to write compensation insurance in this state.

(b) By securing from the Director of Industrial Relations a certificate of consent to self-insure either as an individual employer, or as one employer in a group of employers, which may be given upon furnishing proof satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to their employees."

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

Signature of Contractor:_____

Date:_____

In accordance with Article 5 [commencing at Section 1860], Chapter 1, Part 7, Division 2, of the Labor Code, the above certificate must be signed and filed with the awarding body prior to commencing any work under this contract.

END OF SECTION

DEBARMENT AND SUSPENSION CERTIFICATION

SECTION 00 48 00

TITLE 49, CODE OF FEDERAL REGULATIONS, PART 29

The CONTRACTOR, under penalty of perjury, certifies that, except as noted below, he/she or any other person associated therewith in the capacity of owner, partner, director, officer, manager:

1. is not currently under suspension, debarment, voluntary exclusion, or determination of ineligibility by any Federal, State or local agency;
2. has not been suspended, debarred, voluntarily excluded or determined ineligible by any Federal, State or local agency within the past 3 years;
3. does not have a proposed debarment pending; and
4. has not been indicted, convicted, or had a civil judgment rendered against it by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past 3 years.

If there are any exceptions to this certification, insert the exceptions in the following space.

Exceptions will not necessarily result in denial of award, but will be considered in determining bidder responsibility. For any exception noted above, indicate below to whom it applies, initiating agency, and dates of action.

Notes: Providing false information may result in criminal prosecution or administrative sanctions. The above certification is part of the Proposal. Signing this Proposal on the signature portion thereof shall also constitute signature of this Certification.

Signature of Contractor: _____

Date: _____

END OF SECTION

AGREEMENT

SECTION 00 50 00

This is an AGREEMENT made and entered into this _____ day of _____, 2019 by and between the County of Humboldt, a political subdivision of the State of California (hereinafter referred to as COUNTY) and _____, a corporation organized and existing under the laws of the State of_____, a partnership consisting of _____; an individual doing business as _____ in the State of California, (hereinafter referred to as "CONTRACTOR").

County and Contractor for the consideration hereinafter named agree as follows:

SECTION 1 - SCOPE OF WORK

Contractor shall furnish all labor, tools and materials and perform all the work for the construction of:

HUMBOLDT COUNTY DISTRICT ATTORNEY, VICTIM/WITNESS AND CAST
PROJECT NUMBER: 2018-102

in accordance with the Contract Documents referred to in Section 3 of this Agreement.

The scope of work includes the work included in the “Base Bid” for the project and the following bid alternatives:_____

SECTION 2 - CONTRACT PRICE

County shall pay, and Contractor shall accept Contractor's Price, as follows:
_____ Dollars and /100 ($)

as full compensation for furnishing all materials and for doing all the work contemplated and embraced in this Agreement; also for all loss or damage, arising out of the work aforesaid, or from the actions of the elements, or from any unforeseen difficulties or obstructions which may arise or be encountered in the prosecution of the work until its acceptance by County, and for all risks of every description connected with the work; also for all expenses incurred by or in consequence of the suspension or discontinuance of the work and for well and faithfully completing the work, and the whole thereof, in the manner and according to the Plans and Specifications, and the requirements of the Owner.

SECTION 3 - CONTRACT DOCUMENTS

The complete contract between the parties hereto shall consist of the following, hereinafter referred to as the CONTRACT DOCUMENTS:

- Notice to Contractors
- Bid Form
- Bid Security Form
- This Agreement
- Payment Bond
- Performance Bond
- General Conditions
  - Supplementary General Conditions
  - General Requirements
  - Technical Specifications
  - Plans and Drawings
  - Subcontractor List

- Insurance Certificates
- Non collusion Affidavit
- Public contract code Statement
- Evidence Of Responsibility/Non-responsibility
- Special Conditions
- Debarment suspension certification

And, as published by the California Department of Industrial Relations:

- General Prevailing Wage Rates

And any addenda to any of the above documents, all of which are on file in the office of the Director of Public Works of the County of Humboldt. Each of said CONTRACT DOCUMENTS is incorporated and made a part of this Agreement by the reference contained in this Section.

All rights and obligations of the County and the Contractor are fully set forth and described in the Contract Documents. All of the above named documents are intended to be complementary, so that any work called for in one, and mentioned in the other is to be performed and executed the same as if mentioned in all said documents.

SECTION 4 - BEGINNING OF WORK

Following receipt and full execution and approval of the Contract Documents, and posting of the requisite Bonds as called for therein, the COUNTY will issue a "Notice to Proceed". Under no circumstances shall the CONTRACTOR enter upon the site of work until receipt of the "Notice to Proceed", unless so authorized in writing by the COUNTY.

SECTION 5 - TIME OF COMPLETION

The work called for in this Agreement shall be commenced within ten (10) calendar days of the date of receipt by Contractor of the Notice to Proceed and shall be fully completed within 200 calendar days following receipt of the Notice to Proceed by the Contractor.

SECTION 6 - PREVAILING WAGE

Pursuant to Section 1770 of the Labor Code, the County has determined the Prevailing Wage Rate to be as listed by the Department of Industrial Relations, Division of Labor Statistics and Research, P.O. Box 420603, San Francisco, CA, 94101, Phone: (415) 703-4780. Complete Certified Payrolls must be submitted to the OWNER together with each application for progress payment. Electronic submittal directly to DIR may be required.

SECTION 7 - WORKERS' COMPENSATION

By my signature hereunder, as CONTRACTOR, I certify that I am aware of the provisions of Section 3700 of the Labor Code which requires every employer to be insured against liability for Workers' Compensation or to undertake self insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract.

SECTION 8 - NOTICES

All notices shall be in writing and delivered in person or transmitted by mail. Notices required to be given to the COUNTY shall be addressed as follows:

County Administrative Office
825 5th Street, Eureka, California, 95501

Notices required to be given to CONTRACTOR shall be addressed as follows:

SECTION 9 - NUCLEAR FREE HUMBOLDT COUNTY ORDINANCE COMPLIANCE

Neither the Contractor, his Subcontractors or their suppliers are Nuclear Weapons Contractors, and are not knowingly or intentionally engaged in the research, development, production, or testing of nuclear warheads, nuclear weapons systems, or nuclear weapons components, as defined by the Nuclear Free Humboldt County Ordinance. Contractor, his Subcontractors and/or their suppliers agree to notify Owner immediately if they become a nuclear weapons contractor as defined above.

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IN WITNESS WHEREOF, The parties hereto have entered into this Agreement as of the date first above set forth.

COUNTY OF HUMBOLDT

(SEAL)

By:_____
Chairperson, Board of Supervisors of the County of Humboldt, State of California

ATTEST:

By: _____
Clerk of the Board of Supervisors of the County of Humboldt, State of California

CONTRACTOR: Corporations require signature by 2 (two) corporate officers

By: _____

Title: _____

By: _____

Title: _____

APPROVED AS TO FORM:

By: _____
Deputy County Counsel

INSURANCE CERTIFICATES REVIEWED AND APPROVED:

By: _____
Risk Manager

END OF SECTION

PERFORMANCE BOND

SECTION 00 61 00

LET THE FOLLOWING BE KNOWN:

That_____
(Name of Contractor)

_____
(Address of Contractor)

a _____, hereinafter called Principal, and:
(Corporation, Partnership or Individual)

_____
(Name of Surety)

_____
(Address of Surety)

hereinafter called Surety, are held and firmly bound unto

HUMBOLDT COUNTY
825 5th Street
Eureka, California 95501

hereinafter called OWNER, in the penal sum of

_____

Dollars ..... ($ _____)

in lawful money of the United States, for the payment of which sum well and truly to be made, we bond ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____ day of _____, 20__, a copy of which is hereto attached and made a part hereof for the construction of:

_____

_____

_____

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all of the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during the one year guaranty period, and if Principal shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

Signed and sealed this _____ day of _____, 20___.

By: _____
Principal

By: _____
Surety

SURETY

(Power of Attorney for person signing for Surety Company, or a certified copy thereof, must be attached. Signatures of person or persons executing for the Surety must be acknowledged.)

END OF SECTION

PAYMENT BOND

SECTION 00 62 00

LET THE FOLLOWING BE KNOWN, THAT WHEREAS, the County of Humboldt, by its order made _____, 20____, has awarded to _____, hereinafter designated as the "Principal," a contract for the work described as follows:

_____

_____

_____

NOW, THEREFORE, we the Principal and _____, Surety, are held and firmly bound unto the County of Humboldt in the penal sum of _____ Dollars ($_____), lawful money of the United States of America for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that is said Principal, his/her or its heirs, executors, administrators, successors or assigns, shall fail to pay any of the persons named in Section 9100 of the Civil Code, or amounts due under the Unemployment Insurance Code with respect to work or labor performed by any such claimant, or for any amounts required to be deducted, withheld, and paid over to the Franchise Tax Board from the wages of employees of the Contractor and their subcontractors pursuant to Section 18806 of the Revenue and Taxation Code with respect to such work and labor as required by Sections 9550 et seq. of the Civil Code of California, then said Surety will pay for the same, in or to an amount not exceeding the amount hereinafter set forth, and also will pay in case suit is brought upon this bond, such reasonable attorney's fees, as shall be fixed by the court, awarded and taxed as in the above-mentioned statutes provided.

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 or the specifications accompanying the same shall in any wise affect its obligations 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, or to the specifications.

IN WITNESS WHEREOF, this instrument has been duly executed by the Principal and Surety above named, on the _____ day of _____, 20 ___.

_____	_____
PRINCIPAL	SURETY
BY:_____	BY_____
	ATTORNEY-IN-FACT

END OF SECTION

GENERAL CONDITIONS

SECTION 00 70 00

INDEX TO GENERAL CONDITIONS

GC 1. DEFINITIONS

A. COUNTY: The term "County", or pronouns in place of same where used herein, shall mean Humboldt County acting through its Board of Supervisors.

B. BOARD: The term "Board", or pronouns in place of same where used herein, shall mean the Humboldt County Board of Supervisors.

C. OWNER: The "Owner" is the person or entity identified as such in the Owner-Contractor Agreement; the term Owner means the Owner or their authorized representative.

D. ARCHITECT: The term "Architect" shall mean, Nichols, Melburg & Rossetto as employed by the Owner.

E. CONTRACTOR: The term "Contractor", where used herein, shall mean the Contractor to whom the contract for the work described and specified herein has been awarded by the Board.

F. PLANS AND SPECIFICATIONS: The term "Plans and Specifications", where used herein, shall mean and include all specifications and provisions of every kind, whether general, detailed or otherwise, relating to the equipment, material of work, and the installation thereof, and the plans and drawings accompanying same which are made a part thereof. Such Plans and Specifications are recognized as instruments of professional service.

G. OWNER'S REPRESENTATIVE: The term "Owner's Representative" shall mean agent assigned to the Project by Humboldt County Department of Public Works.

H. PROJECT INSPECTOR: The term "Project Inspector" shall mean agent assigned to the Project by Humboldt County Department of Public Works.

GC 2. CONTRACT

A. The Contract Documents include all documents identified as such in the Agreement (Section 00500), any amendments and Change Orders thereto

B. In the execution of the work or any portion thereof, Contractor shall operate as an independent contractor and not as the agent of Owner or Architect.

C. No verbal agreement or conversation with any officer, agent, or employee of Owner or Architect, either before or after execution of the Agreement, shall affect or modify any terms or obligations of the Contract unless duly incorporated into the Contract by written Change Order or amendment of the Contract.

D. The Contract Documents shall not be construed to create any contractual relationship of any kind between the Architect and the Contractor, but the Architect shall be entitled to performance of obligations intended for their benefit, and to enforcement thereof. Nothing contained in the Contract Documents shall create any contractual relationship between the Owner or the Architect and any subcontractor or sub-subcontractor.

GC 3. BONDS

A. The successful bidder, simultaneously with the execution of the Agreement, will be required to furnish a Payment Bond in an amount equal to one hundred (100%) percent of the contract price, and a faithful Performance Bond in an amount equal to one hundred (100%) percent of the contract price. The Contractor must submit a certificate from the Humboldt County Clerk's Office with all payment bonds. The Clerk's certificate must indicate that the surety is admitted to transact business in the State of California, and certify that the surety's certificate of authority, issued by the Insurance Commissioner, has not been suspended, revoked, canceled, or annulled.

B. The bonds shall comply with Section 9554 of the Civil Code of the State of California. The payment Bond and the faithful Performance Bond shall each be in a form that is satisfactory to the County Counsel, or Risk Management of the County of Humboldt. A copy of an acceptable format is attached to the Agreement forms of these specifications.

GC 4. INSURANCE REQUIREMENTS

A. THIS CONTRACT/AGREEMENT SHALL NOT BE EXECUTED BY COUNTY and the CONTRACTOR is not entitled to any rights, unless certificates of insurance, or other sufficient proof that the following provisions have been complied with, and such certificate(s) are filed with the Clerk of the Humboldt County Board of Supervisors.

B. Without limiting Contractor's indemnification provided herein, Contractor shall and shall require any of its subcontractors to take out and maintain, throughout the period of this Agreement, the following policies of insurance placed with insurers with a current A.M. Bests rating of no less than A:VII or its equivalent against injury/death to persons or damage to property which may arise from or in connection with the activities hereunder of Contractor, its agents, employees or subcontractors:

C. Comprehensive or Commercial General Liability Insurance at least as broad as Insurance Services Office Commercial General Liability coverage (occurrence from CG 0001), in an amount of $2,000,000 per occurrence. If work involves explosive, underground or collapse risks, XCU must be included. If a general aggregate limit is used, either the general aggregate limit shall apply separately to this project or the general aggregate shall be $5,000,000. Said policy shall contain, or be endorsed with, the following provisions:
   1. The County, its officers, employees and agents, are covered as additional insured for liability arising out of the operations performed by or on behalf of Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the County, its officers, agents, and employees.
   2. The policy shall not be canceled or materially reduced in coverage without thirty (30) days prior written notice (10 days for non-payment of the premium) to County by certified mail.
   3. The inclusion of more than one insured shall not operate to impair the rights of one insured against another insured, and the coverage afforded shall apply as though separate policies had been issued to each insured, but the inclusion of more than one insured shall not operate to increase the limits of the insurer's liability.
   4. For claims related to this project, the Contractor's insurance is primary coverage to the County, and any insurance or self-insurance programs maintained by the County are excess to Contractor's insurance and will not be called upon to contribute with it.
   5. Any failure to comply with reporting or other provisions of the parties, including breach of warranties, shall not affect coverage provided to County, its officers, employees, and agents.

D. Automobile liability insurance with coverage at least as broad as Insurance Services Office form CA 0001 06092, Code 1 (any auto), for vehicles used in the performance of this Agreement with minimum coverage of not less than $1,000,000 per accident combined single limit (CSL). Such policy shall contain or be endorsed with the provision that coverage shall not be canceled or materially reduced in coverage without thirty (30) days prior written notice (10 days for non-payment of premium) to County by certified mail.

E. Workers' Compensation insurance meeting statutory limits of the California Labor Code which policy shall contain or be endorsed to contain a waiver of subrogation against County, its officers, agents, and employees and provide for thirty (30) days prior written notice in the event of cancellation.

F. If applicable, Builder's Risk or Course of Construction, written on an "All-Risk" form, for 100% of the completed value of the insurable part of the project. The Builder's Risk policy shall provide for losses to be payable to County and the Contractor as their interests may appear, and that in the event of payment for any loss under the coverage provided, the insurer shall have no rights of recovery against County and Contractor.

G. Contractor shall furnish County with certificates and original endorsements effecting the required coverage prior to execution of this Agreement by County. The endorsements shall be on forms as approved by the County's Risk Manager or County Counsel. Any deductible or self-insured retention over $100,000 shall be disclosed to and approved by County. If Contractor does not keep all required policies in full force and effect, County may, in addition to other remedies under this Agreement, take out the necessary insurance, and Contractor agrees to pay the cost of said insurance.

H. SUBCONTRACTORS: Should contractor subcontract any portion of the work to be performed under this Agreement, said subcontractors shall be required by contractor to:

1. Enter into a written contract with contractor acknowledging that no employee/employer relationship exists between contractor and subcontractor and that no Workers' Compensation, unemployment benefits, or other personnel benefits are required by or available to subcontractor through contractor or County.
2. Hold harmless and to indemnify, defend and save harmless contractor and County, its Board of Supervisors, officers, agents, employees and volunteers, from any and all claims and losses accruing or resulting to any and all contractors, subcontractors, material suppliers, laborers, and any other person, firm or corporation who may be injured or damaged by subcontractor in the performance of this Agreement.

I. HOLD HARMLESS/INDEMNIFICATION CLAUSE

Pursuant to Government Code section 895.4, the parties to this Agreement shall indemnify, defend and hold harmless the other parties hereto and their officers, agents, and employees, from any and all claims, demands, losses, damages, and liabilities of any kind or nature, including attorney's fees, which arise by the virtue of its own acts or omissions (either directly or through or by its officers, agents or employees) in connection with its duties and obligations under this Agreement and any amendments hereto.

Acceptance of insurance, if required by this Agreement, does not relieve Contractor from liability under this indemnification clause. This indemnification clause shall apply to all damages or claims for damages suffered by Contractor's operations regardless if any insurance is applicable or not.

GC 5. TERMINATION OF CONTRACT

A. Each of these general conditions, whether preceding or following this paragraph, is to be considered material and failure to comply with any of such conditions by the Contractor will be deemed a breach of contract.

B. Should the Contractor fail to perform any of the provisions of the Contract, the Owner shall have the right, whether or not an alternative right is provided, to declare the Contract terminated. A written notice by the Owner to the Contractor that the Contract is terminated shall be deemed a complete termination of same.

C. On the Contract being so terminated, the Contractor shall, provided Contractor is ordered to do so by the Owner, immediately remove from the premises all or any materials and personal property belonging to Contractor which have not been used in the construction of the Work or which is not in place in the Work; and both Contractor and their surety shall be liable upon their bond for all damages caused to the Owner by reason of failure to complete the Contract.

D. See GC Article 29, SUFFICIENT LABOR OR MATERIAL.

GC 6. NON-CONTINUANCE OF WORK

A. Should the Contractor at any time during the progress of the Work refuse, neglect or be unable for any reason, except the documented inability to supply a sufficiency of materials or workmen necessary, to complete the Work within the time specified in the Contract, the Owner shall have the power to terminate the Contract as prescribed.

GC 7. ASSIGNMENT OF CONTRACT

A. The Contractor shall not assign or sublet the Contract in whole or in part without the prior written consent of the Owner. The Contractor shall not assign any monies due or to become due to them under the Contract without the prior written consent of the Owner.

B. Any assignments permitted under these documents or approved by the Owner shall, in addition, have prior written approval of all sureties of the Contractor executing bonds or insurance in the interest of this Contract.

C. If the Contractor seeks to assign any portions or monies as permitted, Contractor shall pay to the Owner $1,000 to cover Owner's costs each time an assignment occurs.

GC 8. SEPARATE CONTRACTS

A. The Owner reserves the right to let other contracts in connection with this Project. The Contractor shall afford all other such contractors reasonable opportunity for storage of their materials; shall provide that the execution of their work properly connects and coordinates with theirs; and shall cooperate with them to the end of facilitating the Work.

B. The work performed or executed under other contracts in advance of work under this Contract shall be inspected and determined to be in proper condition by the Contractor before permitting related or connecting work to proceed under this Contract.

C. Contractor shall immediately notify Architect of any discrepancies, defects or other conditions found unsuitable for proper execution of the work.

GC 9. CONFERENCES

A. At any time during the progress of the Work, the Owner, Owner’s Representative, or Architect shall have authority to require the Contractor to attend a conference of any or all of the contractors engaged in the Work; and any notice of such conference shall be duly observed and complied with by the Contractor.

GC 10. TERMS OF PAYMENT

A. At the end of each calendar month, the Contractor shall submit to the Owner’s Representative a statement of all materials actually placed in the building during the month, the labor expended thereon, and the cost thereof; whereupon after verification by the Owner’s Representative it is found to be acceptable, a certificate for the amount less five percent (5%) thereof will be issued by the Owner’s Representative except that no certificate will be issued for defective work and materials until they have been removed, replaced and made good. The Owner will also pay the costs of material on hand under the following conditions: Written approval is given by the Owner’s Representative prior to

requesting payment. Approved items have been inventoried by the Owner's Representative and they are stored in a safe and weather protected manner, and are major items that delay in receiving will adversely affect the construction time schedules. The Owner's Representative will issue a certificate for the certified invoice amount, less five percent (5%) thereof. The Contractor shall be paid monthly as the work progresses, the amount of each such certificate. Final payment shall be made in accordance with E. below.

B. As a basis for determining the amount of monthly payments, the Contractor shall, before commencing the work, submit to the Owner's Representative for approval a detailed statement of all materials and labor included in their original estimate. This statement shall be so arranged that the value of the work as it progresses may be readily determined. Payment for change order work will be made if the change order work is complete and is approved prior to the Owner's Representative issuing the monthly certification of payment. The regular initial schedule of values shall be prepared and submitted by Contractor twenty (20) calendar days in advance of the time the first request for payment is due, allowing sufficient time for review, approval and modifications as may be required prior to use for said first payment. The total sum of the schedule of values shall equal the Contract Price.

C. Acceptance of any work and payments therefore shall be made upon written recommendation of the Owner's Representative and Architect.

D. Payments to the Contractor will be made within 30 days of an approved pay estimate in accordance with Owner's regular approval and accounting procedures, based upon statements or certificates received as issued or approved by the Owner's Representative, including written certification that complete certified payroll records have been, or will be, submitted to the Labor Commissioner as required by the California Labor Code.

E. Thirty-five (35) days after the acceptance of the work by the Owner's Representative and Architect (provided the project has been accepted by the Board of Supervisors), the Contractor shall be entitled to the balance due for the completion and acceptance of the work, provided that all claims for labor and materials have been paid, and that no claims shall have been filed with the County based upon acts or omissions of the Contractor and that no stop notices have been filed.

GC 11. CONFLICTS OR ERRORS

A. During construction, if any conflicts are discovered in the plans or specifications, they shall be immediately submitted to the Owner's Representative who will render an interpretation on what was intended and the Contractor agrees to furnish all things necessary by such interpretation to the satisfaction of the Owner's Representative without additional expense to the Owner.

B. The Contractor shall not contend that any error, delay or default in their work is due to omission or ambiguity in said plans or specifications.

C. If errors are found in the Construction Documents that can not be termed conflicts (shown, sized or called out differently in different places) the Contractor shall immediately notify the Owner's Representative within 15 calendar days following the discovery of any error so that a change order can be prepared and the item corrected prior to construction.

D. Refer to G.C. 24, Unity of Documents.

GC 12. CHANGES TO PLANS AND SPECIFICATIONS

A. No modification or deviation from plans and specifications will be permitted by the Contractor without prior written consent of Owner. However, within the limits allowed by law, the Contractor agrees that Owner, without invalidating the Contract, may order extra work or make changes by altering, adding to, or deducting from the Work, the contract sum being adjusted accordingly, and that Contractor will enter into a modification of the original contract to make such changes by means of a written Change Order.

B. Change Orders shall be signed by the Contractor, Architect and authorized representative of the Owner.

C. All such work shall be executed under the conditions of the original contract except that any claim for extension of time caused thereby shall be adjusted at the time of ordering such change. Both parties agree that the credit to, or charge against the Owner shall be determined as follows:

1. In the event that a modification results in a reduction of the amount of labor and material to be supplied by the Contractor, the Owner shall be given a credit equal to the actual value of such labor and materials plus a reasonable amount for the use of tools, materials and overhead and profit; or, in the event that a modification results in an increase in the amount of labor and materials to be supplied by the Contractor, the Owner shall pay the Contractor the actual value of such labor materials and equipment plus not more than 15% which shall cover the use of Contractor's overhead and profit. In no case shall the total of any subcontractor(s) together with the Contractor's overhead, profit, bonds and insurance exceed 15%. All costs shall be included as a lump sum price on change orders.
2. Cost Estimates for all changes shall be submitted by the Contractor to the Owner's Representative for checking by the Owner's Representative and Architect. The Contractor shall submit all Cost Estimates within 15 calendar days following the discovery of any potential change. The Owner's Representative shall render a written decision as to reasonable costs within 15 calendar days of receiving cost estimate unless more time is agreed to by both Contractor and Owner's Representative.
3. Any increases in cost or extension of time shall be approved by the Owner's Representative, Architect and Owner, on a signed change order.
4. In the event that the Contractor, for whatever reason, does not accept the dollar amount of increase or decrease or extension of time to the contract amount in the decisions rendered by the Owner, Contractor shall, upon receiving written order from the Owner, proceed with the work called for in the Change Order on a force account basis. Any claim for dollar increases or extension of time shall be made in writing to the Owner's Representative in accordance with the provisions of GC 51, Claims Procedures.

D. In response to a request for a proposed modification, Contractor shall promptly furnish within 15 calendar days, relevant cost breakdowns, time estimates and other information as may be required to the Owner's Representative.

GC 13. GUARANTEE

A. The Contractor shall be held responsible to make-good any defects due to faulty, improper or inferior workmanship or materials arising or discovered in any part of the Work within one (1) year after the completion and final acceptance of the same by the Owner's Representative, Architect and Owner unless a longer period is called for in the Technical Specification Sections.

B. Acceptance of the Work by the Owner's Representative, Architect or Owner shall in no way absolve the Contractor from the responsibility of complying with the provisions of the plans and specifications and other contract documents, even though deviations may not be discovered within the aforementioned one year period.

C. The bond for faithful performance furnished by the Contractor shall cover such defects and protect the Owner against them and remain in force during the one year guarantee period.

GC 14. INTERPRETATIONS

A. The Contractor shall comply with the obvious intent and meaning of the plans and specifications which shall be construed to include all material, measures and modes or work necessary to complete the work required in a workmanlike manner, in strict accordance with these plans and specifications, and to the satisfaction of the Owner.

B. Should any question arise as to the intent and interpretation of the plans or specifications, the Contractor shall promptly, upon discovery thereof, refer the same in writing to the Owner's Representative, whose decision thereon shall be final.

GC 15. DECISIONS BY ARCHITECT AND/OR OWNER'S REPRESENTATIVE

A. The Owner's Representative shall, in all cases, determine whether the amount and quality of the several kinds of work which are to be paid for under the Contract are in accordance with the plans and specifications.

B. The Owner's Representative shall have power to cause all or any part of the work to be expedited with greater diligence when delayed or stopped.

C. When requested by the Owner's Representative, the Architect's decisions in matters relating to artistic effect will be final if consistent with the intent of the Contract Documents.

D. Where not involving a change in the agreed Contract Price or Completion Time, and not inconsistent with the intent of the Contract Documents, the Owner's Representative shall have authority to:
1. Correct any errors or inconsistencies in, and make any deletions from or additions to the drawings and specifications;
2. Order minor changes or adjustments in the work, whether by field order, notations on Contractor's submittals, or other instructions;
3. Order certain portions of the work delayed when particularly involved with or affected by any Change Order in process or being considered by Owner.

E. The Owner's Representative will be the interpreter of the requirements of the Contract Documents and the judge of the performance thereunder by both the Owner and Contractor.

F. The Architect through the Owner's Representative will render interpretations necessary for the proper execution or progress of the Work, with reasonable promptness and within fifteen calendar days.

G. Claims, disputes and other matters in question between the Contractor and the Owner relating to the execution or progress of the Work or the interpretation of the Contract Documents shall be referred to the Owner's Representative for decision which the Owner's Representative will render in writing with a reasonable promptness and within fifteen calendar days.

GC 16. ADMINISTRATION OF THE CONTRACT

A. The Owner's Representative will provide administration of the Contract. Maintenance of the Project records for the contract shall be as prescribed by the Owner's Representative and as hereinafter described.

B. The Owner's Representative will be the representative of the Owner during construction and until final payment is due. The Architect will advise and consult with the Owner's Representative and Owner. The Owner's instruction to the Contractor shall be forwarded through the Owner's Representative. The Owner's Representative will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument.

C. The Owner's Representative or Architect will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, and 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 Architect will not be responsible for or have control acts or omissions of the Contractor, Subcontractors, or any of their agents or employees, or any other persons performing any of the Work.

D. The Owner's Representative and Architect shall at all times have access to the Work wherever it is in preparation and progress. The Contractor shall provide facilities for such access so the Owner's Representative and Architect may perform their functions under the Contract Documents.

E. Based on the Owner's Representative and Architect's observations and an evaluation of the Contractor's Applications for Payment, the Owner's Representative will determine the amounts owing to the Contractor and will issue Certificates for Payment in such amounts as provided in GC Article 10.

F. The Owner's Representative shall, upon receipt of a complete submittal from the Contractor, make the submission to the Architect. The Architect shall review and take appropriate action on shop drawings, product data, samples, and other submittals required by the Contract Documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the Contract Documents. It shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor. The Architect's review shall be conducted with reasonable promptness, and within 15 calendar days unless otherwise noted, consistent with sound professional practice. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Architect shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the Contractor, nor shall the Architect be required to review partial submissions or those for which submissions for correlated items have not be received.

G. The Owner's Representative will prepare Change Orders in accordance with GC Article 12.

H. The Contractor shall provide sufficient, safe and proper facilities at all times for the full inspection of the Work by the Architect or other representatives of the Owner, at the project site and at the various other locations where project is being performed.

I. The Owner's Representative and Architect will have authority to reject Work which does not conform to the Contract Documents. Whenever, in their opinion, the Owner's Representative and Architect considers it necessary or advisable for the implementation of the intent of the Contract Documents, the Owner's Representative or Architect will have authority to require special inspection or testing of the Work in accordance with GC Article 31, whether or not such Work be then fabricated, installed or completed. However, the Owner's Representative and Architect's authority to act under this Subparagraph and any decision made by them in good faith to exercise or not to exercise such authority, shall not give rise to any duty or responsibility of the Owner's Representative or Architect to the Contractor, and Subcontractor, any of their agents or employees, or any other person performing any the Work.

J. The duties, responsibilities and limitations of authority of the Owner's Representative as the representative of the Owner during construction as set forth in the Contract Documents will not be modified or extended without written consent of the Owner.

GC 17. NON-CONFORMING WORK

A. The fact that the work and materials have been inspected from time to time and payments on account have been made, shall not relieve the Contractor from the responsibility of replacing and making good any defective work or materials that may be discovered within one year from the date of completion of the Work by the Contractor and its approval by the Owner's Representative, Architect, and its acceptance by the Owner.

B. Failure of Owner's Representative, Architect or Owner to object to any defects in work or material or variances from the plans and specifications during or after construction shall not be deemed a waiver by Owner, Owner's Representative or Architect of such defects or variances; nor by such failure shall Owner, Owner's Representative or Architect be deemed stopped from requiring Contractor to correct such defects or variances.

C. At Owner's sole option, if Owner prefers to accept non-conforming work, Owner may do so instead of requiring its removal and correction, in which case a Change Order will be issued to reflect an

appropriate reduction in the Contract Sum, or if the amount is determined after final payment it shall be paid by the Contractor.

D. Uncovering of Work:
1. If any portion of the Work should be covered contrary to the request of the Owner's Representative, Architect or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Owner's Representative, be uncovered for their observation and shall be replaced at the Contractor's expense.
2. If any other portion of the Work has been covered which the Owner's Representative or Architect has not specifically requested to observe prior to being covered, the Owner's Representative or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work be found in accordance with the Contract Documents, the cost of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work be found not in accordance with the Contract Documents, the Contractor shall pay such costs unless it be found that this condition was caused by the Owner or a separate contractor as provided in GC 8 above, in which event the Owner shall be responsible for the payment of such costs.

GC 18. OWNERSHIP OF DOCUMENTS

A. All plans and specifications shall remain the property of the Owner and shall be returned to the Owner's Representative or shall be accounted for by the Contractor before the final acceptance of building by the Owner.

B. Documents for this project shall not be used on or for any other work or purposes without express written consent of Owner's Representative, Architect and Owner.

GC 19. DOCUMENTS FURNISHED

A. The Contractor will be supplied ten (10) sets of Contract Documents for use in the Work.

B. Additional sets of Contract Documents may be obtained from Architect, at cost, at Contractor's expense.

GC 20. DRAWING DIMENSIONS

A. The general dimensions are shown in figures on the drawings furnished to the Contractor. These figured dimensions shall invariably have preference to scaled measurements; but the Contractor shall exercise proper caution and care to verify the figures before laying out the Work, and shall be held responsible for any omissions or errors therein that might have been avoided.

GC 21. DETAILED DRAWINGS

A. Drawings and details may be furnished to the Contractor as work progresses, showing in more elaboration the work intended to be done and the Contractor shall conform to them as being a part of the Contract.

B. No work shall be performed in advance of the receipt by the Contractor of such detailed drawings, except such work as the Owner's Representative shall order in writing to be done without details. Any complaint as to the character and extent of the details shall be made to the Owner's Representative within ten days after the Contractor has received the same. The Contractor shall notify the Owner's Representative in ample time as to when the Contractor will require these drawings so they may be prepared without causing any delay to the Work.

GC 22. SUBMITTALS

A. Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or any Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

B. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.

C. Samples are physical examples which illustrate materials equipment or workmanship and establish standards by which the Work will be judged.

D. The Contractor shall review, approve and submit, with such promptness as to cause no delay in their own work or in that of any other contractor, copies of all Shop Drawings or Setting Drawings, Schedules for the Work of the various trades and samples of materials and finishes required for the Work, together with information or supporting data as may be required or called for. The Owner's Representative will pass upon them with reasonable promptness in accordance with GC Article 16. The Contractor shall make any corrections required by the Owner's Representative or Architect and resubmit corrected copies.

E. Samples required or called for shall be exactly as specified for and intended to be used in the work; and Shop Drawings shall accurately portray the Work required. Materials, finishes and workmanship shall be equal in every respect to that of the reviewed submittals.

F. Submittals shall be delivered as directed by the Owner's Representative, postage or delivery charges prepaid by the Contractor in all cases. Samples returned upon request from the Contractor shall be returned by collect mail, parcel post or any carrier named by Contractor.

G. The furnishing by the Contractor or the review by the Architect of drawings, samples, schedules or other data shall not relieve the Contractor from responsibility for deviations from drawings or specifications, nor shall it relieve them of responsibility for errors of any sort in shop drawings, schedules or other submittals.

H. By approving and submitting Shop Drawings, Product Data and Samples, the Contractor represents that they have determined and verified all materials, field measurements, and field construction criteria related thereto, or will do so, and that they have checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

I. Each Submittal shall be properly identified as required by the Owner's Representative.

J. Deviations from requirements of Contract Documents, errors, inconsistencies with submittals previously made to or reviewed by Architect, and corrections to dimensions or supporting data shall be clearly identified by the Contractor by notations on the submittals or attached explanations.

K. No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been reviewed by the Architect as provided in Subparagraph of GC Article 16. All such portions of the Work shall be in accordance with reviewed submittals.

GC 23. SURVEY AND LAYOUT

A. All work pertaining to this Contract shall be laid out on the premises by the Contractor who shall be held responsible for its correctness.

B. The Contractor shall retain and pay for the services of a registered Engineer or licensed surveyor, when applicable, who shall lay out the main lines of the building and other improvements at the site and provide other primary lines, pile locations and levels as may be required.

C. All stakes, benchmarks, survey marks, monuments and other line or level points which have been or may be established in the building or on or about the premises shall be carefully preserved and respected by the Contractor.

D. On-site work shall be laid out to properly meet existing off-site work not required to be removed or replaced, or to lines and levels established by civil authorities having jurisdiction, as applicable to conditions at the place of the Work.

GC 24. UNITY OF DOCUMENTS

A. The Plans and Specifications are one document and any work shown, required or called for in the one and not in the other, or vice versa, shall be furnished or performed as though it were shown, required or called for in both.

B. 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 Contractor further agrees to furnish all labor or material for any detail that is necessary to carry out said intent and purpose without extra charge to the Owner.

C. The misplacement, addition or omission of any word, letter or punctuation mark shall in no way change the intent, purpose of meaning or the Plans and Specifications.

D. Any part of the Work or any article or detail pertaining thereto which is not specifically set forth in the Specifications or shown on the Drawings, but which is necessary for the proper completion of the Work, shall be furnished and installed at the Contractor's expense the same as if it had been partly or fully shown or specified. The Contractor shall do and furnish all things necessary to make a complete and workmanlike job in accordance with the intent and purpose of the Contract Documents.

GC 25. INSPECTION BY CONTRACTOR

A. The Contractor shall inspect, review, compare and familiarize himself with the Contract Documents and the premises of the Work, and shall at once report to the Architect, in writing if requested, any error, omission or inconsistency within the documents or between information given and conditions observed or found at the premises.

B. The Contractor shall make a close inspection of all materials as delivered, and shall promptly return all damaged or defective materials without waiting for their rejection by the Owner’s Representative, Project Inspector, or Architect.

C. Before beginning any of the work, the Contractor shall examine all construction and work of other contractors or trades that may affect this work, and to satisfy that everything is in proper condition to receive this work; and shall at once notify the Owner’s Representative, in writing if requested, of any exception taken to any construction or condition so affecting this work, whether placed under this Contract or other contracts.

D. Failure to file with the Owner’s Representative any notice to the contrary shall constitute acceptance by the Contractor of the construction of other contractors or trades as being suitable in all ways to receive their work, except as to defects which later develop in the work of other contractors after the execution of their own work.

E. Contractor's inspection of documents and premises shall include making known to himself the general and particular location, nature and character of the project work, the physical and contractual conditions, provisions and requirements, the nature and extent of work and equipment to be furnished by Owner, and the limitations and various other aspects relative to this project, including all coordination necessary for proper and timely execution of the Work.

F. Owner will not consider any claims whatsoever on account of Contractor's failure to fully investigate or determine their requirements in advance of commencing the work or the conditions of the work throughout its progress.

GC 26. DEVIATION FROM PLANS OR SPECIFICATIONS

A. No deviations shall be made from the plans or the specifications. If the Contractor shall vary from the plans the amount or value of the materials herein provided for, the Owner shall have the right to order such improper work or materials removed or replaced; any other work disturbed or damaged by such alteration shall be made good at the Contractor's expense.

GC 27. STANDARDS OF MATERIALS

A. Wherever the name or brand of a manufacturer's article is specified herein, it is used as a measure of quality and utility; a standard.

B. If the Contractor desires to use any other brand or manufacturer of equal quality and utility to that specified, Contractor shall make application to the Owner's Representative in writing, and submit samples if requested. The Architect will then determine whether or not the named brand or article is equal in quality and utility to that specified and Architect's decision shall be final. Submit at least 14 days prior to bid date. Refer to sections of Technical Specifications for these items.

GC 28. QUALITY OF MATERIALS AND LABOR

A. All materials used on this Contract shall be new and the best market quality unless specified or shown otherwise. All labor used on this Contract shall be competent and skilled for the Work. All Work executed under this Contract shall be done in the best, most thorough, substantial and workmanlike manner. All material and labor shall be subject to the approval of the Architect as to its quality and fitness, and shall be immediately removed if it does not meet with approval. The Owner's Representative may refuse to issue a Certificate of Payment for unapproved work until all defective materials or work have been removed and other material of proper quality substituted therefore.

GC 29. SUFFICIENT LABOR OR MATERIALS

A. Should the Contractor abandon the Work called for under these specifications, or seek to assign this Contract, or if at any time the Owner's Representative shall be of the opinion and so certify in writing to the Owner that the Contractor is unnecessarily and unreasonably delaying the work, or that the Contractor is willfully violating any of the conditions or provisions of the plans and specifications, or is performing their work in bad faith, the Owner shall, in addition to all other remedies provided by Contract or by law, after seven (7) days written notice to the Contractor, have the power to notify the Contractor to discontinue all work or any part thereof under this Contract; and thereupon, the Contractor shall cease to continue said Work or such part thereof as the Owner may designate, and the Owner shall thereupon have the power to obtain by contract, purchase or hire, such implements, tools, labor or materials by contract or otherwise, as Owner may deem advisable, to work at and be used to complete the Work herein described, or such part thereof as the Owner's Representative shall certify has not been completed, and to use such material as it may find at the building site. The expenses so incurred in the process shall be deducted by the Owner out of such monies as may either be due or may at any time thereafter become due to the Contractor under and by virtue of these plans and specifications, or any part thereof.

B. If the unpaid balance of the Contract Sum exceeds the cost of finishing the Work, including compensation for the Owner's Representative or Architect's additional services made necessary thereby, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor or their bondsmen shall pay the difference to the Owner on notice to either from Owner. The amount to be paid to the Contractor or to the Owner, as the case may be, shall be certified by the Owner's Representative, upon application, in the manner provided in GC Article 10, and this obligation for payment shall survive the termination of the Contract.

GC 30. OLD MATERIAL

A. Old material shall not be used.

B. Construction materials or other items used or placed in the work later shall be considered old materials and not reused.

GC 31. TESTS

A. Contractor shall comply with the requirements set forth in Division 1, General Requirements Sections.

GC 32. PATENT RIGHTS, COPYRIGHTS, TRADE NAMES AND ROYALTIES

A. The Contractor shall indemnify and save harmless the Owner and authorized persons acting for the Owner against 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.

B. 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 claims or charges whatsoever which may arise; and shall furnish written assurance satisfactory to the Owner that such charges have been paid.

GC 33. COMPLIANCE WITH BUILDING LAWS

A. The Contractor shall conform to and abide by all applicable city, county, regional, state and federal building, labor, sanitary, health and safety laws, ordinances, rules and regulations as currently adopted or enforced, including Part 1 & 2 of Title 24, Calif. Code of Regulation and the International Building Code; a copy of Title 24, CCR and the current California Building Code shall be kept at the job site at all times by the Contractor. Such laws and regulations shall be considered a part of these specifications the same as if set forth herein full, and all work hereunder shall be executed in accordance therewith.

B. All work and materials shall be in full accordance with the latest rules and regulations of the State Fire Marshal, the Safety Orders of the Division of Industrial Safety, the National Electric Code, the Uniform Plumbing & Mechanical Codes published by the International Association of Plumbing and Mechanical Officials, and other applicable state laws or regulation including all of Title 24, Calif. Code of Regulation. Nothing in these plans or specifications is to be construed to permit work not conforming to these codes.

GC 34. PERMITS AND LICENSES

A. Unless otherwise provided in the Contract Documents, the Owner shall give all notices and procure and pay for permits and governmental fees, licenses and inspections necessary for the proper execution and completion of the Work which are customarily secured after execution of the Contract and not excluded in Paragraph D below.

B. LICENSES: Professional, trade, business and other licenses required by state statute or local government are entirely the responsibility of the Contractor and Subcontractors, and shall be prerequisite to submitting a bid proposal or performing work on the Project.

C. PERMITS:
1. Permits shall also include any cash deposits, returnable or otherwise, required by authorities having legal jurisdiction to make such demands;
2. Owner reserves the right to cancel and declare null and void the Contract should any legal permit be refused or not issued for any reason;
3. Due to cancellation for said reasons, Owner will not consider any claims by Contractor for loss of anticipated profits; or for work performed or materials procured prior to obtaining all permits required herein.
4. The Contractor shall obtain Encroachment Permits from the City of Eureka, County of Humboldt, and CalTrans as needed.

D. Contractor shall procure and deliver to the Owner's Representative, in forms prescribed and complete with dates and authorized signatures, all certificates of inspection, testing or approvals required of or by State or Civil authorities having legal jurisdiction or any public authority bearing on the performance of the Work.

E. The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the Work.

GC 35. TEMPORARY FACILITIES

A. The Contractor shall provide and maintain a temporary field base of operation on the sites. Said base of operation shall be for the exclusive use of the Contractor; and shall be wind and weatherproof, furnished with sufficient lighting to permit reading of blueprints. A complete set of plans and specifications shall be kept continuously at each site. When vacated, said structure shall be removed and the work in that area completed in accordance with the Contract requirements. Based on need, Contractor shall maintain and pay for all utilities and fuels; shall provide maintenance and other services necessary for proper use and operation; and comply with related provisions as specified.

B. The Contractor shall maintain a viable communications system at each site acceptable to the Owner's Representative, and shall maintain the same until the final completion of the Contract and the acceptance of the Work. The Owner's Representative, Architect and Inspector shall have free and unrestricted use of this communications system for all purposes in conjunction with the Work.

C. The Contractor shall provide water closets and urinals for use by their employees and subcontractors and their employees, and in no case shall the permanent plumbing fixtures of buildings on the site be used for this purpose without the written consent of the Owner's Representative.

D. The Contractor and each subcontractor shall furnish, at their own expense, all tools, equipment, appliances, materials, scaffolding or other means necessary for the entire completion of the Work; and shall be responsible for the care and guarding of same.

E. The Contractor and each subcontractor shall erect and maintain where necessary to the progress and completion of the Work, all exterior and interior scaffolding which shall be erected in accordance with the safety rules of the State of California; and use of which shall be unrestricted for all persons performing work on the Project.

F. The Contractor shall pay the cost of all water, gas and electricity used by their employees or subcontractors during the process of the Work, or as required for temporary services or tests and inspections.

G. Also refer to Division 1, General Requirements Sections.

GC 36. LIABILITY FOR ACCIDENTS

A. The Contractor shall be liable for any and all loss, accident, neglect, injury, or damage to person, life or property which may be the result of or may be caused by their building operations or their execution of this Contract, and for which the Owner might be held liable; and shall protect and indemnify the Owner, the Owner's Representative, the Project Inspector, the Architect, and/or any officer, agent or employee of the Owner and hold them harmless in every way from all claims and from all suits or actions at law for damage or injury to persons, life or property that may arise or be occasioned in any way because of their building operations or their execution of this Contract.

B. Safety Precautions and Programs:
   1. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work.

C. The Contractor shall assume the full responsibility for personnel safety on the project and the means and methods of construction that pertain to personnel safety. Contractor is responsible that such means and methods of construction are adequate to provide safety to all personnel while accomplishing all requirements and standards of the Contract Documents. The Owner, Architect, Inspector and/or their representatives have no obligation, responsibility, or jurisdiction over safety or means and methods of construction that pertain to personnel safety on the project.

GC 37. ACCIDENT PREVENTION

A. The Contractor shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, and any other necessary construction required to secure safety of life or property; and shall maintain during all night hours sufficient lights to prevent accidents or damage to life or property.

B. No earth, building, temporary or other structure shall be loaded, used or stressed so as to endanger its safety.

B. In the event of an emergency affecting the safety of persons or property, the Contractor shall act, at their discretion, to prevent threatened damage, injury or loss. Claims by Contractor on account of alleged emergency actions shall be filed in writing with the Owner's Representative.

GC 38. EXISTING PREMISES AND IMPROVEMENTS

A. The Contractor shall care for, preserve and protect existing structures, utilities and other features, fixtures or improvements at the premises, including adjacent or co-terminus properties which are not required to be removed or altered by reason of work under this Contract; and shall, likewise, care for and protect work or improvements newly placed or recently installed at the premises. Any part or portion of said existing or newly placed improvements which are removed, damaged or disturbed because of this work, shall be replaced, cleaned or otherwise returned to the original condition entirely at the expense of the Contractor.

B. The removal and/or replacing of any existing structure, pipe, conduit, pavement or other existing improvement necessary for the proper completion of any work under the Contract shall be performed by the Contractor, and no claim for extra work shall be made on account of such removal and replacement.

C. In case it shall be necessary to remove any telephone, telegraph or electrical power transmission poles, water pipes, electrical conduits, or underground structures of any character, or any portion thereof, the Owner or their agents shall be notified by the Contractor and the Contractor shall make the necessary arrangements for such removal. The right is reserved to the Owner and to gas, water, telephone, telegraph and electrical power transmission companies to enter upon the Work for purpose of making repairs and changes that have become necessary by reason of work related to the Project.

D. The Contractor shall thoroughly investigate all existing poles, wires, pipes and conduits above and below ground and shall provide for the maintenance or replacing of same, in good condition and at no expense to the Owner. Any necessary new or additional pipe or materials shall be furnished by the Contractor at their expense.

E. At the completion of the Work, the Contractor shall furnish the Owner's Representative with a written certificate from the owner of each and all conduits, pipes or structures to the effect that such replacements and maintenance have been satisfactorily performed.

F. The Contractor shall amply protect all work or improvements, set in the building or at the premises, against any possible damage; and shall furnish all necessary building paper, rough boarding or other means or materials necessary therefore.

G. Also refer to Division 1, General Requirements Sections.

GC 39. USE OF PREMISES AND CLEAN-UP

A. During the progress of the Work, materials shall be neatly stacked at such points so as not to interfere with site access and shall be properly cared for and protected against damage by weather or other causes. Project staging and parking area are defined in the plans.

B. In the case where there are several contractors operating at one time, arrangements must be made to allow the joint use of storage space so as to prevent delays in the work and unnecessary inconveniences.

C. At the end of each working day, or as directed by the Owner's Representative, Project Inspector or Architect, the Contractor shall clean the building, premises, streets and adjacent properties of accumulated rubbish, debris, unnecessary appliances or any unused material which may constitute an obstruction to the progress or completion of the Work, whether the same was caused by their work or by the work of other crafts. Failure by the Contractor to maintain the site and building premises in a safe and clean condition will be considered a breach of contract and Contractor agrees to pay Owner for costs to have site cleaned or deduct said costs from any money due the Contractor under the contract.

D. At the completion of the Work, and as one of the requisites thereof, the Contractor shall remove any and all tools, construction equipment, machinery, surplus materials, appliances, rubbish, packing, debris or other extraneous matter of any kind from the building, premises, sidewalks, streets or adjacent premises; Contractor shall go over all of their work and put the same in perfect order and condition and in strict accordance with the terms of the Contract; and shall repair or replace all damaged, broken or stained parts of their work, whether so injured by their workmen or others.

E. No advertising signs of any kind shall be displayed on the building, premises, fences, offices or elsewhere upon the job, except the Project sign as called for in the specifications.

F. At the completion of each phase of work of each kind of work or activity, the areas so used or involved shall be left in a "broom clean" condition daily unless otherwise more particularly required.

GC 40. DIRECTION OF THE WORK

A. The Contractor shall have control or charge over their Subcontractors; shall be responsible to the Owner for the acts and omissions of their employees, subcontractors and their agents and employees, and other persons performing any of the Work under a contract with the Contractor, and for all orders or instructions from the Owner, Owner's Representative or the Architect.

B. It shall be the Contractor's duty to see that all of the subcontractors commence their work properly at the proper time and carry it on with due diligence as not to cause delay or injury either to work or materials; and that all damage caused by them or their workmen be properly made good by them or by himself at no cost to the Owner.

C. The Contractor shall keep on the Work Site at all times and until the acceptance certificate is issued, a competent Project Manager and Project Superintendent for the purpose of receiving and executing without delay any orders in keeping with the terms of the Contract issued by the Owner, Owner's Representative or Architect. This Superintendent shall have charge of Plans and Specifications kept on the job; shall be instructed to be familiarized closely with all the provisions of the plans and specifications and to follow them in a precise manner.

D. If at any time the Superintendent or workman who shall be employed by the Contractor or any of their Subcontractors shall be declared by the Owner's Representative to be incompetent or unfaithful in executing the work, then the Contractor upon receiving written notice shall, forthwith, dismiss such person and shall not again employ him on any part of the Work.

E. Contractor shall supervise and direct the Work using their best skill and attention, and shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the work under the Contract; except that said responsibilities shall not be construed to permit use of any material, process, method or means if they are deemed unsuitable by Owner's Representative.

F. Processing of Change Orders, Cost Estimates and like administrative matters, shall follow the procedures established and approved by the Owner at commencement of Work under the Contract. Change orders and other forms shall be as approved by the Owner's Representative or otherwise required or directed by Owner. Refer to GC 12.

G. Review of Contract Documents: The Contractor shall carefully study and compare the Contract Documents and shall at once report to the Architect through the Owner's Representative any conflict, error, inconsistency or omission Contractor may discover. Refer to GC 11 A.

H. The Contractor shall not be relieved from their obligations to perform the Work in accordance with the Contract Documents by the activities or duties of the Owner's Representative in their administration of the Contract, or by inspections, tests or approvals required or performed under GC 31, by person other than the Contractor.

I. Progress Schedule:

1. The Contractor shall prepare and submit to the Owner's Representative with copy to the Architect and the Construction Inspector the Contractor's Initial Construction Schedule within ten (10) calendar days after date on the Notice to Proceed. The Contractor's Initial Construction Schedule shall be comprised of either a Detailed Bar Chart, if the contract value is less than one million dollars ($1,000,000), or a Critical Path Method network, if the contract value is one million dollars ($1,000,000) or more. The Contractor's Initial Construction Schedule shall show the dates on which each part or division of the work is expected to be started and completed, and shall show all submittals associated with each work activity, allowing a minimum of fifteen (15) calendar days (per GC 16 F) for the Architect's review of each submittal unless a longer period of time is specified elsewhere in these Contract Documents. The work activities making up the schedule shall be of sufficient detail to assure that adequate planning has been done for proper execution of the work and such that, in the sole judgment of the Owner, it provides an appropriate basis for monitoring and evaluating the progress of the work. The schedule shall show the interdependence of each activity and a single critical path. The Contractor shall also submit a separate progress schedule listing all submittals required under the contract and when it is anticipated that each submittal will be submitted.
2. The Contractor's Initial Construction Schedule shall show the sequence, duration in calendar days, and interdependence of activities required for the complete performance of all work. The Contractor's Initial Construction Schedule shall begin with the date of issuance of the Notice to Proceed and conclude with the date of final completion.
3. Float, slack time, or contingency within the schedule (i.e., the difference in time between the project's early completion date and the required contract completion date), and total float within the overall schedule, is not for the exclusive use of either the Owner or the Contractor, but is jointly owned by both and is a resource available to and shared by both parties as needed to meet contract milestones and the contract completion date.
4. The Contractor shall not sequester shared float through such strategies as extending activity duration estimates to consume available float, using preferential logic, or using extensive crew/resource sequencing, etc. Since float time within the schedule is jointly owned, no time extensions will be granted nor delay damages paid until a delay occurs which extends the work beyond the Contract completion date. Since float time within the construction schedule is jointly owned, it is acknowledged that Owner caused delays on the project may be offset by Owner caused time savings (i.e., critical path submittals returned in less time than allowed by the contract, approval of substitution requests which result in a savings of time to the Contractor, etc.) In such an event, the Contractor shall not be entitled to receive a time extension or delay damages until all Owner caused time savings are exceeded and the contract completion date is also exceeded.

5. Comments made by the Owner on the Contractor's Initial Construction Schedule during review will not relieve the Contractor from compliance with the requirements of the contract documents. The review is only for general conformance with the scheduling requirements of the contract documents. Upon the Owner's request, the Contractor shall participate in the review of the Contractor's Initial Construction Schedule submissions (including the original submittal, all update submittals, and any re-submittals). The Owner may request the participation of subcontractor in these reviews, as determined necessary by the Owner. All revisions shall be resubmitted within fifteen (15) calendar days after the Owner's review.
6. The submittal of a fully revised and acceptable Contractor's Initial Construction Schedule shall be a condition precedent to the processing of the first monthly payment application.
7. On any project with a construction value equal to or greater than one million dollars ($1,000,000), the Contractor must submit a Critical Path Method (CPM) network. The network shall provide a workable plan for monitoring the progress of all the elements of the work, establish and clearly display the critical elements of the work, forecast completion of the construction, and match the contract duration in time. Exclusive of those activities for submittal review and material fabrication and delivery, activity duration shall not be less than one (1) or more than thirty (30) calendar days, unless otherwise approved by the Owner. In addition to the detailed network diagram, the Contractor shall submit the following reports with the original submittal and all updates and revisions:

    a. Predecessor/Successor Report or a list showing the predecessor activities and successor activities for each activity in the schedule.
    b. Activity Report sorted by early start or a list showing each activity in the schedule, arranged by early start dates.
8. Regardless of which schedule method the Contractor elects to use in formulating the Contractor's construction schedule, and unless the Owner's Representative in writing each month, specifically waives this requirement, an updated construction schedule shall be submitted to the Owner's Representative five (5) days prior to the submittal of the Contractor's monthly payment request. The submittal of the updated construction schedule which satisfies the requirements of the Contract Documents accurately reflects the status of the work, and incorporates all changes into the schedule, shall be a condition precedent to the processing of the monthly payment application. Updated schedules shall also be submitted at such other times as the Owner may direct. Upon approval of a change order or issuance of a direction to proceed with a change, the approved change shall be reflected in the next schedule update submittal by the Contractor, or other update submittal approved by the Owner.
9. If completion of any part of the work, the delivery of equipment or materials, or submittal of the Contractor submittals is behind the updated construction schedule and will impact the end date of the work past the contract completion date, the Contractor shall submit in writing, a plan acceptable to the Owner for completing the work on or before the current contract completion date.
10. No time extensions shall be granted nor delay damages paid unless the delay can be clearly demonstrated by the Contractor on the basis of the updated construction schedule current as of the month the change is issued or the delay occurred and which delay cannot be mitigated, offset, or eliminated through such actions as revising the intended sequence of work or other means. Contractor shall submit all disputes or claims under the provisions of GC 51, Claims Procedure, otherwise it shall be waived.
11. As a condition precedent to the release of retained funds, the Contractor shall, after completion of the work has been achieved, submit a final Contractor's construction schedule which accurately reflects the manner in which the project was constructed and includes actual start and completion dates for all work activities on the construction schedule.

J. The Contractor shall forward all communications to the Owner and Architect through the Owner's Representative.

GC 41. CUTTING, FITTING AND PATCHING

A. The Contractor shall do all cutting, fitting and patching of Work that may be required to make its several parts come together properly, and prepare it to join or be joined by the work of other contractors; and Contractor shall make good after them.

B. The Contractor shall not endanger any work by cutting, digging or otherwise; and shall not cut or alter the work of any other contractor without the written consent of the Architect; and shall not cut a beam, timber or support of any kind without the consent of the Architect. Under no circumstances shall any principal brace, timber, truss, support or other structural member be cut or structurally weakened in any way.

C. Where the construction is required to join with or match existing work, it shall be finished exactly similar to that work so as to form complete, unified and finished work.

D. Contractor shall be responsible for and particularly supervise each and every operation and all work which in any way may affect the structural integrity of the various works, including below, or, or above grade structures, and whether for temporary or permanent work.

E. Any cost for repairs or restoration caused by cutting, digging or otherwise due to ill-timed or defective work shall be borne by the Contractor.

F. Also refer to Division 1, General Requirements Sections.

GC 42. RIGHT TO OCCUPY OR USE

A. The Owner reserves the right to occupy or use any part or parts, or the entirety of the building and/or grounds when the Owner deems the same may be safe for use or occupancy.

B. The exercising of this right shall in no way constitute an acceptance of such parts, or any part of the work, nor shall it in any way affect the dates and times when payments shall become due from the Owner to the Contractor, nor shall it in any way prejudice the Owner's right under the Contract or any bonds guaranteeing the same. The Contract shall be deemed completed only when all the Work contracted for shall be duly and properly performed and accepted by the Board of Supervisors.

C. When any part or portion of the Project is to be used or occupied by Owner in advance of final completion and acceptance, and when duly notified by Owner’s Representative, the Contractor shall arrange for completion of said portions of the Work the same as required under the Documents for the whole Work, including cleaning and other readying by the date stipulated with such notice.

D. Contractor shall not be held responsible for any damage to the occupied part of the Project resulting from Owner's occupancy.

E. Occupancy by Owner shall not be deemed to constitute a waiver of existing claims on behalf of Owner or Contractor against each other.

F. Use and occupancy by Owner prior to project acceptance shall not relieve Contractor's responsibility to maintain all insurance and bonds required of Contractor under the Contract until the entire Project is completed and accepted by Owner.

G. If after written notification by the Owner of the intent to occupy, the Contractor feels that such occupancy will delay progress of the work or will cause additional expense to the Contractor, Contractor may file a request for an equitable adjustment in Contract Price or Time of Completion, or both, with the Owner’s Representative. If the Owner’s Representative agrees he will either prepare a written change order for the Owner to sign or advise the Owner to delay occupancy.

GC 43. CHANGE OF CONTRACT TIME & LIQUIDATED DAMAGES

A. Change by Change Order. The contract time may only be changed by change order. A request for an extension or shortening of the contract time shall be based on written notice delivered by the party making the request to County promptly after the occurrence of the event giving rise to the request and stating the general nature of the request. Notice of the extent of the request with supporting data shall be delivered to County and shall be accompanied by the written statement that the adjustment requested is the entire adjustment to which the requesting party has reason to believe it is entitled as a result of the occurrence of said event. No request for an adjustment in the contract time will be valid if not submitted in accordance with the requirements of this paragraph.

C. Contract time may be extended. The contract time will be extended in an amount equal to time lost due to delays beyond the control of Contractor if the request is made therefor as provided in this article. Such delays shall include, but not be limited to, acts of neglect by County or others performing additional work, or to fires, floods, labor disputes, epidemics, abnormal weather conditions or acts of God.

D. Delay and price change. All time limits stated in the contract documents are of the essence. There shall be no adjustment of contract price due to delays for fires, floods, labor disputes, epidemics, abnormal weather conditions or acts of God. The provisions of this Provision shall not exclude recovery for damages (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court costs) for delay by either party.

E. Delays in completion of work :

1. Notice of delays. Whenever the Contractor foresees any delay in the prosecution of the work, and in any event immediately upon the occurrence of any delay which the Contractor regards as unavoidable, Contractor shall notify County in writing of the probability of the occurrence of such delay and its cause in order that County may take immediate steps to prevent, if possible, the occurrence or continuance of the delay or, if this cannot be done, may determine whether the delay is to be considered avoidable or unavoidable, how long it continues, and to what extent the prosecution and completion of the work are to be delayed thereby. It will be assumed that any and all delays which have occurred in the prosecution and completion of the work have been avoidable delays, except such delays as shall have been called to the attention of County at the time of their occurrence and found by County to have been unavoidable. The Contractor shall make no requests for extensions of time as to delay not called to the attention of County at the time of its occurrence.
2. Avoidable delays. Avoidable delays in the prosecution or completion of the work shall include all delays which in the opinion of County would have been avoided by the exercise of care, prudence, foresight and diligence on the part of the Contractor or Contractor's subcontractors.
3. Unavoidable delays. Unavoidable delays in the prosecution or completion of the work shall include all delays which, in the opinion of County, result from causes beyond the control of the Contractor and which could not have been avoided by the exercise of care, prudence, foresight and diligence on the part of the Contractor or the subcontractors and/or any suppliers. Delay in completion due to contract modifications ordered by County and unforeseeable delays in the completion of work or interference by other contractors employed by County will be considered unavoidable delays insofar as they interfere with the Contractor's completion of the work.

F. Extension of time:

1. Avoidable delays. In case the work is not completed in the time specified, including such extensions of time as may have been granted for unavoidable delays, the Contractor will be assessed damages for delay in accordance with liquidated damages provision. The County, however, shall have the right to grant an extension of time for avoidable delay if it is deemed in County's best interest to do so. During such extension of time, the Contractor will be charged for engineering and inspection services and other costs but will not be assessed damages for the delay.

2. Unavoidable delays. For delays which County considers to be unavoidable, the Contractor shall, pursuant to Contractor's application, be allowed an extension of time beyond the time herein set forth, proportional to such delay or delays, in which to complete the contract. During such extension of time, neither extra compensation for engineering and inspection provided nor damages for delay will be charged to the Contractor.
3. Liquidated damages. County and Contractor recognize that time is of the essence and that County will suffer financial loss if the work is not completed within the time specified above, plus any extensions thereof allowed in accordance with this contract. They also recognize the delays, expense and difficulties involved in proving the actual loss suffered by County if the work is not completed on time. Accordingly, instead of requiring any such proof, and due to impracticality and difficulty of ascertaining exact damages caused by delay, County and Contractor agree that as liquidated damages for delay (but not as a penalty) Contractor shall pay County that amount set forth in the Contract, or if no such amount is specified, then one-half of one percent of the total contract price for each day that expires after the time specified above for completion. In case of joint responsibility for delay in the final completion of the work, where two or more separate contracts are in force at the same time and cover work at the same site, liquidated damages assessed against any one Contractor will be based upon the individual responsibility of that Contractor for the delay as determined by, and in the judgment of, County.

County shall have the right to deduct the liquidated damages from any money in its hands, otherwise due, or to become due, to Contractor, or to sue for and recover compensation for damages for nonperformance of this contract within the time stipulated. County has determined and the Contractor acknowledges that the liquidated damages as established herein are governed by the provisions of Government Code § 53069.85 and are predicated upon the reasonable damages accruing to County stemming from any delay in the completion of this project.

GC 44. HOURS OF WORK

A. The time of service of any labor, workman or mechanic employed upon any of the Work herein specified, shall be limited and restricted to that allowed by law, and no laborer, workman or mechanic employed upon said Work herein specified shall be required or permitted to labor more than that allowed by law, except in cases of extraordinary emergency caused by fire, military or naval defenses or works in time of war.

B. Within thirty (30) days after any workman is permitted to work over that allowed by law in any one calendar day due to such an extraordinary emergency, the Contractor shall file with the Owner a verified report setting forth the nature of the said emergency, which shall contain the name of said workman and the hours worked by them on said particular day; and failure to file said report within the said thirty day period shall be prima facie evidence that no extraordinary emergency existed.

C. The Contractor and each subcontractor shall keep an accurate record showing the name of and actual hours worked by each worker employed by said Contractor and subcontractor in connection with the work contemplated by this agreement. The record shall be kept open at all reasonable hours to inspection by the Owner or its officers or agents and by the Division of Labor Law Enforcement of the Department of Industrial Relations.

D. The Contractor shall forfeit as a penalty to the Owner twenty-five dollars ($25) for each laborer, workman or mechanic employed in the execution of this Contract by them or by any subcontractor under him, upon any public work herein specified for (a.) each calendar day during which any laborer, workman or mechanic is required or permitted to labor more than that allowed by law; or (b.) each calendar week during which any laborer, workman or mechanic is required or permitted to labor more than that allowed by law of the Labor Code of the State of California. Said sums and amounts which shall have been so forfeited pursuant to the herein paragraph and said provisions of said Labor Code shall be withheld and retained from payments due to the Contractor under this Contract, pursuant to this Contract, and the terms of said Code; but no sum shall be so withheld, retained or forfeited

except from the final payment without a full investigation by either the Division of Labor Law Enforcement of the State Department of Industrial Relations or by the Owner.

GC 45. PREVAILING WAGE RATES & PAYROLL RECORDS

A. Prevailing Wage Rates

1. Pursuant to section 1770 and following of the Labor Code of the State of California, the Director of Industrial Relations has ascertained the general prevailing rate of per diem wages and the rates for overtime and holiday work in the locality in which the work is to be performed for each craft, classification or type of worker needed to execute the Contract which will be awarded to the successful bidder, copies of which are on file at Humboldt County Public Works, 1106 Second Street, Eureka, CA 95501, Phone (707) 445-7493 and are available to interested parties on request and by reference are incorporated herein and made a part hereof. Contractor will maintain a copy of prevailing rates and wages on the job site during the contract period.
2. It shall be mandatory upon the Contractor and upon any subcontractor under it, to pay not less than the specified rates to all laborers, workers, and mechanics employed in the execution of the Contract. It is further expressly stipulated that the Contractor shall, as a penalty to the Owner, forfeit not more than $200 for each calendar day, or portion thereof, for paying less than the stipulated prevailing rates for any work done under this contract by Contractor or by any subcontractor under it; and Contractor agrees to comply with all provisions of Section 1775 of the Labor Code.
3. In case it becomes necessary for the Contractor or any subcontractor to employ on the project under this Contract any person in a trade or occupation (except executives, supervisory, administrative, clerical, or other non-manual workers as such) for which no minimum wage rate is herein specified, the Contractor shall immediately notify the Owner, who will promptly thereafter determine the prevailing rate for such additional trade or occupation and shall furnish the Contractor with the minimum rate based thereon. The minimum rate thus furnished shall be applicable as a minimum for such trade or occupation from the time of the initial employment of the person affected and during the continuance of such employment. Each contractor shall file a certified copy of the payroll records with the entity that requested the records within ten (10) days after receipt of a written request.
4. Any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the Owner, shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address, and social security number. The name and address of the contractor awarded the contract for performing the contract shall not be marked or obliterated.
5. The Contractor shall inform the Owner of the location of the payroll records, including the street address, city and county, and shall, within five working days, provide a notice of any change of location and address.
6. The Prime Contractor shall be responsible for compliance with this section.

B. Payroll Records. The Contractor agrees to comply with all requirements of Section 1776 of the Labor Code, including, without limitation, the following:

1. The Contractor and each subcontractor shall keep an accurate payroll record, showing 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 employed by it in connection with the public work. Each payroll record shall be verified by written declaration, under penalty of perjury, stating both the following:
   a. The information contained in the payroll record is true and correct.
   b. The employer has complied with the requirements of sections 1771, 1811 and 1815 of Labor Code for any work performed by his employees on the project.
2. The above-referenced payroll records shall be certified and shall be available for inspection at all reasonable hours at the principal office of the Contractor on the following basis:
   a. A certified copy of an employee's payroll record shall be made available for inspection or furnished to the employee or their authorized representative on request;

b. A certified copy of all payroll records shall be made available for inspection or furnished upon request to the Owner, the Division of Labor Standards Enforcement, or the Division of Apprenticeship Standards of the Department of Industrial Relations.

c. A certified copy of all payroll records shall be made 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 Apprenticeship Standards, or the Division of Labor Standards Enforcement. If the requested payroll records have not been provided, pursuant to paragraph b. above, the requesting party shall, prior to being provided the records, reimburse the cost of the Contractor, subcontractors, 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.

C. Pursuant to Section 1771.1(a) of the California Labor Code, a contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of any contract for public work, as defined in Sections 1770 et seq. of the Labor Code, unless currently registered and qualified to perform public work pursuant to Section 1725.5 of the Labor Code. It is not a violation of Section 1771.1(a) for an unregistered contractor to submit a bid that is authorized by Section 7029.1 of the Business and Professions Code or by Section 10164 or 20103.5 of the Public Contract Code, provided the contractor is registered to perform public work pursuant to Section 1725.5 at the time the contract is awarded.

GC 46. TAXES

A. Any federal, state or city tax, including sales, excise, use and other taxes payable on articles furnished by the Contractor under the Contract shall be included in the Contract Price and paid for by the Contractor.

GC 47. SUBCONTRACTORS

A. In accordance with the provisions of Section 4100 et seq, of the Public Contract Code of the State of California, each bidder for the work herein specified shall set forth in their Bid Proposal the name and location of the place of business of each subcontractor who will perform work or labor or render service to the General Contractor in or about the construction of the Work or improvements an the amount in excess of one-half (1/2) of one percent (1%) of the General Contractor's total Base Bid; and the portion of the Work which will be done by each subcontractor if the Contract or said Work is awarded to said Bidder.

B. If any General Contractor fails to specify a subcontractor or specifies more than one subcontractor for the same portion of the Work to be performed on the Contract in excess of one-half of one percent of the General Contractor's total Bid, Contractor agrees to perform such portion himself and, if Contractor's Bid is accepted, Contractor shall not be permitted to subcontract that portion of the Work.

C. Should the General Contractor violate any provision of the subletting and subcontracting Fair Practices Act, the Contractor will be deemed in violation of the contract and the Owner may at it’s option, (1) cancel the Contract. (2) assess upon the Contractor a penalty in an amount of not more than ten percent (10%) of the amount of the subcontract involved.

D. Prior to the award of the Contract, the Owner’s Representative shall notify the successful bidder in writing if the Owner, after due investigation, has reasonable objection to any person or organization on the required list of subcontractors. Failure of the Owner to make an objection to any person or organization on the list prior to the award shall constitute acceptance of such person or organization.

E. The Contractor shall not contract with any subcontractor or any person or organization for any portion of the work who has not been accepted by the Owner. The Contractor will not be required to contract

with any subcontractor or person or organization against whom Contractor has a reasonable objection.

F If after the award of the contract, the Owner refuses to accept any person or organization on the required list of subcontractors, the Contractor shall submit an acceptable substitute and the Contract Sum shall be increased or decreased by the difference in cost occasioned by such substitution, and an appropriate Change Order shall be issued; however, no increase in the Contract Sum shall be allowed for any such substitution unless the Contractor has acted promptly and responsively in submitting a name with respect thereto prior to the award.

G. After the award, the Contractor shall resubmit the list of subcontractors, corrected or modified as may be necessary as directed by the Owner.

H. Subcontracting

1. Nothing contained in the Contract Documents shall be construed as creating any contractual relationship between Owner and any subcontractor. The Divisions or Sections of the Specifications, and the divisioning of the Drawings are not intended to control the Contractor in dividing the Work among subcontractors or to limit the Work performed by any trade.
2. The Owner, Owner's Representative or Architect will not undertake to settle any differences between the Contractor and their subcontractors or between subcontractors.
3. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions, and other Contract Documents insofar as applicable to the work of subcontractors; and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents. The Contractor shall make available to each proposed subcontractor prior to the execution of the Subcontract, copies of the Contract Documents to which the subcontractor will be bound by this Paragraph and identify to the subcontractor any terms and conditions of the proposed Subcontract which may be at variance with the Contract Documents. Each subcontractor shall similarly make copies of such Documents available to their sub-subcontractors.

I. Payments to Subcontractors:

1. Contractor shall pay each subcontractor or supplier upon receipt of payment from Owner, an amount equal to the percentage of completion allowed to Contractor on account of such work performed or material supplied. Contractor shall also require each subcontractor to make similar payments to their subcontractors or suppliers.
2. Contractor shall pay each subcontractor a just share of any insurance monies received by Contractor when and as applicable, and Contractor shall require each subcontractor to make similar payments to their subcontractors or suppliers.
3. The Owner's Representative may, on request and at their discretion, furnish to any subcontractor, if practicable, information regarding percentages of completion certified to the Owner on account of Work done under the Contract.
4. Neither Owner, Owner's Representative or Architect shall have any obligation to see to the payment of any monies to any subcontractor except as may otherwise be required by law.

GC 48. RECORDS, ACCOUNTS AND SEGREGATED PRICES

A. Contractor agrees to keep one complete set of records and books of accounts, on a recognized cost accounting basis, satisfactory to Owner and Owner's Representative showing all expenditures, of whatever nature, made pursuant to this Contract.

B. Contractor shall furnish such records, information and data as may be reasonably required and shall cooperate with Owner or Owner's Representative in establishing total costs for various major portions of the Work as will be designated by the Owner's Representative.

C. If required for convenience of Owner's accounting, Contractor shall furnish segregated prices for various other portions of the Work. These segregated prices shall be in addition to or separate from the required Schedule of Values.

GC 49. LIABILITY FOR TREES

A. In case of damage to or loss of trees due to carelessness or lack of sufficient protective measures specified, Contractor shall forfeit an amount in proportion to the extent of damage or loss, which shall not be less than Two hundred ($200) dollars nor exceed One Thousand ($1,000) dollars per tree for total loss.

GC 50. LIABILITY FOR SURVEY MARKS

A. In case of damage to, disturbance or removal of survey marks, field markers, monuments, or other survey or layout devices due to carelessness or lack of sufficient protective means, the party responsible for such damage, disturbance or removal shall be liable for the expense to have them replaced and reset in compliance with specified requirements.

GC 51. CLAIMS PROCEDURES

A. For purposes of this section:
   1. "Claim" means a separate demand by a contractor sent by registered mail or certified mail with return receipt requested, for one or more of the following:
      a. A time extension, including, without limitation, for relief from damages or penalties for delay assessed by the County under the contract for the project.
      b. Payment by the County of money or damages arising from work done by, or on behalf of, the contractor pursuant to the contract for the project and payment for which is not otherwise expressly provided or to which the claimant is not otherwise entitled.
      c. Payment of an amount that is disputed by the County.
   2. "Contractor" means any type of contractor within the meaning of Chapter 9 (commencing with Section 7000) of Division 3 of the California Business and Professions Code who has entered into a direct contract with the County for a project.
   3. "Subcontractor" means any type of contractor within the meaning of Chapter 9 (commencing with Section 7000) of Division 3 of the California Business and Professions Code who either is in direct contract with a Contractor or is a lower tier subcontractor.

B. Upon receipt of a Contractor's claim, the County shall conduct a reasonable review of the claim and, within a period not to exceed 45 days, shall provide the claimant a written statement identifying what portion of the claim is disputed and what portion is undisputed. Upon receipt of a claim, the County and a contractor may, by mutual agreement, extend the time period provided in this section.

C. The claimant shall furnish reasonable documentation to support the claim.

D. If the County needs approval from its Board of Supervisors to provide the claimant a written statement identifying the disputed portion and the undisputed portion of the claim, and the governing body does not meet within the 45 days or within the mutually agreed to extension of time following receipt of a claim sent by registered mail or certified mail, return receipt requested, the County shall have up to three days following the next duly publicly noticed meeting of the governing body after the 45-day period, or extension, expires to provide the claimant a written statement identifying the disputed portion and the undisputed portion.

E. Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after the County issues its written statement. If the County fails to issue a written statement, paragraph (K) shall apply.

F. If the Contractor disputes the County's written response, or if the County fails to respond to a claim issued pursuant to this section within the time prescribed, the Contractor may demand in writing an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand in writing sent by registered mail or certified mail, return receipt requested, the County shall schedule a meet and confer conference within 30 days for settlement of the dispute.

G. Within 10 business days following the conclusion of the meet and confer conference, if the claim or any portion of the claim remains in dispute, the County shall provide the Contractor a written statement identifying the portion of the claim that remains in dispute and the portion that is undisputed. Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after the County issues its written statement.

Any disputed portion of the claim, as identified by the contractor in writing, shall be submitted to nonbinding mediation, with the County and the claimant sharing the associated costs equally. The County and Contractor shall mutually agree to a mediator within 10 business days after the disputed portion of the claim has been identified in writing. If the parties cannot agree upon a mediator, each party shall select a mediator and those mediators shall select a qualified neutral third party to mediate with regard to the disputed portion of the claim. Each party shall bear the fees and costs charged by its respective mediator in connection with the selection of the neutral mediator. If mediation is unsuccessful, the parts of the claim remaining in dispute shall be subject to applicable procedures outside this section.

H. For purposes of this section, mediation includes any nonbinding process, including, but not limited to, neutral evaluation or a dispute review board, in which an independent third party or board assists the parties in dispute resolution through negotiation or by issuance of an evaluation. Any mediation utilized shall conform to the timeframes in this section.

I. Unless otherwise agreed to by the County and the Contractor in writing, the mediation conducted pursuant to this section shall excuse any further obligation under Section 20104.4 to mediate after litigation has been commenced.

J. This section does not preclude the County from requiring arbitration of disputes under private arbitration or the Public Works Contract Arbitration Program, if mediation under this section does not resolve the parties' dispute.

K. Failure by the County to respond to a claim from the Contractor within the time periods described in this subdivision or to otherwise meet the time requirements of this section shall result in the claim being deemed rejected in its entirety. A claim that is denied by reason of the County’s failure to have responded to a claim, or its failure to otherwise meet the time requirements of this section, shall not constitute an adverse finding with regard to the merits of the claim or the responsibility or qualifications of the claimant.

L. Amounts not paid in a timely manner as required by this section shall bear interest at 7 percent per annum.

M. If a subcontractor or a lower tier subcontractor lacks legal standing to assert a claim against the County because privacy of contract does not exist, the Contractor may present to the County a claim on behalf of a subcontractor or lower tier subcontractor. A subcontractor may request in writing, either on his or her own behalf or on behalf of a lower tier subcontractor, that the Contractor present a claim for work which was performed by the subcontractor or by a lower tier subcontractor on behalf of the subcontractor. The subcontractor requesting that the claim be presented to the County shall furnish reasonable documentation to support the claim. Within 45 days of receipt of this written request, the Contractor shall notify the subcontractor in writing as to whether the Contractor presented the claim to the County and, if the original Contractor did not present the claim, provide the subcontractor with a statement of the reasons for not having done so.

N. A waiver of the rights granted by this section is void and contrary to public policy, provided, however, that (1) upon receipt of a claim, the parties may mutually agree to waive, in writing, mediation and proceed directly to the commencement of a civil action or binding arbitration, as applicable, and (2) the County may prescribe reasonable change order, claim, and dispute resolution procedures and requirements in addition to the provisions of this section, so long as the contractual provisions do not conflict with or otherwise impair the time frames and procedures set forth in this section.

GC 52. ATTORNEY'S FEES

A. Contractor hereby agrees to pay Owner, Owner's Representative and/or Architect a reasonable sum as attorney's fees in all court actions including arbitration brought by either of them against the other or in which they are both plaintiffs or defendants, and also in court actions involving claims of subcontractors or material suppliers and in actions involving offsetting claims between Contractor and Owner, Owner's Representative or Architect because of any doubts, disputes or actions arising out of this Contract, except in the following cases:

1. When Contractor obtains a favorable net judgment against the Owner, Owner's Representative and/or Architect after consideration of claims and offsets of Owner which are allowed by the court against Contractor for breach of this Contract;
2. When Owner, Owner's Representative and/or Architect is denied a favorable judgment by a court in a suit against Contractor which may be brought by Owner, Owner's Representative or Architect.

END OF GENERAL CONDITIONS

SUPPLEMENTARY GENERAL CONDITIONS

SECTION 00 80 00

SGC 1. GUARANTEE WORK

A. In the event of failure of Contractor to comply with the requirements of any guarantee by this Contract within seven (7) days after being notified in writing, Owner is authorized to proceed to have the defects repaired and made good at the expense of Contractor, who shall pay the costs and charges therefore immediately on demand.

SGC 2. LAWS AFFECTING PUBLIC WORKS

A. Attention to bidders is called to necessity of being familiar with the various Federal, State and Local laws affecting public work, especially, but not limited to, those laws relating to hours of employment, minimum wage rates, payment of wages, sanitary and safety conditions for workmen, workmen's compensation insurance, type and kind of materials that can be used, non-discrimination in employment and affirmative-action programs. Contractor is advised that this project is being paid for by State and local funds. Contractor shall comply with applicable regulations and hold harmless the Owner for their failure to comply. Certain of those provisions may be set forth herein or in the General Construction Contract. The existence of these provisions does not excuse the Contractor from complying with other statutory requirements or provisions which are not set forth in these Contract Documents.

SGC 3. OWNER'S REPRESENTATIVE, INSPECTOR

A. The Owner will employ an "Owner's Representative" and "Inspector". The Inspector will observe the installation of all materials and equipment to be incorporated into the Work and the placing of such materials and equipment to determine in general if the Work is proceeding in accordance with the Contract Documents. On the basis of their observations, the Inspector will keep the Owner's Representative informed as to the progress of the Work and will endeavor to guard the Owner against defects and deficiencies in the Work of the Contractor and subcontractors employed by the Contractor in the prosecution of the Work. The Owner's Representative and Inspector shall not be responsible for means, methods, techniques, sequences or procedures of construction, nor be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents.

SGC 4. RESPONSIBILITY FOR COMPLIANCE WITH OSHA

A. All work, materials, work safety procedures and equipment shall be in full accordance with the latest OSHA rules and regulations.

B. Contractor warrants that Contractor and each of their subcontractors shall, in performance of this Contract, comply with each and every compliance order issued pursuant to OSHA and CAL-OSHA. The Contractor assumes full and total responsibility for compliance with OSHA and CAL-OSHA Standards by their subcontractors as well as himself. The cost of complying with any compliance order and/or payment of any penalty assessed pursuant to OSHA and CAL-OSHA shall be borne by the Contractor. Contractor shall save, keep and hold harmless the Owner and all officers, employees and agents thereof from all liabilities, costs or expenses in law or in equity, that may at any time arise or be set up because of Contractor's or subcontractor's non-compliance or alleged non-compliance with OSHA and CAL-OSHA requirements.

C. Nothing contained herein shall be deemed to prevent the Contractor and their subcontractors from otherwise allocating between themselves responsibility for compliance with OSHA and CAL-OSHA requirements; provided, however, that the Contractor shall not thereby be, in any manner whatsoever, relieved of their responsibility to the Owner as herein above set forth.

SGC 5. AS BUILT DRAWINGS

A. The Contractor shall be given an extra set of drawings and specifications which shall be kept at the site of the Work at all times. Exact locations of all pipes and conduits, and all changes in construction

and details shall be indicated and dimensioned upon these drawings, and all changes in materials and equipment installed shall be indicated in these specifications. The as-built drawings shall be current (up-to-date) to qualify for payment; the job Inspector will verify. Upon completion of the Work, the As-Built Drawings shall be prepared by the Contractor and Specifications shall be reviewed by the Owner's Representative and Consultants and returned to the Owner prior to the final payment. The As-Built Drawings shall be neatly drafted on erasable mylar reproducible transparencies, or printed on vellum and submitted as a .dwg file if prepared electronically.

SGC 6. FINAL CERTIFICATES

A. When the Work is ready for acceptance, by the Owner, the Owner's Representative shall so certify in writing to the Owner, indicating substantial completion and that the building can be occupied and used and a Certificate of Acceptance will be issued to the Contractor which will bring their Progress Payment up to ninety-five (95%) percent of the Contract Price, with five (5%) percent to remain in retention until after Notice of Completion, less sums withheld regarding liquidated damages, if any, or any other damages incurred by owner, or other sums withheld pursuant to the terms of this agreement or by law.

B. Notice of Completion will be filed by the Owner after substantial completion and acceptance of the Work by the Board of Supervisors. Providing no stop notices have been filed, thirty-five days after filing of such notice of completion, payment due under the Contract will become due to the Contractor and the Owner's Representative shall so certify to the Owner authorizing the final payment. Such payment may withhold any reasonable sums payable to Contractor for any Work which has not been completed on said date, or that the Owner may have found defective and ordered to be replaced; final payment for withholding to be made when certified by Owner's Representative in writing to Owner.

SGC 7. LIENS AND STOP NOTICES

A. Should Stop Notices be filed with the Owner, Owner shall in accordance with California Civil Code Section 9358, withhold the amount claimed, plus an allowance of 25% to cover its litigation costs plus interest at the rate of 10%, from certificates until such claims have been resolved pursuant to law.

SGC 8. GUARANTEES AND MAINTENANCE MANUALS

A. The Contractor and each subcontractor and each supplier shall provide to the Owner, copies of all maintenance guarantees, maintenance manuals and technical specifications relating to their portion of the Project prior to completion of the Project, and in accordance with the GENERAL REQUIREMENTS, PROJECT CLOSE-OUT.

SGC 9. THE WORK

A. The Work comprises the completed construction required by the Contract Documents and approved change orders and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated in such construction.

SGC 10. THE PROJECT

A. The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part.

B. By executing the Contract, the Contractor represents that Contractor has visited the sites, familiarized themselves with the local conditions under which the Work is to be performed, and correlated their observations with the requirements of the Contract Documents.

C. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work. The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all. Work not covered in the Contract Documents will not be

required unless it is consistent therewith and is reasonably inferable therefrom as being necessary to produce the intended results. Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

D. The organization of the Specifications into divisions, sections and articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among subcontractors or in establishing the extent of Work to be performed by any trade.

SGC 11. OWNER

A. The Owner shall forward all instruction to the Contractor through the Owner's Representative.

B. Information or services under the Owner's control shall be furnished by the Owner with reasonable promptness to avoid delay in the orderly progress of the Work.

SGC 12. OWNER'S RIGHT TO STOP THE WORK

A. If the Contractor fails to correct defective Work as required by GC 17, or persistently fails to carry out the Work in accordance with the contract Documents, the Owner, by a written order signed personally or by an agent specifically so empowered by the Owner in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

SGC 13. OWNER'S RIGHT TO CARRY OUT THE WORK

A. If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within seven calendar days after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, after seven calendar days following receipt by the Contractor of an additional written notice and without prejudice to any other remedy the Owner may have, make good such deficiencies. In such case an appropriate Change Order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Owner's Representative or Architect's additional services made necessary by such default, neglect or failure. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner immediately upon demand.

SGC 14. INDEMNIFICATION

A. To the fullest extent permitted by law, the Contractor shall indemnify, defend and hold harmless the Owner, Owner's Representative, Inspector and the Architect and their agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense is (1) attributable to bodily injury, sickness, disease or death, or the injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom, and (2) is caused in whole or in part by any negligent act or omission of the Contractor, and subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder; excepting only such claims as are caused by the sole negligence or willful misconduct of the Owner, Owner's Representative, Inspector or Architect. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this paragraph.

B. In any and all claims against the Owner, Owner's Representative, Inspector or the Architect or any of their agents or employees by any employee of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this paragraph shall not be limited in any way by any limitation on the

amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under Workers' or Workmen's Compensation Acts, disability benefit acts or other employee benefit acts.

C. The obligations of the Contractor under this paragraph shall not extend to the liability of Owner's Representative or the Architect, their agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, design or specification, or (2) the giving of or the failure to give directions or instruction by the Owner's Representative or the Architect, their agents or employees provided such giving or failure to give is the primary cause of the injury or damage.

SGC 15. COMPLIANCE WITH TITLE 24, CALIFORNIA CODE OF REGULATIONS AND THE INTERNATIONAL BUILDING CODE

A. Governing Codes: Title 24, California Code of Regulations (C.C.R.),latest edition which adopts and amends the International Building Code, latest edition; International Fire Code, latest edition; Uniform Mechanical Code, latest edition; National Electrical Code, latest edition; Uniform Mechanical Code, latest edition; and the Uniform Plumbing Code, latest edition. The project shall also comply with the Americans with Disabilities Act, and the latest editions of associated regulations.

SGC 16. LIABILITY OF CONTRACTOR

A. The Contractor shall do all of the Work and furnish all labor, materials, tools, and appliances, except as otherwise herein expressly stipulated, necessary or proper for performing the Work herein required in the manner and within the time herein specified. The mention of any specific duty or liability imposed upon the Contractor shall not be construed as a limitation or restriction of any general liability or duty imposed upon the Contractor by this contract, said reference to any specific duty or liability being made herein merely for the purpose of explanation.

B. The right of general supervision by the Owner shall not make the Contractor an agent or employee of the Owner, and the liability of the Contractor for all damages to persons or to public or private property arising from the Contractor's execution of the Work shall not be lessened because of such general supervision.

C. Until the completion and final acceptance by the Owner of all of the Work under and implied by this contract, the Work shall be under the responsible care and charge of the Contractor. The Contractor shall rebuild, repair, restore and make good all injuries, damages, re-erections and repairs occasioned or rendered necessary or caused of any nature whatsoever, excepting only acts of God not covered by the all-risk insurance policy called for in Article GC 4 and not other, to all or any portions of the Work except as otherwise expressly stipulated.

SGC 17. NUCLEAR FREE HUMBOLDT COUNTY ORDINANCE COMPLIANCE

A. Neither the Contractor, their Subcontractors or their suppliers are Nuclear Weapons Contractors, and are not knowingly or intentionally engaged in the research, development, production, or testing of nuclear warheads, nuclear weapons systems, or nuclear weapons components, as defined by the Nuclear Free Humboldt County Ordinance. Contractor, their Subcontractors and/or their suppliers agree to notify Owner immediately if they become a nuclear weapons contractor as defined above.

SGC 18. REQUIRED LISTING OF PROPOSED SUBCONTRACTORS

A. Each proposal shall have listed therein the name, address, description of work, contractor's license number, and DIR registration number of each subcontractor to whom the bidder proposes to subcontract portions of the work in the amount of 1/2 of one percent of their total bid, in accordance with the Subletting and Subcontracting Fair Practices Act, commencing with Section 4100 of the Public Contract Code and for verification of conformance with Labor Code Sections 1771 and 1725.5. The bidder's attention is invited to other provisions of said Act related to the imposition of penalties for

a failure to observe its provisions by using unauthorized subcontractors or by making unauthorized substitutions.

B. Pursuant to Section 1771.1(a) of the California Labor Code, a contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of any contract for public work, as defined in Sections 1770 et seq. of the Labor Code, unless currently registered and qualified to perform public work pursuant to Section 1725.5 of the Labor Code. It is not a violation of Section 1771.1(a) for an unregistered contractor to submit a bid that is authorized by Section 7029.1 of the Business and Professions Code or by Section 10164 or 20103.5 of the Public Contract Code, provided the contractor is registered to perform public work pursuant to Section 1725.5 at the time the contract is awarded.

C. A sheet for listing the subcontractors, as required herein, is included in the proposal.

SGC 19. NONDISCRIMINATION

A. During the performance of this contract, the Contractor and its subcontractors shall not deny the contract's benefits to any person on the basis of religion, color, ethnic group identification, sex, age, physical or mental disability, nor shall they unlawfully discriminate, harass or allow harassment, against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, disability (including HIV and AIDS), medical condition (cancer), age (over 40), marital status, denial of family care leave and denial of pregnancy disability leave in connection with any program or activity funded in whole or in part by Federal and/or State funds provided through this grant contract.

B. Contractor and all subcontractors shall insure that the evaluation and treatment of their employees and applicants for employment are free from such discrimination and harassment. Contractor and subcontractors shall comply with the provisions of the Fair Employment and Housing Act (Government Code, Section 12990 [a-f] et seq.) and the applicable regulations promulgated thereunder (California Code of Regulations, Title 2, Section 7285.0 et seq.).

C. The applicable regulations of the Fair Employment and Housing Commission implementing Government Code, Section 12990 (a-f), set forth in Chapter 5 of Division 4 of Title 2 of the California Code of Regulations are incorporated into this contract by reference and made a part hereof as set forth in full. Contractor and subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement.

D. Contractor shall comply with all applicable nondiscrimination laws and regulations.

E. The Contractor and all subcontractors shall include the nondiscrimination and compliance provisions of this clause in all contracts and subcontracts to perform work under the contract.

SGC 20. HAZARDOUS WASTE IN EXCAVATION

A. If the Contractor encounters material in excavation which Contractor has reason to believe may be hazardous waste, as defined by Section 25117 of the Health and Safety Code, Contractor shall immediately so notify the Owner’s Representative in writing. Excavation in the immediate area of the suspected hazardous material shall be suspended until the OWNER authorizes it to be resumed. If such suspension delays the current controlling operation, the Contractor will be granted an extension of time by means of a change order.

B. The Owner reserves the right to use other forces for exploratory work to identify and determine the extent of such material and for removing hazardous material from such area.

SGC 21. CONSTRUCTION ACTIVITIES

A. Construction activities at the site shall be as required by the Contractor to complete the project by the prescribed completion date. Contractor must comply with Noise Abatement Provisions.

SGC 22. DISCOVERY OF HUMAN REMAINS OR AN ARCHAEOLOGICAL SITE

A. If during construction activities, human remains or evidence of an archaeological site, including outhouse pits, construction shall be immediately halted and the Owner's Representative notified who will request an evaluation by a qualified archaeologist, approved by the Owner as to whether the discovery constitutes an "important archaeological resource" as defined in Section III, Appendix K of the CEQA Guidelines.

B. If the resource is determined to be important, mitigation shall proceed as outlined by Appendix K of the Guidelines and as recommended by the archaeologist.

SGC 23. CONTRACTOR RESPONSIBILITY AND DEBARMENT

A. A responsible contractor is a contractor who has demonstrated the attribute of trustworthiness, as well as quality, fitness, capacity and experience to satisfactorily perform the contract. It is the County's policy to conduct business only with responsible contractors. (Ord. 2291, § 1, 01/07/2003)

B. The contractor is hereby notified that, in accordance with Title II, Division 14 of the County Code, if the County acquires information concerning the performance of the contractor on this or other contract which indicates that the contractor is not responsible, the County may, in addition to other remedies provided in the contract, debar the contractor from bidding on County contracts for a specified period of time, not to exceed three (3) years, and terminate any or all existing contracts the contractor may have with the County. (Ord. 2291, § 1, 01/07/2003)

C. The County may debar a contractor if the Board of Supervisors finds, in its discretion, that the contractor has done any of the following: (1) violated any term of a contract with the County; (2) committed any act or omission which negatively reflects on the contractor's quality, fitness, or capacity to perform a contract with the County or any other public entity, or engaged in a pattern or practice which negatively reflects on same; (3) committed an act or offense which indicates a lack of business integrity or business honesty; or (4) made or submitted a false claim again the County or any other public entity. (Ord. 2291, § 1, 01/07/2003)

D. If there is evidence that the contractor may be subject to debarment, the department will notify the contractor in writing of the evidence which is the basis for the proposed debarment and will advise the contractor of the scheduled date for a debarment hearing before the CHB (Contractor's Hearing Board). (Ord. 2291, § 1, 01/07/2003)

E. The CHB will conduct a hearing where evidence on the proposed debarment is presented. The contractor and/or the contractor's representative shall be given an opportunity to submit evidence at that hearing. After the hearing, the CHB shall prepare a proposed decision, which shall contain a recommendation regarding whether the contractor should be debarred, and, if so, the appropriate length of time of the debarment. If the contractor fails to avail itself of the opportunity to submit evidence to the CHB, the contractor may be deemed to have waived all rights of appeal. (Ord. 2291, § 1, 01/07/2003)

F. A record of the hearing, the proposed decision and any other recommendation of the CHB shall be presented to the Board of Supervisors. The Board of Supervisors shall have the right to modify, deny or adopt the proposed decision and recommendation of the hearing board. (Ord. 2291, § 1, 01/07/2003)

G. These terms shall also apply to subcontractors and subconsultants of County contractors. (Ord. 2291, § 1, 01/07/2003)

SGC 24. BID PROTEST

Any bid protest must be in writing and must be received by the Director of Public Works, Humboldt County Department of Public Works, 1106 Second Street, Eureka, CA, 95501, Fax: (707) 445-7409 or by email before 5:00 p.m. no later than three (3) working days following bid opening (the "Bid Protest Deadline") and must comply with the following requirements:

A. Only a bidder who has actually submitted a Bid Proposal is eligible to submit a bid protest against another bidder. Subcontractors are not eligible to submit bid protests. A bidder may not rely on the bid protest submitted by another bidder, but must timely pursue its own protest.

B. The bid protest must contain a complete statement of the basis for the protest and all supporting documentation. Material submitted after the Bid Protest Deadline will not be considered. The protest must refer to the specific portion or portions of the Contract Documents upon which the protest is based. The protest must include the name, address and telephone number of the person representing the protesting bidder if different from the protesting bidder.

C. A copy of the protest and all supporting documents must also be transmitted by fax or by e-mail, by or before the Bid Protest Deadline, to the protested bidder and any other bidder who has a reasonable prospect of receiving an award depending upon the outcome of the protest.

D. The protested bidder may submit a written response to the protest, provided the response is received by the Department Director before 5:00 p.m., within two (2) working days after the Bid Protest Deadline or after receipt of the bid protest, whichever is sooner (the "Response Deadline"). The response must include all supporting documentation. Material submitted after the Response Deadline will not be considered. The response must include the name, address and telephone number of the person representing the protested bidder if different from the protested bidder.

E. The procedure and time limits set forth in this section are mandatory and are the bidder's sole and exclusive remedy in the event of bid protest. The bidder's failure to comply with these procedures shall constitute a waiver of any right to further pursue a bid protest, including filing a Government Code Claim or initiation of legal proceedings.

END SUPPLEMENTARY GENERAL CONDITIONS

SUMMARY OF WORK

SECTION 01 11 00

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contractor’s use of site and premises.

B. County-furnished, Contractor-installed (OFCI) items.

C. County’s occupancy requirements.

D. Specification formats and conventions.

1.2 CONTRACTOR’S USE OF SITE AND PREMISES

A. Vehicle access to Project site shall be held to a minimum. Vehicle access will be on one specific route approved by County; no exceptions will be allowed.

B. Coordinate use of the premises under the direction of the County.

C. Assume full responsibility for the protection and safekeeping of materials, products, and equipment under this Contract, stored on the site.

D. Move any stored materials, products, and equipment under Contractor's control which interfere with the operations of County or a separate contractor.

E. Obtain and pay for the use of additional storage or work areas needed for Contractor’s operations.

F. Contractor shall be aware of and abide by the Humboldt County and local Noise Ordinance and County’s noise prevention requirements. Contractor to verify County’s requirements.

1.3 COUNTY-FURNISHED AND CONTRACTOR-INSTALLED (OFCI) ITEMS

A. County-Furnished and Contractor-Installed (OFCI) Items: As indicated on the Drawings and Technical Specifications.

B. County's Responsibilities:

1. County will furnish products indicated. Schedule relocation of items with County.
2. After relocation, County will inspect delivered items for damage, jointly with Contractor.

C. Contractor's Responsibilities:

1. Contractor is responsible for relocating, unloading, and handling County-furnished items at Project site.
2. Contractor is responsible for protecting County-furnished items from damage during storage and handling, including damage from exposure to the elements.
3. Contractor shall install and incorporate County-furnished items into the Work, as indicated and as required. Work includes providing support systems to receive County's equipment and making plumbing, mechanical, electrical connections, and miscellaneous work items associated with installation of County-furnished items.
4. Contractor shall repair or replace County-furnished items damaged by Contractor’s operations, as approved by County in writing.

5. Contractor shall furnish and install fasteners and other accessories, as required for complete installation of County-furnished items.

1.4 COUNTY'S OCCUPANCY REQUIREMENTS

A. Full County Occupancy: County will occupy the Project site, with the exception of areas under construction, during the entire construction period to conduct normal operations.

B. Cooperate with County to minimize conflicts, and to facilitate County's operations.

C. Verify occupancy requirements with County, and schedule the Work to accommodate County's requirements.

D. Maintain access to existing walkways and other adjacent occupied or used facilities. Do not close or obstruct walkways or other occupied or used facilities without written permission from County and authorities having jurisdiction.

E. Provide not less than 72 hours' notice to County of activities that will affect County's operations.

1.5 ENVIRONMENTAL MANAGEMENT

A. Spills: Contractor shall clean up all fluid spills caused by leaks in the equipment or generated while Contractor is performing the work under this Contract. Contractor shall provide drip catch pans for all equipment that drips or leaks oils or other fluids. Spills generated by Contractor's operation shall be cleaned up by Contractor at no cost to County.

B. Dust and Noise Control:

1. Precaution shall be exercised at all times to control dust and excessive noise created as a result of any operations during the construction period.
2. If serious problems and/or complaints arise due to airborne dust and excessive noise, and when directed by the County, operations causing such problems shall be temporarily discontinued until a suitable remedy is established. The remedy shall be approved by the County before implementation, and shall be considered part of Contractor's normal effort to maintain safety and cleanliness without cause for further payment.

1.6 MATERIALS AND WORKMANSHIP

A. Except as otherwise specified all materials and equipment incorporated in the Work under the Contract shall be new. All workmanship shall be first-class and by persons qualified in the respective trades.

1.7 ACCIDENT PREVENTION AND PROTECTION OF LIVES AND HEALTH

A. Precaution shall be exercised at all times for protection of all personnel and occupants, including employees of Contractor, County, and property.

B. The California Department of Industrial Relations, Division of Occupational Safety and Health (DOSH, also known as Cal/OSHA) requirements for safety and health protection of workers and public apply. Other requirements not covered by Cal/OSHA, shall be in accordance with U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) requirements.

C. Comply with safety requirements of CCR, Title 8, Division 1, Chapter 4, "Division of Industrial Safety," and Title 8, Division 1, Chapter 3.2, "Cal/OSHA Regulations"; CCR, Title 24, CBC; and other applicable building and construction codes. Machinery, equipment, openings, power lines, and all other safety hazards shall be guarded or eliminated in accordance with safety requirements of Title 8, and Manual of Accident Prevention in Construction published by the Associated General Contractors of America.

1.8 PROTECTION OF EXISTING FACILITIES

A. Contractor shall take appropriate measures to prevent damage to existing facilities. Should damage occur, such facilities shall be restored to original condition, at no cost to County.

1. Contractor shall arrange for protection of existing buildings at all times. Contractor shall furnish, install, and maintain, necessary barricades, temporary coverings, etc., as required for protection, and remove them at completion of the Work. When all Work is complete, damaged areas of the premises shall be restored to original undamaged condition that existed prior to installation of temporary protection.

B. Housekeeping: The premises shall be kept in a clean, safe condition at all times. Rubbish shall be removed as fast as it accumulates.

C. Burning: Burning of refuse, debris, and construction waste at Project site will not be permitted.

1.9 OVERLOADING

A. Contractor shall not overload any part or parts of structures beyond their safe calculated carrying capacities by placing materials, equipment, tools, machinery or any other item thereon. No loads shall be placed on floors or roofs before they have attained their permanent and safe strength.

1.10 MANUFACTURER'S INSTRUCTIONS

A. Where required in the Specifications that materials, products, equipment, and processes be installed or applied in accordance with manufacturer's instructions, directions, or specifications, or stated in words to that effect, it shall be construed to mean that said installation or application shall be in strict accordance with printed instructions furnished by manufacturer of the specified item and is suitable for use under conditions similar to those at the jobsite. Three copies of such instructions shall be included in the applicable submittal and furnished to the County for review. Obtain County’s acceptance prior to commencement of the Work.

1.11 RESPONSIBILITY FOR THEFT AND DAMAGE

A. County will not be responsible for the loss or theft of Contractor's tools, equipment and materials.

1.12 FIRE PROTECTION

A. Contractor shall at all times maintain good housekeeping practices to reduce the risk of fire and water damage. All scrap materials, rubbish and trash shall be removed daily from jobsite, inside and around the buildings or structures, as applicable, and shall not be scattered on adjacent property.

B. Suitable storage space shall be provided outside immediate building areas during construction for temporary storage of flammable materials and paints, as required by CFC Chapter 14 and NFPA 241. Excess flammable liquids being used inside the building shall be kept in closed metal containers and be removed from the building during unused periods.

C. Contractor shall provide temporary fire extinguishers during construction in accordance with the recommendations of CBC Chapter 33, CFC Chapter 14, and NFPA Bulletins Nos. 10 and 241. However, in all cases a minimum of one fire extinguisher shall be available for use.

D. Under provisions of CFC Chapters 14 and 26, provide a fire extinguisher at each location where cutting, soldering, or welding is being performed. Where electric or gas welding or cutting work is done, interposed shields of noncombustible material shall be used to protect against fire damage due to sparks and hot metal. When temporary heating devices are used, a watchman shall be present to cover periods when other workmen are not on the premises.

1.13 EMERGENCY CONDITIONS

A. Emergency condition shall be any condition at the Project site which has the actual or potential for significant adverse effects to persons or property, whether or not resulting from Contractor's operations.

B. Immediate action shall be taken by Contractor by whatever means necessary to alleviate the condition and to prevent damage or injury to persons or property. County shall be notified of the existence of such a condition, but shall not be called upon to perform emergency service.

C. County may not respond to the emergency condition, which shall not be used as an excuse by Contractor to neglect immediate action; County will not be responsible or liable for any resulting conditions. Absence of Contractor's Representative during emergency conditions at jobsite shall not relieve Contractor from contractual responsibility of providing an immediate response to the situation, for restoration of conditions to normalcy.

D. If the emergency conditions are not caused by Contractor's fault or neglect, the Contract Sum shall be adjusted to reflect the actual direct field costs of labor and materials to perform and complete emergency measures.

E. The Contract Time shall also be adjusted to reflect the actual direct effect of such actions to the then critical path of the Construction Progress Schedule. The foregoing not withstanding, adjustments of the Contract Sum or the Contract Time for actions taken by Contractor in response to emergency circumstances shall be subject to Contractor's strict compliance with all other applicable provisions of the Contract Documents relating to notices and time for delivery of notices.

1.14 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and numbering system of CSI "MasterFormat, 2004 Edition.

B. Division 01 Sections govern the execution of the Work of all Sections in the Specifications.

C. Specifications Conventions: Singular words shall be interpreted as plural and plural words shall be interpreted as singular, where applicable, as the context of the Contract Documents indicates.

D. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

PRODUCT SUBSTITUTION PROCEDURES

SECTION 01 25 13

PART 1 – GENERAL

1.1 SUMMARY

A. There are two time periods allowed for submission of data substantiating a request for a substitution of "an equal" item:

1. Bidders may request a substitution up to six (6) calendar days prior to the time indicated for receipt of bids in Notice to Bidders. The burden of proof as to the quality and suitability of alternatives shall be upon the Contractor, and the Contractor shall furnish all information necessary as required by County. County shall be the sole judge as to the quality and suitability of alternative articles or materials, and the County's decision shall be final. The Contractor's attention is directed to these Special Provisions.

2. Contractor may request a substitution after the award of the contract for a period of thirty five (35) calendar days immediately following award of the contract.

B. Contractor shall provide products from one manufacturer for each type or kind as applicable. Contractor shall provide secondary materials as recommended by manufacturers of primary materials.

C. Contractor shall provide products selected or equal. Products submitted for substitution as an equal shall be submitted with acceptable documentation, and include costs of substitution including related work.

D. Request for substitution must be in writing. Conditions for substitution include:

1. An 'or equal' phrase in the specifications.

2. Specified material shall be coordinated with other work.

3. Specified material is acceptable to authorities having jurisdiction.

4. For requests for substitution made after the award of the contract, substantial advantage is offered to the County in terms of cost, time, or other valuable consideration.

E. Approval of shop drawings, product data, or samples is not a substitution approval unless clearly presented as a substitution at the time of submittal.

F. For convenience in designation on the plans or in the specifications, certain articles or materials to be incorporated in the Work may be designated under a trade name or the name of a manufacturer and the manufacturer's catalogue information. The use of an alternative article or material which is of equal quality and of the required characteristics for the purpose intended will be permitted, subject to the following requirements:

1. The burden of proof as to the quality and suitability of alternatives shall be upon the Contractor and the Contractor shall furnish all information necessary as required by the County. The County shall be the sole judge as to the quality and suitability of alternative articles or materials, and the County's decision shall be final.

2. Whenever the Specifications permit the substitution of a similar or equivalent material or article, no tests or action relating to the approval of the substitute material will be made until the request for substitution is made in writing by the Contractor accompanied by complete data as to the equality of the material or article proposed. The request shall be made in ample time to permit approval without delaying the Work.

END OF SECTION

PROJECT MEETINGS

SECTION 01 31 19

PART 1 – GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS:

A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions bidding documents and drawings.

1.2 PRECONSTRUCTION CONFERENCE

A. The Preconstruction Conference will be scheduled within 15 working days after the County has issued the Notice to Proceed, but prior to actual start of the Work.

B. Attendance: Representative of County, Project Architect, Contractor, contractor's subcontractors and representatives from the agencies occupying the building.

C. Minimum agenda: Data will be distributed and discussed on:

1. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, materials suppliers, and the County.

2. Channels and procedures for communication.

3. Review set-up area.

4. Review all required permits.

5. Review insurance requirements.

6. Construction schedule, including sequence of critical work.

7. Contract Documents, including distribution of required copies of Drawings and revisions.

8. Processing of Shop Drawings and other data submitted to the County for review.

9. Processing of field decisions and Change Orders.

10. Rules and regulations governing performance of the work. How will Contractor's people on site respond to fire accident of other emergencies.

11. Procedures for safety and first aid, security, quality control, housekeeping, and related matters.

12. How will Contractor work with the security, noise and access limitations of this facility and the agencies that occupy this facility.

13. How will Contractor get materials to and from the roof and throughout the facility?

1.3 PROGRESS MEETINGS

A. Will be scheduled by the County bi-weekly.

B. Attendance: County, Contractor, Job Superintendent, Project Architect, Subcontractors and representatives of the agencies that occupy the building, as appropriate.

C. Minimum Agenda:

1. Review of work progress.

2. Field observations, problems, and decisions.

3. Identification of problems which impede planned progress.

4. Maintenance of progress schedule.

5. Corrective measures to regain projected schedules.

6. Planned progress during succeeding work period.

7. Coordination of projected progress.

8. Maintenance of quality and work standards.

9. Effect of proposed changes on progress, schedule, and coordination.

10. Impacts of the work on the agencies occupying the building.

11. Other business relating to work.

1.4 PRE-FINAL INSPECTION

A. Contractor must inform Project Architect and County that Contractor is ready for pre-final inspection and that the pre-final inspection will then be scheduled.

B. Installations or details noted as deficient during inspection must be repaired and corrected by Contractor.

C. Once corrections have been made, contractor must inform Project Architect and County so a second inspection can be scheduled.

1.5 FINAL INSPECTION

A. Scheduled by Contractor upon job completion.

B. Attendance: County or designated representative, Contractor, Project Architect.

C. Minimum Agenda:

1. Walkover inspection.

2. Identification of needed corrections to be completed by Contractor and final approval from warrantor.

END OF SECTION 01 31 19

CONSTRUCTION PROGRESS SCHEDULES

SECTION 01 32 16

PART 1 – GENERAL

1.1 The Contractor shall submit to the County construction schedules as required by and conforming to Section 00 31 13, “Construction Schedule and Liquidated Damages;” to Part 8, “Time,” of Section 00 72 13, “General Conditions;” and to Section 01 33 00, “Submittal Procedures.”

1.2 The Contractor may furnish the construction schedule on a form of its choice.

1.3 The construction schedule shall show the order in which the Contractor proposes to carry out the Work, the dates on which he will start the salient features of the Work (including the submission of required submittals and the procurement of materials), the proposed dates and times of utility shut downs or any contractor operation that might impact the Work Site’s operations, and the contemplated dates for completing the said salient features. The Contractor shall coordinate Contractor’s activities with the County's use of the Work Site.

1.4 The construction schedules submitted shall be consistent in all respects with the time and order of work requirements of the Contract, conform to Section 00 31 13, “Construction Schedule and Liquidated Damages;” to Part 8, “Time,” of Section 00 72 13, “General Conditions.”

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SUBMITTAL PROCEDURES

SECTION 01 33 00

PART 1 – GENERAL

1.1 Timing: Make submittals far enough in advance of scheduled dates of installation to allow the time required for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery. Contractor shall allow the County a minimum of 14 calendar days from receipt by the County for review. Contractor is to coordinate submittal review items with critical timelines with the County to avoid problems.

1.2 Identification:

A. Identify each submittal and resubmittal with the following information:

1. Project name and address as they appear on the Contract Documents.

2. Contract number.

3. Contractor's name and address.

4. Date of submission.

5. Numbering System: Submittals shall be identified by specification section (i.e., 02 81 02-001, 07 21 13-001, 11 19 10-001, etc.). Any resubmittals shall be numbered sequentially according to the original submittal section, followed by the subscript 1, .2, .3 submittal number (i.e., 001.1, 001.2, etc.). Submittals and resubmittals shall be kept intact with the original number. Do not add new drawing or information outside the scope of the original submittal, unless specifically requested. Do not assign a new number for a resubmittal.

6. Reference: List Specification Section number and product reference as a cross-reference for each submittal.

B. Identify each submittal with the following additional identification:

1. Contractor's stamp with initials or signature, certifying to review of submittal, compliance with Contract Documents, and coordination with other impacted work, and verification of field measurements. The County will return any submittal not bearing this stamp without being reviewed.

2. Drawing and Specification Section numbers to which the submittal applies.

3. Subcontractor's or supplier's name and address.

4. Name and telephone number of the individual to contact for additional information regarding the submittal.

5. Whether it is an original or a resubmittal.

1.3 Coordination of Submittals:

A. General: Prior to submittal for the County's review, as applicable, fully coordinate material as follows:

1. Determine and verify field dimensions and conditions, materials, catalog numbers, and similar data.

2. Coordinate shop drawing submittals with previously issued addenda and information bulletins.

3. Coordinate with the various types of work and public agencies involved.

4. Secure necessary approvals from public agencies and others and signify by stamp, or other means, that approvals have been secured.

5. Unless otherwise specifically permitted by the County, make submittals in groups containing all associated items.

B. Completeness: Submittals shall be complete; partial submittals will be rejected for not complying with the Contract Documents.

PART 2 – SUBMITTALS PROCEDURES

2.1 Requests for deviation from Contract Documents shall be submitted for consideration before submittal of affected items. Only deviations, which have been previously accepted in writing, shall be included in submittals.

2.2 Place permanent label or title block on each submittal for identification. Indicate name or entity preparing each submittal in label or title block. Refer to Part 1.3.1 above for further information required on each submittal label or title block.

A. Provide space on label or beside title block to record Contractor's and County's review and approval markings and action taken.

2.3 Contractor's Review:

A. Review submittals for accuracy, completeness, and conformity with Contract Documents.

1. Submittal shall be construed as stipulating Contractor has thoroughly and completely reviewed, and coordinated data.

2. Submittals that indicate less than Contractor's full compliance will be returned without action.

3. Delays caused by failure to comply will not be acceptable basis for extension of Completion Time.

B. Certify submittals have been reviewed and coordinated by adding following affidavit to each submittal:

"The undersigned certifies this submittal has been reviewed, approved, and coordinated in compliance with requirements of this section and the contract documents."

Signature_____ Date_____

Name Printed_____ Title_____

C. Submittals not certified by being stamped and signed by Contractor will be returned without action, as will submittals, which, in the County's opinion, have not been

adequately reviewed and coordinated by the Contractor.

2.4 Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

2.5 Package each submittal appropriately for transmittal and handling.

2.6 County's Review:

A. Submittals are reviewed for general conformance with design concept and general compliance with information given in Contract Documents only.

B. Review of separate item shall not indicate acceptance of assembly of which item is part.

C. The County or its consultants, as applicable, will review the submittal; mark the required revisions; stamp the submittals and indicate "No Exceptions Noted," "Make Corrections Noted," "Revise and Resubmit," or "Rejected," and return the submittals. "Revise and Resubmit" or "Rejected" stamps shall not be construed by the Contractor as a valid reason for an extension of time.

2.7 Contractor shall review the returned drawings and take appropriate action as indicated.

A. If drawings are marked "Revise and Resubmit," make revisions and indicate them with a "cloud," stamp and date, and resubmit in the same manner and number as for the original submittal.

B. If drawings are marked "Rejected," make a new submittal and submit in the same manner and number as for the original submittal.

C. If drawings are marked "No Exceptions Noted" or "Make Corrections Noted," print and distribute copies as required for Inspector, Contractor and Subcontractors.

2.8 Review shall not relieve Contractor from responsibility for errors or deviations from requirements of Contract Documents.

2.9 Revisions: Make only those revisions required or accepted by County.

2.10 Submittal Log: Maintain accurate submittal log for duration of Contract. Indicate status of all submittals at all times. Make submittal log available for the County's review upon request.

2.11 Number of Submittal items required:

A. Shop Drawings: submit a minimum of four (4) black-line or blue-line prints.

B. Product Data: Submit in the quantity required to be returned, together with three additional copies each of brochures, catalog cuts, and similar material for mechanical, electrical, hardware, and elevator items; and three additional copies for all others.

1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, rough-in diagrams and templates, wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."

2. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
   a. Manufacturer's printed recommendations.
   b. Compliance with recognized trade association standards.
   c. Compliance with recognized testing agency standards.
   d. Application of testing agency labels and seals.
   e. Notation of dimensions verified by field measurement.
   f. Notation of coordination requirements.
3. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

C. Samples:

1. Submit in the size specified in the individual Specification Sections, and in the quantity required to be returned to the Contractor, together with two additional Samples, which will be retained by the County or the County's consultants, as applicable.
2. Submit samples to illustrate functional and aesthetic characteristics of product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
3. Preliminary Submittals:
   a. Unless precise color, pattern, and texture or similar characteristics are specifically described, submit full set of choices for material or product.
   b. Preliminary submittals will be reviewed and returned with County's mark indicating selection and other action.
   c. County reserves right not to make individual determination or selections until all samples of all materials are submitted.
   d. Submit samples of all selected colors, patterns, textures or other similar characteristics as selected by County.
4. Where variations in color, pattern, texture or other characteristics are inherent in material or product, submit multiple units (not less than 3) that show approximate limits of variations.
5. Accepted samples will form standard of comparison for finished work. Defects, and deviations in excess of those in accepted samples, are unacceptable and are subject to rejection of completed work.
6. Include identification on each sample, with full project information, including:
   a. Project name and location.

b. Manufacturer and supplier.

c. Name, finish, and composition of material.

d. Location where material is to be used.

e. Specification Section number.

f. Reviewed samples that may be used in the Work are indicated in individual specification sections.

g. Field Samples: Provide field samples as required by individual sections. Install samples in locations as directed, completed and finished.

7. Other Submittals: Submit as specified in the individual Specification Sections.

PART 3 – MANUFACTURERS' INSTRUCTION

3.1 When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

3.2 Identify conflicts between manufacturers' instructions and the Contract Documents.

PART 4 – PATTERNS AND COLORS

4.1 Unless the exact pattern and color of a product are indicated in the Contract Documents, whenever a choice of pattern or color is available for a product, submit accurate color charts and pattern charts to the County for review and selection.

PART 5 – CERTIFICATES OF COMPLIANCE

5.1 Submit certificates of compliance with the associated Shop Drawings, Product Data, Samples, and other submittals required for the product.

5.2 Submit on 8-1/2-inch-x-11-inch white paper.

5.3 Submit three copies.

5.4 Submit in form of letter or company standard forms, signed by officer of manufacturer.

5.5 Each certification shall include the following:

1. Project name and location
2. Contractor's name and address
3. Quantity and date or dates of shipment or delivery to which certificate applies
4. Manufacturer's name

5.6 Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

5.7 Certificates may be based on recent or previous test results of materials or products, but must be acceptable to County.

5.8 The County will retain the certificates of compliance; no review reply is intended.

END OF SECTION

MODIFICATION PROCEDURES

SECTION 01 35 00

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing the following contract modifications:

1. Request for Information.
2. Field Order.
3. Request for Cost Proposal.
4. Cost Proposal.
5. Change Orders.

1.2 DEFINITIONS

A. Request for Information (RFI)

1. Written request submitted by Contractor to Owner's Representative via the County's online project management system on a form supplied by Owner's Representative requesting clarification, interpretation, or additional information pertaining to Contract Documents.
2. An RFI shall not be used as a vehicle for only confirming or verifying issues.

B. Field Order (FO)

1. Owner's Representative written directives to the Contractor covering a specific aspect of work, signed by the Owner or Owner's lead agency that authorizes changes in the Work to expedite the change order process.

C. Request for Cost Proposal (RFCP)

1. Written request by the Owner's Representative to the Contractor to quote change to Contract Sum and/or Contract Time for proposed change to Contract Document.

D. Cost Proposal (CP)

1. Written request by the Contractor to the Owner's Representative to change Contract Sum and/or Contract Time for proposed change to Contract Document.

E. Change Order (CO)

1. Initiated by the Owner, Contractor, Consultant, Owner's lead agency, or the Owner's Representative and signed by the Owner and Contractor stating their agreement to a change to Contract Documents and adjustment to Sum and/or Contract Time.

1.3 REQUEST FOR INFORMATION (RFI)

A. Submit RFIs numbered in sequential order, reviewed by the Contractor with respect to Contract Documents.

1. Submit RFIs on forms designated by the Owner's Representative.

B. Owner's Representative will monitor the RFI process and responses from the Consultant. The Consultant will receive RFIs only from the Owner's Representative; Consultant will not accept RFIs directly from any other entity.

C. Owner's Representative will receive only legible, properly prepared RFI:

1. Unreadable facsimile machine RFIs, illegibly written RFIs, or RFIs with incomplete information, will be returned promptly without action.
2. RFIs may be transmitted to Owner's Representative by online project management system.
   a. Owner's Representative will forward to Consultant for review, and return response by same method received from Contractor.
3. Consultant will review RFIs with respect to Contract Documents and return response in a timely manner, generally within 7 calendar days, or commensurate with RFI subject.
   a. RFIs marked "URGENT" will take precedence over outstanding RFIs and be answered by Consultant as soon as possible.

D. Contractor being fully familiar with Contract Documents, shall not be relieved of responsibility to coordinate the Work to prevent adverse impact to Project schedule when submitting RFIs to Owner's Representative for clarification or interpretation of Contract Documents, or additional information.

E. If the Contractor believes the scope of work referenced in the RFI has a cost and /or time impact, he will not proceed with the work until either a Field Order or a Change Order has been issued.

1.4 FIELD ORDER (FO)

A. Field Orders may include supplementary or revised Drawings and/or Specification to describe changes to Contract Documents.

B. Field Orders will be executed on forms designated by the Owner's Representative.

C. Field Orders may be generated by the Contractor's written notice submitted on a Cost Proposal form, that an RFI response or other unforeseen condition has changed the Contract cost and /or time, and that schedule impact will result if written directive is not provided in a timely manner.

D. Contractor shall provide an estimate of cost and/or time impact at the time of the request for a Field Order.

E. Owner's Representative will review the request for a Field Order and initiate a written Field Order for authorization by the Owner or Owner's lead agency.

F. If the Field Order is approved by the Owner or Owner's lead agency, Owner's Representative will release the signed Field Order to the Contractor. If rejected, the Contractor is so notified by the Owner's Representative.

1.5 REQUEST FOR COST PROPOSAL (RFCP)

A. Request for Cost Proposal is an informational request only, and is not an instruction or authorization to execute a change, or an order to stop Work in progress.

B. Request for Cost Proposal may include supplementary or revised Drawings and/or Specification to describe proposed changes to Contract Documents.

C. Contractor shall submit cost and/or time quotation to Owner's Representative within 15 calendar days following receipt of Request for Cost Proposal.

1.6 COST PROPOSAL (CP)

A. Contractor shall submit to the Owner's Representative a Cost Proposal for all occurrences the Contractor believes impacts Scope of Work cost and/or time.

1. A Cost Proposal shall be submitted within 15 calendar days of the occurrences.

B. Submit Cost Proposal numbered in sequential order, reviewed by the Contractor with respect to Contract Documents.

1. Submit Cost Proposals on forms designated by the Owner's Representative.

C. All Cost Proposals submitted shall have detailed breakdown for all associated work, cost and/or time.

D. Owner's Representative will solicit and monitor independent cost estimates responses from the Consultant.

E. Owner's Representative shall return Cost Proposal responses and reviews to the Contractor within 15 calendar days following receipt of Cost Proposal.

F. A processed Cost Proposals is informational back-up for a potential Change Order, and not an instruction or authorization to execute a change, or an order to stop Work in progress.

1.7 CHANGE ORDER (CO)

A. Change Orders may be initiated by the Owner, Contractor, Consultant, Owner's lead agency, or the Owner's Representative.

B. Changes to the Project Contract Sum and/or Contract Time listed or indicated in Change Orders shall include or be determined by methods described in the General Conditions.

C. Owner's Representative has responsibility for processing and administering Change Orders for the Project, and will prepare each Change Order using form designated by the Owner's Representative.

D. Contractor shall provide all pricing proposals Cost Proposals for a Change Order. The Consultant shall provide independent cost estimates to Cost Proposals.
1. Cost differentials between the Contractor's Cost Proposal and the Owner's Representative may negotiate the Consultants cost estimates.
2. If no agreement is reached, the Owner's Representative may issue a time and material change Order.
    a. Use Daily Force Account Report designated by Owner's Representative.

E. The Contractor, Consultant, Owner's Representative, Owner's lead agency and Owner will sign a fully documented Change Order.

1.8 CORRELATING CHANGE ORDERS WITH OTHER CONTRACT REQUIREMENTS

A. Revise Schedule of Values and Applications for Payment to record each Change Order as a separate item of work with adjustment to Contract Sum and Contract Time.

B. Revise Construction Schedule to reflect each change in Contract Time.

C. Record modifications in Record Documents.

END OF SECTION

REFERENCES

SECTION 01 42 00

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Reference Standards.

B. Industry Standards.

C. Definitions.

D. Specification format and content explanation.

E. Codes, regulations and governing agencies.

F. References. abbreviations, and acronyms.

1.2 REFERENCE STANDARDS

A. General: References are made throughout the Specification to various codes, reference standards, practices and requirements for materials, work quality, installation, inspections and tests which are published and issued by government agencies, professional and trade organizations, societies, associations and testing agencies. References to these publications are made by acronyms or abbreviations as listed in this Section.

B. Obtain copies of reference standards, manuals and codes directly from publication sources as needed for proper performance and completion of the Work.

C. Standards, manuals and codes referenced in the Specifications form part of these Specifications to the extent referenced. No provisions of any such standard, specification, manual, or code or instruction shall be effective to change the duties and responsibilities of County, or Contractor; any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents; nor shall it be effective to assign to County or any of County's consultants, agents, or employees, a duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

D. Reference to standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Contract Book unless noted otherwise.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference. Individual Sections indicate which codes and standards the Contractor must keep available at the Work Site for reference.

B. Publication Dates: Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of these specifications.

C. Updated Standards: At the request of the County, Contractor, or authority having jurisdiction, submit a Change Order Request where an applicable code or standard has been revised and reissued after the date of the Contract Documents and before performance of Work affected. The County will decide whether to issue a Proposal Request to proceed with the updated standard.

D. Conflicting Requirements: Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the County for a decision before proceeding.

E. Minimum Quantity or Quality Levels: In every instance the quantity or quality level shown or specified shall be the minimum to be provided or performed. The actual installation may comply exactly, within specified tolerances, with the minimum quantity or quality specified, or it may exceed that minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum values, as noted, or appropriate for the context of the requirements. Refer instances of uncertainty to the County for a decision before proceeding.

F. Copies of Standards: Each entity engaged in construction on the Work is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

G. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

1.4 DEFINITIONS

A. General: Words and abbreviations used in the Specifications are given meaning as defined in “The American Heritage Dictionary of the English Language” and as commonly used and accepted in the construction industry. Abbreviations and symbols used on Drawings are identified on Drawings.

B. Words and Terms: The following words and terms used in the Specifications shall mean as indicated.

1. Accepted Equal: Reviewed and accepted by County as being equal in quality, utility, and appearance.

2. Words and terms “or Approved Equal” and “or Equal” used in the Specifications shall have the same meaning as “Accepted Equal.”

3. Contractor Shall: To be concise; sentences, statements, and clauses used in the Specifications that exclude any form of the verb “shall”, which is normally expressed in a verb phrase with verbs such as “furnish”, “install”, “provide”, “perform”, “construct”, “erect”, “comply”, “apply”, “submit”, etc. Any such sentences, statements, and clauses are to be interpreted to include applicable form of phrase “Contractor shall”.

4. Furnish: Supply and deliver to Work Site, ready for installation; unload and inspect for damage.

5. 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 including all necessary labor, tools, equipment, and implements necessary to perform work indicated, ready for operation or use.

6. Observe: Used in reference to Architect means to become familiar with the process and quality of the Work and to determine if the Work is proceeding in general accordance with the Contract Documents based on what is plainly visible at the construction site, without removal of its materials or other construction that is in place.

7. Products: New material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.

8. Provide: Furnish and install all items necessary to complete work, ready for operation or use.

9. “Indicated” refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help locate the reference; no limitation on location is intended except as specifically noted.

10. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the County", "requested by the County", and similar phrases. However, no implied meaning shall be interpreted to extend the County's responsibility into the Contractor's area of construction supervision.

11. Approve: The term "approved," where used in conjunction with the County's action on the Contractor's submittals, applications, and requests, is limited to the duties and responsibilities of the County as stated in General and Supplementary Conditions. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.

12. Regulation: The term "Regulation” includes laws, ordinances, statutes, regulations, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.

13. Unless otherwise indicated, the term "experienced," when used with the term "Installer" means having a minimum of 5 previous projects similar in size and scope to this Work, being familiar with the precautions required, and having complied with requirements of the authority having jurisdiction.

14. “Work Site” is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other construction activities as part of the Work.

15. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

16. Demolish: Unless otherwise indicated, to demolish an item indicates that the Contractor shall take apart, remove and dispose of the subsequent materials. "Demo" shall mean the same as demolish.

1.5 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 48-Division format and Master Format numbering system.

B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is the abbreviated type. Implied words and meanings will be appropriately interpreted. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and where the full context of the Contract Documents so indicates.

2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

a. The words "shall be" shall be included by inference wherever a colon (:) is used within a sentence or phrase.

C. Assignment of Specialists: The Specification requires that certain specific construction activities shall be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.

1. This requirement shall not be interpreted to conflict with enforcement of building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

2. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

1.6 CODES, REGULATIONS AND GOVERNING AGENCIES

A. California Code of Regulations (CCR).

1. Title 8, Division 1, Chapter 3.2 – California Occupational Safety and Health Regulations (Cal/OSHA).

2. Title 8, Division 1, Chapter 4, Subchapter 4 – Construction Safety Orders.

3. Title 8, Division 1, Chapter 4, Subchapter 6 – Elevator Safety Orders

4. Title 19, Division 1 – Regulations of the State Fire Marshal (SFM).

5. Title 24 – California Building Standards Code (CBSC).

a. Part 1 – California Administrative Code (CAC).

b. Part 2 – California Building Code (CBC).

c. Part 3 – California Electrical Code (CEC).

d. Part 4 – California Mechanical Code (CMC).
e. Part 5 – California Plumbing Code (CPC).

f. Part 6 – California Energy Code.

g. Part 7 – California Elevator Safety Construction Code.

h. Part 8 – California Historical Building Code.

i. Part 9 – California Fire Code.

j. Part 10 – California Existing Building Code.

k. Part 11 – California Green Building Standards Code.

l. Part 12 – California Referenced Standards Code.

B. California Department of Transportation (Caltrans).

C. California Department of General Services (DGS).

D. California Environmental Protection Agency (Cal/EPA).

1. California Air Resources Board (ARB).

2. California State Water Resources Control Board (SWRCB).

3. Department of Pesticide Regulation (DPR).

E. Code of Federal Regulations (CFR) Title 28, Part 36 – ADA Standards for Accessible Design, Appendix A – ADA Accessibility Guidelines (ADAAG) for Buildings and Facilities.

F. Occupational Safety and Health Act (OSHA).

G. U.S. Environmental Protection Agency (EPA).

H. U.S. Department of Energy (DOE).

1.7 REFERENCES, ABBREVIATIONS AND ACRONYMS

AA	Aluminum Association.
AAADM	American Association of Automatic Door Manufacturers.
AABC	Associated Air Balance Council.
AAC	Aluminum Anodizers Council.
AAMA	American Architectural Manufacturers Association.
AASHTO	American Association of State Highway and Transportation Officials.
AATCC	American Association of Textile Chemists and Colorists.
ABMA	American Boiler Manufacturer's Association.
ACGIH	American Conference of Government Industrial Hygienists, Inc.
ACI	American Concrete Institute.
ACPA	American Concrete Pipe Association.
AF&PA	American Forest and Paper Association (formerly National Forest Products Association).
AFBMA	Anti-Friction Bearing Manufacturer's Association.
AGA	American Gas Association.
AGC	Associated General Contractors of America.
AGMA	American Gear Manufacturers Association
AHA	American Hardboard Association.
AHJ	Authority Having Jurisdiction.
AI	Asphalt Institute.
AIA	American Institute of Architects.
AIEE	American Institute of Electrical Engineers.
AIHA	American Industrial Hygiene Association.
AISC	American Institute of Steel Construction.
AISI	American Iron and Steel Institute.
AITC	American Institute of Timber Construction.
ALSC	American Lumber Standards Committee.
AMCA	Air Movement and Control Association.
ANSI	American National Standards Institute, Inc.
APA	The Engineered Wood Association.
API	American Petroleum Institute.
APWA	American Public Works Association.
AQMD	Air Quality Management District.
ARI	Air-Conditioning and Refrigeration Institute.
ARMA	Asphalt Roofing Manufacturers Association.
ASCE	American Society of Civil Engineers.

ASD	Advanced Simulation and Design.
ASHRAE	American Society of Heating Refrigerating and Air Conditioning Engineers.
ASME	American Society of Mechanical Engineers.
ASPA	American Sod Producers Association.
ASSE	American Society of Sanitary Engineers.
ASTM	American Society for Testing and Materials.
ATF	Academy of Textiles and Flooring.
AWC	American Wood Council.
AWCI	Association of Wall and Ceiling Industries.
AWG	American Wire Gage.
AWI	Architectural Woodwork Institute.
AWPA	American Wood Protection Association.
AWS	American Welding Society.
AWWA	American Water Works Association.
BAAQMD	Bay Area Air Quality Management District
BHMA	Builders Hardware Manufacturers Association.
BIA	Brick Industry Association.
BOCA	Building Officials and Code Administrators International, Inc.
CAN/ULC	Underwriters' Laboratory of Canada.
CAS	Chemical Abstracts Service (division of the American Chemical Society).
CBC	California Building Code
CBM	Certified Ballast Manufacturers.
CCR	California Code of Regulations
CDA	Copper Development Association.
CE	US Army Corps of Engineers
CFFA	Chemical Fabrics and Film Association, Inc.
CFR	Code of Federal Regulations
CISCA	Ceiling and Interior Systems Construction Association.
CISPI	Cast Iron Soil Pipe Institute.
CLFMI	Chain Link Fence Manufacturing Institute.
CPA	Composite Panel Association.
CRA	California Redwood Association.
CRI	Carpet and Rug Institute.
CRSI	Concrete Reinforcing Steel Institute.
CS	Commercial Standard.
CSI	Construction Specifications Institute.
CSIAC	California State Industrial Accident Commission.
DHI	Door Hardware Institute.
EIA	Electronic Industries Association.
EIMA	EIFS Industry Manufacturers Association.
ETL	Electrical Testing Laboratories.
EWS	Engineered Wood Systems
FEMA	Federal Emergency Management Agency.
FM	Factory Mutual Research and Engineering Corporation.
FMRC	Factory Mutual Research Corporation.
FS	Federal Specification – U.S. General Services Administration.

FSC	Forest Stewardship Council.
GA	Gypsum Association.
GANA	Glass Association of North America.
GMA	Flat Glass Marketing Association.
HPVA	Hardwood Plywood and Veneer Association.
IAPMO	International Association of Plumbing and Mechanical Officials.
ICC	International Code Council, Inc.
ICC	Interstate Commerce Commission.
ICC-ES	ICC Evaluation Service, Inc.
ICEA	Insulated Cable Engineers Association.
ICRI	International Concrete Repair Institute
IEEE	Institute of Electrical and Electronics Engineers.
IESNA	Illuminating Engineering Society of North America
IMIAC	International Masonry Industry All-Weather Council.
IPCEA	Insulated Power Cable Engineers Association.
ISO	International Standards Organization.
ITS	Intertek Testing Services.
LEED™	Leadership in Energy and Environmental Design (USGBC standard).
LRFD	Load and Resistance Factor Design.
LSGA	Laminators Safety Glass Association.
MBMA	Metal Building Manufacturers Association.
MFMA	Maple Flooring Manufacturers Association.
MFMA	Metal Framing Manufacturers Association.
MIA	Marble Institute of America
MIL	Military Specifications (U.S. Department of Defense).
ML/SFA	Metal Lath/Steel Framing Association Division of NAAMM.
MPI	Master Painters Institute.
MS4	Municipal Separate Storm Sewer Systems.
MSDS	Material Safety and Data Sheet.
MSJC	Masonry Standards Joint Committee.
MSMA	Metal Stud Manufacturers Association.
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry.
MUTCD	Manual of Uniform Traffic Control Devices (U.S. Department of Transportation).
NAAMM	National Association of Architectural Metal Manufacturers.
NAFS	North American Fenestration Standard (Co-published by AAMA & WDMA).
NAPHCC	National Association of Plumbing Heating Cooling Contractors.
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors.
NBFU	National Board of Fire Underwriters.
NBGQA	National Building Granite Quarries Association, Inc.
NCMA	National Concrete Masonry Association.
NCPWB	National Certified Pipe Welding Bureau.
NCRP	National Council on Radiation Protection and Measurement.
NEBB	National Environmental Balancing Bureau.
NEC	National Electrical Code.
NEHRP	National Earthquake Hazards Reduction Program.
NEMA	National Electrical Manufacturers Association.

NES	National Evaluation Service, Inc.
NFPA	National Fire Protection Association.
NFRC	National Fenestration Rating Council.
NIBS	National Institute of Building Sciences.
NIST	National Institute of Science and Technology.
NOFMA	National Oak Flooring Manufacturers Association.
NPDES	National Pollutant Discharge Elimination System.
NRCA	National Roofing Contractors Association.
NRMCA	National Ready Mixed Concrete Association.
NSF	National Sanitation Foundation.
NTMA	National Terrazzo and Mosaic Association.
NWWDA	National Wood Window and Door Association.
OSHA	Occupational Safety and Health Act of 1970.
PCA	Portland Cement Association.
PCI	Precast Prestressed Concrete Institute.
PDI	Plumbing and Drainage Institute.
PEI	Porcelain Enamel Institute.
PS	Voluntary Product Standard (US Department of Commerce / NIST).
RCSC	Research Council on Structural Connections.
RIS	Redwood Inspection Service.
RMA	Rubber Manufacturers Association.
SC	Shading Coefficient.
SCAQMD	South Coast Air Quality Management District
SDI	Steel Deck Institute.
SDI	Steel Door Institute.
SFBC	South Florida Building Code.
SHGC	Solar Heat Gain Coefficient.
SIGMA	Sealed Insulating Glass Manufacturers Association.
SMACNA	Sheet Metal and Air Conditioning Contractors National Association.
SPRI	Single-Ply Roofing Institute.
SSMA	Steel Stud Manufacturers Association.
SSPC	The Society for Protective Coatings.
SWI	Steel Window Institute.
SWPPP	Storm Water Pollution Prevention Plan.
SWRI	Sealant, Waterproofing, and Restoration Institute.
TCA	Tile Council of America.
TEMA	Tubular Exchanger Manufacturers Association, Inc.
TMS	The Masonry Society.
TPI	Truss Plate Institute.
TRI	Tile Roofing Institute.
UL	Underwriters Laboratories, Inc.
ULC	Underwriters Laboratories of Canada.

USGBC	US Green Building Council.
VOC	Volatile Organic Compounds.
WCLIB	West Coast Lumber Inspection Bureau.
WDMA	Window and Door Manufacturers Association (formerly NWWDA - National Wood Window and Door Association).
WDMA	Window and Door Manufacturers Association.
WH	Warnock Hersey.
WI	Woodwork Institute (formerly WIC – Woodwork Institute of California).
WSRCA	Western States Roofing Contractors Association.
WSFI	Wood and Synthetic Flooring Institute.
WWPA	Western Wood Products Association.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

TEMPORARY FACILITIES BARRIERS, CLOSURES AND CONTROLS

SECTION 01 56 00

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, water and sanitary facilities.

B. Construction Facilities: Vehicular access, parking, progress cleaning, and fire prevention facilities.

C. Temporary Controls: Barriers, enclosures, security, water control, dust control, erosion control, noise control, and pollution control.

D. Protection of Work.

E. Removal of utilities, facilities, and controls

1.2 TEMPORARY ELECTRICITY

A. 110V electrical service is available in the facility. Contractor shall provide generator power for use in excess of what is available in the Work Site.

1.3 TEMPORARY WATER

A. Domestic water service is available near the Work Site. Water in excess of that which can be conveniently be supplied by the County shall be supplied by the Contractor.

1.4 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required temporary facilities for use by construction personnel. Maintain daily in sanitary and clean condition. Locate sanitary facilities in parking lot as directed by the County.

1.5 VEHICULAR ACCESS

A. Limit access of construction equipment to designated areas.

B. Extend and relocate vehicular access as Work progress requires, provide detours as necessary for unimpeded traffic flow.

C. Provide unimpeded access for emergency vehicles.

D. Provide and maintain access to fire hydrants and control valves free of obstructions.

1.6 PARKING

A. Coordinate parking areas to accommodate construction personnel with County.

1.7 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain all areas free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces and other closed or remote spaces prior to enclosing the space.

C. Remove waste materials, debris and rubbish from site daily and dispose off-site.

1.8 BARRIERS AND ENCLOSURES

A. Contractor shall provide and maintain temporary fencing or other barriers sufficient to prevent hazard to the public and County employees in the vicinity of the Work.

B. Provide security and facilities to protect Work and County occupied areas affected by the Work from unauthorized entry, vandalism or theft.

C. Initiate program at mobilization. Maintain program throughout construction period.

1.9 DUST CONTROL

A. Execute Work by methods to minimize raising dust from construction operations.

B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

C. Protect all adjacent spaces and systems from dust during construction.

D. Provide barriers/protection for all existing systems and equipment during construction including, but not limited to: HVAC system, plumbing system, fire alarm system, paging system, body scanner.

1.10 (NOT USED)

1.11 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.12 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.13 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual specification Sections.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.

C. Provide protective coverings at walls, projections, jambs, sills and soffits of openings.

D. Protect finished floors, stairs and other surfaces from traffic, dirt, wear, damage or movement of heavy objects, by protecting with durable sheet materials.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary above-grade or buried utilities, equipment, facilities, and materials prior to Completion of the Work.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

PRODUCT REQUIREMENTS

SECTION 01 60 00

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product Delivery Requirements.

C. Product Storage and Handling Requirements.

D. Product Options.

1.2 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. All products shall be new, of first class quality, and shall be delivered, installed, connected and finished in every detail, and shall be so selected and arranged as to fit correctly into the proper spaces. Where no specific kind or quality of material is given, a first-class standard article as approved by Architect shall be furnished. Contractor shall provide satisfactory evidence as to the kinds and quality of material and workmanship.

C. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

D. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Delivery of materials to the Project site shall be coordinated by and received by Contractor or his representative, and stored in secured areas as agreed upon at the job start meeting.

C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct and products are undamaged.

D. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

E. Contractor shall take into consideration the available space and location of work site when delivery of materials is necessary.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

B. For exterior storage of fabricated products, place on sloped supports above ground.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation and degradation of products.

E. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

H. Contractor shall be responsible to provide all new materials in unopened manufacturer's original containers and deliver such items to Project site in good condition for use on this project. Contractor shall be responsible to store all new materials received as per manufacturer recommendations. Any and all materials discovered to be improperly stored and/or damaged will be replaced at the sole expense to Contractor. Any requests for delays or extension of the Contract Time due to the above will not be considered.

I. Contractor shall use all means necessary to protect all materials before, during and after installation and to protect the installed work and materials of all other trades and of existing structures. In event of damage, Contractor is to immediately make all repairs and replacements necessary using compatible and like materials.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One Manufacturer and stating “No Substitutions Allowed, County’s Standard”: Products of manufacturer named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers without naming a Product, with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Products specified by Naming One or More Manufacturers and Naming Product(s) by the first listed Manufacturer, with a Provision for Substitutions: Submit a request for substitution for any product, by any manufacturer, listed or not listed, other than the product(s) listed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials furnished shall be new and never been used before, unless specified otherwise, and will satisfy the requirements herein and all specifications referenced by provisions within these specifications. Contractor shall furnish, upon request of Project Manager, an affidavit from the manufacturer or supplier to the effect that materials furnished shall conform to the General Conditions, the latest revision of AWWA Specifications, ASTM, and Federal Specifications that pertain. All materials shall be installed in accordance with manufacturer's recommendations and the Standard Drawings and Specifications that pertain. Material for one specific product shall be one manufacturer unless otherwise approved by Architect. All materials shall be subject to inspection after delivery to the site and during installation of the Work. Failure of the Inspector, Project Manager or Architect to note faulty material shall not relieve Contractor of the responsibility for removing or replacing any such material at no additional cost to County.

B. For the ease of maintenance and parts replacement, to the maximum extent possible use materials of a single manufacturer, delivered in manufacturer's original, unopened containers with labels intact and legible, and in sufficient quantity to allow continuity of work. Deviation from this requirement shall require written approval from County.

C. County reserves the right to reject any materials list which contains materials from various manufacturers if suitable materials can be secured from fewer manufacturers and to require that source of materials be unified to maximum extent possible.

PART 3 EXECUTION

Not Used

END OF SECTION

CUTTING AND PATCHING

SECTION 01 73 29

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section describes the requirements for performing cutting and patching; patching includes the insertion or projection of other products in or from a surface.

1.2 QUALITY ASSURANCE

A. Design Criteria:

1. Patching shall achieve security, strength, and weather protection, as applicable, and shall preserve continuity of existing fire ratings.

2. Patching shall successfully duplicate undisturbed adjacent finishes, especially in performance, colors, textures, and profiles. Where there is dispute as to whether duplication is successful or has been achieved to a reasonable degree, the County's judgment shall be final.

1.3 COORDINATION AND PROTECTION

A. Contractor shall protect from damage all portions of the Work or work of the County or separate contractors adjacent to cutting or patching operations, including excavation.

B. Contractor shall obtain written permission prior to commencing cutting, patching or excavation operations on the work of the County or any separate contractors.

C. Contractor shall protect adjacent occupied spaces from damage during concrete cutting and coring.

D. Contractor shall maintain the security and weather protection of facility at all times.

E. Contractor shall, when requested in writing, allow the County or any separate contractor to perform reasonable cutting, patching or excavation operation on the Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, Contractor shall submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.

3. List products to be used and firms or entities that will perform the Work.

4. Indicate dates when cutting and patching is to be performed.

5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.

7. Approval by the County to proceed with cutting and patching does not waive the County's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Materials shall be as specified in the applicable, individual Sections of the Specifications and as required to match existing construction. Contractor shall use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect after consulting with the County. Contractor shall use materials whose installed performance will equal or surpass that of existing materials.

PART 3 – EXECUTION

3.1 GENERAL

A. Contractor shall perform cutting associated with structural reinforcing, and patching in a manner to prevent damage to other Work and to provide proper surfaces for the installation of materials, equipment, and repairs.

B. Contractor shall not cut or alter structural members without prior consultation with the County.

C. Wherever practicable, Contractor shall employ original installer or fabricator providing Work under this Contract to perform cutting and patching for new:
1. Weather-exposed and moisture-resistant products.

2. Finished surfaces exposed to view.

D. Contractor shall adjust and fit products to provide a neat installation.

E. Contractor shall finish or refinish, as required, cut and patched surfaces to match adjacent finishes. Paint over complete surface plane, unless otherwise indicated. Over patched wall or ceiling surfaces, paint to nearest cutoff line for entire surface, such as intersection with adjacent wall or ceiling, beam or pilasters or to nearest opening frame, unless otherwise indicated. Painted surfaces shall not present a spotty, touched-up appearance.

3.2 INSPECTION

A. Before cutting existing surfaces, Contractor shall examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action

before proceeding, if unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, Contractor shall meet at the Work Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.3 PREPARATION

A. Temporary Support: Contractor shall provide temporary support of Work to be cut.

B. Protection: Contractor shall protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Work that might be exposed during cutting and patching operations.

C. Contractor shall avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Contractor shall take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.4 PERFORMANCE

A. General: Contractor shall employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required restoring surfaces to their original condition.

B. Cutting: Contractor shall cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible, review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill.

4. (NOT USED)

5. Contractor shall by-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Contractor shall patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.

4. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken area containing the patch, after the patched area has received primer and second coat.

5. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.5 CLEANING

A. Contractor shall thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION

CONTRACT CLOSEOUT

SECTION 01 75 00

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operation and maintenance manual submittal.
   4. Submittal of warranties.
   5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections.

1.2 SUBSTANTIAL COMPLETION

A. Prior to requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
      a. 100 percent completion will bring the Contractor's progress Payment up to (95%) ninety percent of the Contract Price with (5%) percent to remain in retention until after Notice of Completion.
      b. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
      c. If 100 percent completion cannot be shown, include a list ("punchlist") of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

   2. Advise the Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
   4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra stock, and similar items.
   7. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
   8. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
   9. Complete final cleanup requirements, including touchup painting.
   10. Touch up and otherwise repair and restore marred, exposed finishes.

B. Substantial Completion will not be issued without the following:

   1. Issuance of a Certificate of Occupancy.
   2. The electrical system, fire alarm, and sprinkler system 100% complete.
   3. Operation manuals, maintenance manuals and warranties submitted and approved.

4. Instruction of staff in the operation and maintenance of equipment and systems.
5. Record drawings submitted and approved.
6. Any extra material required by contract delivered.

C. Inspection Procedures:

1. On receipt of a request for inspection, the Owner's Representative and the Architect will either proceed with inspection or advise the Contractor of unfilled requirements.
2. The Owner's Representative will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
   a. The Owner's Representative and the Architect will repeat inspection when requested and assured that the Work is substantially complete.
   b. Results of the completed inspection will form the basis of requirements for final acceptance.
3. Owner will allow the Contractor no longer than 30 calendar days from the Date of Substantial Completion to remedy deficiencies.

1.3 FINAL ACCEPTANCE

A. Prior to requesting final inspection for certification of final acceptance and final payment, complete and submit the following:

1. Final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Certified copy of the Owner's Representative and Architect's final inspection list of items to be completed or corrected endorsed and dated by the Owner's Representative and Architect.
   a. Certification shall state that each item has been completed or otherwise resolved for acceptance.
4. Submit consent of surety to final payment.
5. Submit all subcontractor final unconditional lien releases.
6. Submit a final liquidated damages settlement statement.
7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Re-inspection Procedure:

1. Owner's Representative and /or Architect will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed.
   a. Indicate items whose completion is delayed under circumstances acceptable to the Owner's Representative.
2. Should the Owner's Representative determine that Work is incomplete or defective:
   a. Owner's Representative will notify the Contractor, in writing, listing incomplete or defective Work.
   b. Contractor shall remedy deficiencies promptly and notify Owner's Representative when ready for re-inspection.

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C. Final Acceptance Certificate

1. Upon completion of inspection or any re-inspections, the Owner's Representative and /or Owner's Lead Agency will prepare a certificate of final acceptance in accordance with the Project Specification Section 00800, Supplemental General Conditions.
2. Final Acceptance will be presented to the County Board of Supervisors.
   a. Only the County Board of Supervisors has final authority over Acceptance of Project.

D. Notice of Completion

1. Upon final acceptance by the County Board of Supervisors, the Owner's Lead Agency will prepare and file a Notice of Completion in accordance with the Project Specification Section 00800, Supplemental General Conditions.
   a. Start of mandatory 35-day lien period.

1.4 RECORD DOCUMENT SUBMITTALS

A. Project Record Drawings:

1. Maintain a clean, undamaged set of Contract Drawings and Shop Drawings and identify as "RECORD DRAWINGS - PROJECT SET".
2. Mark the Drawings to show the actual installation where the installation varies substantially from the Work as originally shown.
   a. Using an erasable colored pencil (not ink or indelible pencil) clearly describes change by graphic line or note.
   b. Date all entries, and note related Change Order number where applicable.
   c. Call attention to all entries by a "cloud" drawn around area affected.
   d. Where overlapping changes occur, mark with different colors.
3. Conversion of schematic layouts:
   a. Design of future modifications of facility may require accurate information as to final physical layout of items that are shown schematically on Drawings.
   b. Show on Project set of Record Drawings, by dimension accurate to within one inch, centerline of each run of items shown schematically on Drawings. Clearly identify item by accurate note such as "cast iron drain", "galv. water", and the like. Show, by symbol or note, vertical location of item ("under slab", "in ceiling plenum", "exposed" and the like).
4. Prior to request for Substantial Completion, secure from the Owner's Representative at no charge to the Contractor, a complete set, full sized drawings and (.DWG) files of all Contract Documents.
   a. Clearly transfer change data shown on Project set of Record Drawings to corresponding transparencies, coordinating changes as required.
   b. Clearly indicate at each affected detail and other drawings a full description of changes made during construction, and actual location of items.
   c. Show final location of electrical junction boxes and outlets, telephone and data outlets, supply and return registers, and like items.
   d. Call attention to all entries by a "cloud" drawn around area affected.
   e. Make changes neatly, consistently, and with proper media to assure longevity and clear reproduction.

B. Record Specifications:

1. Maintain one complete copy of the Project Manual, including addenda and other written construction documents, such as Change Orders and modifications issued during construction.
2. Mark Specifications to show substantial variations in actual Work performed in comparison with the text of the Specifications.
3. Note substitutions in reference to items specified.

C. Maintenance Manuals:

1. Contractor to submit a written summary of all maintenance manuals to be transmitted to Owner's Representative.
2. Submit 3 complete copies of all maintenance manuals prior to start-ups and instruction of operation to maintenance personnel.

3. Provide manuals in 8-1/2 x 11 inch format with plastic/fiberboard covers and colored fly-sheets separating sections, to include the following:

    a. Covered labeled as “Operating and Maintenance Instructions” with name and address of Project, and names of Contractor and Subcontractor.
    b. Typewritten index near front of manual, providing immediate information as to location within manual of emergency information regarding installation.
    c. Complete instructions regarding operation and maintenance of all equipment, including lubrication, disassembly, and re-assembly.
    d. Complete nomenclature of all parts of all equipment.
    e. Complete nomenclature and part number of all replacement parts, name and address of nearest vendor, and all other data pertinent to procurement and procedures.
    f. Copy of garnets and warranties issued.
    g. Manufacturers’ bulletins, cuts, and descriptive data, where applicable, clearly indicating precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers’ data which this installation is not concerned.
    h. Such other data as required in applicable Specification Sections.

D. Guarantees/warranties and Bonds:
    1. General:
        a. Manufacturers' warranties notwithstanding, warrant the entire Work against defects in materials and workmanship for twelve (12) months from the date of Substantial Completion in accordance with the GENERAL CONDITIONS AND SUPPLEMENTARY CONDITIONS.
        b. Guarantee/warrant or bond Work as required in the Specifications.
        c. Warranties between the Contractor and manufacturers, and the Contractor and suppliers, shall not affect guarantees/ warranties between the Contractor and the Owner.
        d. The Contractor will not be held responsible for defects due to misuse, negligence, willful damage, improper maintenance, or accident caused by Others, nor shall he be responsible for defective parts whose replacement is necessitated by failure of the Owner's maintenance forces to properly clean and service them, provided the Contractor has furnished complete maintenance instructions to the Owner.
        e. Compile specified guarantees/warranties and bonds.
        f. Time of Submittal:
            i. For equipment or component parts of accepted equipment put into service for the Owner's benefit during the progress of the Work, submit guarantees/warranties within ten (10) calendar days after acceptance of the Work.
            ii. Otherwise, submit guarantees/warranties within ten (10) calendar days after date of Substantial Completion and prior to the Final Application for Payment.
            iii. For items of Work where acceptance is delayed materially beyond the date of Substantial Completion, furnish updated submittal within ten (10) calendar days after such delayed acceptance, listing the date of delayed acceptance as the start of the guarantee/warranty period.

E. Other Documents:

    1. Three sets of warranties, guaranties and bonds.
    2. Spare parts and materials extra stock list.
    3. One set of evidence of compliance with requirements of governmental agencies having jurisdiction including, but not limited to:
        a. Certificates of Inspection.
        b. Certificates of Occupancy.
    4. One set of certificates of insurance for products and completed operations.
    5. One set of evidence of payment and release of liens.
    6. One copy of list of Subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reach for emergency service at all times including nights, weekends, and holidays.

1.5 INSTRUCTION

A. Arrange for each Installer of equipment and systems that requires regular maintenance to meet with the Owner's personnel for instruction in proper operation and maintenance of systems, equipment and similar items, which were provided as part of the Work.

1. Submit to Owner’s Representative an instruction schedule listing instruction subjects and proposed dates at least 15 calendar days prior to the first proposed date.

1.6 FINAL CLEANING

A. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.

1. Remove labels that are not permanent labels.
2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
4. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
5. Clean the site, sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

B. Remove temporary protection and facilities installed for protection of the Work during construction.

C. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION

DEMOLITION

SECTION 02 41 16

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of existing building elements.
   2. Disconnecting, capping or sealing, and removing utilities.
   3. Salvaging items for reuse by Owner.
   4. Removal of hazardous materials shall be performed by a licensed abatement contractor, and shall be under a separate contract.
   5. Protect existing building from weather damage.
   6. Repair procedures for selective demolition operations.

1.2 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 SUBMITTALS

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

B. Schedule of Building Demolition Activities: Indicate the following:

   1. Detailed sequence of demolition work, with starting and ending dates for each activity.
   2. Temporary interruption of utility services.
   3. Shutoff and capping of utility services.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

C. Pre-demolition Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Existing building will be occupied during the entire course of construction. Conduit demolition to minimize interference with adjacent building areas.

B. Maintain protected egress and access at all times.

C. Provide not less than 72 hours' notice of activities that will affect operations on adjacent spaces.

D. Hazardous Materials: It is expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner or under a separate contract. Coordinate removal schedule with the County.
2. If materials suspected of containing hazardous substances are encountered, do not disturb; immediately notify Owner.
3. Refer to Appendix for Hazardous Materials Surveys by Brunelle and Clark Consulting identifying hazardous materials.

1.7 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Where available and appropriate for use, provide repair materials that are identical to existing materials.

B. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

C. Use materials whose installed performance equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

C. Inventory and record the condition of items to be removed and salvaged if any. These should be removed prior to demolition by Owner.

D. Verify that hazardous materials have been remediated before proceeding with demolition operations.

3.2 PREPARATION

A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving building components to be demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.

B. Temporary Shoring: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, building entries, and other building facilities during demolition operations. Maintain exits from existing building.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection.

1. Protect adjacent facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent facilities to remain.
4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of building.
5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated existing construction completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least two hours after flame cutting operations.
3. Maintain adequate ventilation when using cutting torches.

4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls or framing.

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

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

D. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

E. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.

1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Division 31 Section "Earth Moving."

3.5 REPAIRS

A. Promptly repair damage to building caused by demolition operations.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in an approved landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.7 CLEANING

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

END OF SECTION

CONCRETE CRACK REPAIR

SECTION 03 94 00

PART 1 - GENERAL

1.1 SUMMARY:

A. Furnish all materials, labor, tools, equipment and incidentals required to make all concrete crack repairs. The County will direct the Contractor where to perform concrete crack repairs.

B. Concrete Crack Repairs are classified as follows:
   1. Type 1- Repair to be used, as directed by the County, for 1/16" to 1/8" wide structural cracks.
   2. Type 2- Repair to be used, as directed by the County, for 1/16" to 1/8" wide structural cracks, with exposed surfaces ground smooth for finishes.

C. Measurement and Payment Procedures:
   1. Work documented on the contract drawings shall be included in the base bid.
   2. Undocumented Concrete Crack Repair Type 1 discovered during construction will be measured separately for payment and be paid for at the contract unit price per linear foot of repair length.
   3. Undocumented Concrete Crack Repair Type 2 discovered during construction will be measured separately for payment and be paid for at the contract unit price per linear foot of repair length. Concrete REFERENCES

D. Codes, Regulations and Referenced Standards:
   1. ASTM C-881: "Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete."

1.2 SUBMITTALS

A. The Contractor shall furnish recent independent laboratory tests showing compliance with requirements specified. Certification or affidavits will not be acceptable.

B. The Contractor shall furnish manufacturer's literature describing product and instructions for use.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. The Contractor qualifications shall include:
      a. A minimum of five years experience in applying crack repair materials similar to those specified.
      b. A list of the five previous jobs that successfully utilized the application of the crack repair material.
      c. A letter from the crack repair material manufacturer, on the manufacturer's letterhead, signed by an officer of the company, stating that the applicator has been trained in the proper techniques for the proper preparation of the surface, and

proper methods of mixing, placing, curing, caring and application of the manufacturer's product.

1.4 DELIVERY, STORAGE AND HANDLING

A. Product shall be delivered in moisture proof containers with the manufacturer's name, product name and general instructions for placement printed on the container.

B. Product shall be stored and handled per manufacturer's instructions and protected from damage and freezing. Material that freezes shall be discarded.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Crack Repair Types 1 and 2 — Product shall be very low viscosity, low VOC, high strength moisture tolerant epoxy adhesive.
   1. Product shall be:
      a. Sikadur *35,* Hi-Mod LV, as manufactured by Sika Corporation.
      b. Eucopoxy Injection Resin, as manufactured by The Euclid Chemical Company.
      c. Or Accepted Equal.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION:

A. Crack must be clean and sound, free of standing water and in accordance with the Manufacturer's written instructions regarding surface preparation. Removal of all dust, grease, and foreign particles from cracks shall be done with compressed air.

3.2 MIXING:

A. Product shall be mixed in strict accordance with the manufacturer's written instructions.

B. At most mix only that quantity of material that can be placed within 20 minutes after mixing.

3.3 APPLICATION:

A. All work shall be done in strict accordance with the manufacturer's recommendations, including special procedures for hot and cold weather application.

B. At the request of the County, the manufacturer's representative shall be called to the job site for consultation regarding detailed use of the product.

C. At enclosed, occupied spaces, seal area and keep under constant negative pressure as required to minimize odor.

3.4 PROCEDURES:

A. Concrete Crack Repair Types 1 and 2
   1. All cracks identified by the Engineer for Type 1 or 2 Crack Repair shall have resin product pressure injected into crack. The manufacturer's installation instructions and recommendations shall be followed.
   2. Location of Injection Ports: Injection ports shall be spaced as recommended by the manufacturer and as needed to insure complete penetration of the joint of crack with the injected material. Spacing of injection ports shall not exceed 2 feet.
   3. Drilling Ports: Holes for injection ports shall be drilled to the depth needed for proper distribution of the injected material. Care shall be taken to not damage any reinforcing steel.
   4. Port Penetration: Holes for injection ports shall be cleaned of all debris and fitted with an injection fitting as provided by the manufacturer of the injected material, or equal. The injection fitting shall be installed as per manufacturer's instructions and will remain in place until injection work has been completed at that area. Caps or valves will be installed at the injection ports to prevent back flow of the uncured injected material after it has been injected.
   5. Injection Produces:
      a. The Contractor shall follow the instructions of the manufacturer and their representatives for all mixing and injection procedures.
      b. All cracks shall be sealed at the surface where needed to provide for complete penetration of the injected material and prevent loss of material.
      c. Prior to sealing material injection, water shall be injected into the ports in order to flush the crack clean and to verify continuity between adjacent ports. Water shall be injected into each of the ports until it begins to flow from an adjacent or nearby port.
      d. If the water injection procedure indicates the potential presence of voids within members or behind members resting against soil, the County shall be notified immediately.
      e. Beginning at the lowest injection port, inject the sealing material until it begins to flow from an adjacent or nearby port. Repeat the process until the crack is completely filled. In general, the port to port travel of the injection will be from low to high in a continuous operation.
      f. If port to port continuity does not occur at locations where continuity was verified through water injection, mark location and notify the County.
      g. Avoid sudden application of high pressures during the injection process.
      h. After completion of the injection operation, all ports and surface sealing materials shall be removed so as to leave an undamaged surface.

B. Finishing Concrete Crack Repair Type 2
   1. Grind all exposed surfaces smooth and flush with adjacent concrete.

END OF SECTION

METAL FABRICATIONS

SECTION 05 50 00

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section describes the requirements for furnishing and installing metal fabrications made from steel shapes, plates, bars, strips, tubes, pipes and castings not a part of structural steel or specified in other Sections.

1.2 SUBMITTALS

A. Product Data:
1. Manufacturer's specifications, anchor details and installation instructions, including paint products and grout.

B. Shop Drawings:
1. Include plans, elevations and details of metal fabrications and their connections. Show anchorage and accessory items.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the work.

B. Welding Qualifications: Qualify welding processes and welding operators in accordance with AWS D1.1, D1.3, and D1.2 as applicable. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved.

1.4 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule to avoid delay of work.

1.5 SEQUENCING AND SCHEDULING

A. Painting: Items specified in this Section as having a shop applied prime coat will be job painted as specified in Section 09 91 00, unless otherwise noted.

B. Furnish templates for anchors and bolt installation by other Sections.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: For fabrication of metal work, which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

B. Wide Flange Steel Shapes: ASTM A992

C. Steel Plates, Shapes and Bars: ASTM A36

D. Steel Tubing: Cold formed, ASTM A500; or hot rolled, ASTM A501

E. Structural Steel Sheet: Hot rolled, ASTM A1011; or cold rolled ASTM A1008

F. Galvanized Structural Steel Sheet: ASTM A653

G. Steel Pipe: ASTM A53; type and grade selected by fabricator; black finish unless galvanizing is indicated or specified; standard weight, schedule 40, unless otherwise indicated

H. Gray Iron Castings: ASTM A48, Class 30

I. Malleable Iron Castings: ASTM A47, grade selected by fabricator

J. Brackets, Flanges and Anchors: Cast or formed metal of same type material and finish as supported rails, unless otherwise indicated

K. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers and shims as required, hot dip galvanized, ASTM A153.

L. Grout:
1. Metallic Non-Shrink Grout: Pre mixed, factory packaged, ferrous aggregate grout
2. Non Shrink Non Metallic Grout: Pre mixed, factory packaged, non-staining, non-corrosive, non-gaseous grout.

M. Fasteners: Steel fasteners, galvanized in accordance with ASTM A153, selected by fabricator

N. Paint:

1. Metal Primer: SSPC 20, Type 2

a. Exterior Exposure: Tnemec 90-97 Tnemec Zinc or approved equal

b. Interior Exposure: Tnemec 18 Enviro-Prime acrylic emulsion rust-inhibitive primer or approved equal

c. Exposed to view items to be field painted shall be primed with a primer compatible with final finish coats specified in Section 09 91 00.

2. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel; Rust Oleum Corp. "Zinc Rich Cold Galvanizing Compound", Tnemec 90 93, ZRC Chemical Products Div. of Norfold Corp. "ZRC Cold Galvanizing Compound" or approved equal.

2.2 FABRICATION, GENERAL

A. Workmanship:

1. Use materials of size and thickness indicated or required to produce strength and durability in finished product for use intended.

2. Work to dimensions indicated,

3. Form exposed work true to line and level with accurate angles and surfaces and straight, sharp edges.

4. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated.

5. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

6. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces. Welds shall be imperceptible in the finished work.

7. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use Phillips flat head countersunk screws or bolts for exposed fasteners, unless tamperproof security screws are indicated.

8. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

B. Galvanizing: Provide zinc coating for items indicated or specified to be galvanized, as follows:

1. ASTM A153 for galvanizing iron and steel hardware.

2. ASTM A123 for galvanizing both fabricated and un-fabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299-inch thick and heavier.

C. Fabricate joints exposed to the weather to exclude water or provide weep holes.

D. Shop Painting:

1. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces.

2. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP 2, SP 3, or SP 7.

3. Remove oil, grease and similar contaminants in accordance with SP 1.

4. Brush or spray on primer in accordance with manufacturer’s instructions, at a rate of 2.0 mils thickness for each coat.

5. Apply one shop coat to fabricated metal items, except apply 2 coats to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish from the first.

6. Primer on exposed to view items to be field painted shall be smooth and suitable for application of final finish coats specified in Section 09 91 00.

7. Apply a heavy coat of bituminous paint, compounded for application in 30 mil coat, to metal surfaces in contact with concrete, masonry and dissimilar metals. Do not apply on exposed surfaces.

2.3 MISCELLANEOUS METAL FABRICATIONS

A. Loose Bearing and Leveling Plates: Provide for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill to receive anchor bolts and for grouting as required. Galvanize after fabrication.

B. Miscellaneous Framing and Supports:

1. Provide miscellaneous framing and supports not a part of structural steel framework, as required to complete work.

2. Fabricate to sizes, shapes and profiles shown or required.

3. Fabricate from structural steel shapes and plates and steel bars of welded construction using mitered joints for field connection.

4. Cut, drill and tap units to receive hardware and similar items.

5. Furnish integrally welded anchors for casting into concrete or building into masonry.

6. Finish: Galvanize exterior frames and supports, shop prime interior frames and supports.

C. Steel Pipe or Tube Railings: Fabricate to design, dimensions and details indicated.

1. Interconnect railing members by butt welding or welding with internal connectors.

2. Provide coped joints at tee and cross sections.

3. Form simple and compound curves by bending pipe or tubing in jigs to produce uniform curvature for each repetitive configuration. Maintain cylindrical cross section of pipe or tube throughout entire bend without buckling, twisting or deforming exposed surfaces.

4. Close exposed ends of pipe by welding 3/16 inch steel plate in place or by using prefabricated fittings.

5. Flanges, Fittings and Anchors: Provide end closures, flanges, miscellaneous fittings and anchors for interconnections of pipe or tubing and attachment of railings to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry.

6. Finish: Galvanize exterior steel railings, including pipe or tubing, fittings, brackets, fasteners, and other ferrous components. Provide black steel pipe or tubing for interior railings.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors.

3.2 INSTALLATION

A. General:
1. Fastening to In Place Construction: Provide threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws and other connectors as required
2. Cutting, Fitting and Placement:
   a. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications.
   b. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
   c. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry or similar construction.
3. Fit exposed connections together forming tight hairline joints.
   a. Weld connections not shop welded.
   b. Grind exposed joints smooth and imperceptible, and touch up shop paint coat.
   c. Do not weld, cut or abrade the surfaces of exterior units which have been hot dip galvanized after fabrication, and intended for bolted or screwed field connections.
4. Field Welding: Comply with AWS for procedures of manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
5. Install prefabricated items in accordance with manufacturer’s instructions.

B. Setting Loose Plates:
1. Clean concrete and masonry bearing surfaces of bond reducing materials, and roughen to improve surface bond. Clean bottom surface of bearing plates.
2. Set loose leveling and bearing plates on wedges, or other adjustable devices.
3. Tighten anchor bolts after the bearing members have been positioned and plumbed.
4. Cut off protruding ends of wedges flush with the edge of the bearing plate before packing with grout.
5. Use metallic non shrink grout in concealed locations where not exposed to moisture; use non metallic non shrink grout in exposed locations.
6. Pack grout solidly between bearing surfaces and plates to ensure no voids remain.

C. Steel Pipe or Tube Railings:
1. Adjust railings prior to anchoring to ensure matching alignment at abutting joints.
2. Space posts as indicated.
3. Plumb posts in each direction.
4. Anchor posts in concrete with pipe sleeves preset and anchored into concrete. After posts are inserted in sleeves, fill annular space between post and sleeve solid with non-shrink, non-metallic grout mixed and placed to comply with grout manufacturer's directions.
5. Anchor posts to steel with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.

6. Provide removable railing sections where indicated. Furnish slip fit metal socket or sleeve for casting into concrete. Locate sleeves to match post spacing.
7. Expansion Joints: Provide at intervals not exceeding 40 feet. Provide slip joint with internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of posts.

3.3 ADJUST AND CLEAN

A. Touch-Up Painting: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and spot prime with specified primer applied to a minimum dry film thickness of 2.5 mils.

END OF SECTION

CUSTOM CASEWORK

SECTION 06 40 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide mill fabricated custom casework with accessories as required for complete finished installation including cabinetwork hardware.

1. Provide cabinetwork.
2. Provide plastic laminate countertops.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's literature for manufactured items.

B. Shop Drawings: Indicate materials and wood species, component profiles, fastening, joining details, finishes, and accessories.

1. Certification: Provide WI Certified Compliance Label on shop drawings.

2. Shop drawings shall be complete, accurate, to-scale, and in conformance with applicable and referenced industry standards. Cursory use of Architect's interior elevation drawings as shop drawings will not be accepted.

C. Samples: Furnish samples of each of the following:

1. Plastic laminates: Complete sample ring which includes manufacturer's full range of available colors and patterns, excluding metallics.

a. Architect reserves the right to request sample rings from more than one manufacturer.

2. Melamine: Samples of each available standard color. ("Standard" colors shall be defined as White, Almond, and Gray.)

3. PVC edge strips, as requested by Architect.

4. 4" wire pull, in specified finish.

5. All exposed casework hardware.

6. Wood veneer samples, showing proposed range of grain patterns.

D. Certificates: WI certification is required.

1. General: Before delivery to jobsite, provide WI Certified Compliance Certificate indicating grade of millwork products to be furnished and certify WI requirements for specified grades shall be met.

2. Casework: Each unit to bear WI Certified Compliance Label.

3. Plastic Laminate Countertop: Each unit to bear WI Certified Compliance Label.

4. Installation: Provide WI Certified Compliance Certificate for Installation.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Member of Woodwork Institute (formerly Woodwork Institute of California) with minimum five years successful experience fabricating architectural woodwork similar to that required for Project.

B. Standards: Perform architectural woodwork in accordance with recommendations Woodwork Institute (formerly Woodwork Institute of California) "Manual of Millwork" (WI MoM).

1. Installation Certification Program: Install work in this section as specified in the WI Manual of Millwork and provide WI Certified Compliance Certificate for installation at completion of Project installation.

C. Seismic Anchorage: Provide seismic anchorage for wall cabinets; comply with loads required by California Code of Regulations (CCR), Title 24, Part 2.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver architectural woodwork until site conditions are adequate to receive work; protect items from weather while in transit.

1. Allow architectural woodwork shop finish to completely dry prior to delivery to site; allow materials to off-gas volatile organic compound (VOC) emissions off site.

B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60 degrees F and maximum relative humidity of 25% to 55%.

C. Do not begin installation of architectural woodwork until space is fully enclosed and mechanical systems are fully operational.

1. Maintain interior installation areas at 70 degrees F and 50% to 55% relative humidity.

D. Immediately remove from site materials with visible mold and materials with mildew.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Transparent/Stained Finished Casework:

1. Quality: WI MoM/Custom Grade, Type II, Style A, flush overlay type.

2. Veneer: Clear cherry unless otherwise indicated; veneers as approved by Architect; a uniform appearance shall be required.

a. Veneer Thickness: Minimum 0.036” thick.

b. Inside Surfaces: White Birch stained to match exterior veneers; melamine interiors is not acceptable.

3. Particleboard Core: Provide Medite Corp. (Sierrapine) Medite II or Rodman Industries/Resincore I formaldehyde-free medium density fiberboard (MDF) or particleboard made from recycled wood products.

4. Exposed Edges: Hardwood matching veneer.

B. Plastic Laminate Finished Casework and Countertops:

1. Quality: WI/Custom Grade, Type I, Style A, frameless, multiple unit construction.

2. Plastic Laminates:

a. Types: NEMA LD-3.1 high pressure laminates.

1) Horizontal Surfaces: General Purpose Type, nominal 0.050".
2) Vertical Surfaces: Vertical Surface Type, nominal 0.032".
3) Unexposed Surfaces: Balanced with 0.030" melamine backing sheet.
4) Formed Surfaces: Postforming Type, nominal 0.042".

b. Manufacturers:

1) Formica Corp.
2) Nevamar Corp.
3) Wilsonart, Ralph Wilson Plastics.
4) Or accepted equal.

c. Colors: As selected by Architect from manufacturer's full range of available colors and patterns, excluding metallics.

3. Particleboard Core: formaldehyde-free medium density fiberboard (MDF) or particleboard made from recycled wood products.

4. Provide 1 1/8” thick plastic laminate covered plywood shelving at all open casework units and at all locations where shelving span exceeds 36” (thirty-six inches)

C. Casework Hardware: Provide casework hardware items as required for complete installation as indicated; provide types as listed in WI "Manual" but no less than following types. Plug-In Pin Type Shelf Supports (Transparent Finished Casework): Provide holes 1" on center.

1. Adjustable Shelf Standards and Supports (Contractor Option at Plastic Laminate Casework): Flush mounted in cabinet.

a. Manufacturers:

1) Futura/No. AS 662 with AS 563/663 support.
2) Knape & Vogt/No. 255 with No. 256 support.
3) Or accepted equal.

2. Cabinet Hinges: European concealed type, minimum 160 degree opening, with spring closer.

3. Cabinet and Drawer Pulls: Wire type, 4" center to center, brushed chrome.

   a. Manufacturers:

      1) Baldwin Hardware Manuf. Corp.
      2) Stanley Hardware.
      3) The Engineered Products Co.
      4) Or accepted equal

4. Drawer Slides: Full extension, rail mounted type, minimum 100 lb. capacity with ball-bearing rollers.

   a. Manufacturers:

      1) Accuride.
      2) Knape & Vogt.
      3) Or accepted equal

5. Cabinet Locks: Pin and tumbler slide bolt lock, two keys each.

   a. Manufacturers:

      1) Schlage Lock Co./46-002 Cabinet Locks.
      2) Best Access Systems/5L Series.
      3) CompX International/Timberline Locks.
      4) Or accepted equal

D. Anchors, Nails and Screws: Select material, type, size and finish required by each substrate for secure anchorage; provide toothed steel or lead expansion bolt screws for drilled-in-place anchors.

E. Wood Filler: Color to match wood being filled.

2.2 FABRICATION

A. General: Fabricate architectural woodwork in accordance with specified quality standards.

B. Plastic Laminate:

1. Apply plastic laminate finish in full, uninterrupted sheets consistent with manufactured sizes.

2. Make corners and joints hairline; slightly bevel arises.

3. Locate butt joints at least 2'-0" from cutouts.

4. Cap exposed edges with plastic laminate of same finish and pattern.

5. Apply laminate backing sheet to reverse side of laminate surfaces.

6. Provide cutouts for inserts, fixtures and fittings; verify locations from on-site dimensions.

7. Prime paint contact surfaces of cutouts.

8. Plastic Laminate Countertops: Square butt joints and self edging; applied plastic or metal edging not permitted.

C. Countertops: Provide maximum sizes available. Locate butt joints at least 2'-0" from cutouts where more than one piece countertops are required.

1. Make corners and joints hairline; slightly bevel arises.

2. Provide cutouts for inserts, fixtures and fittings; verify locations from on-site dimensions.

D. Use exposed fastening devices or nails only when approved and unavoidable; arrange neatly.
E. Assemble woodwork in shop in sizes easily handled and to ensure passage through building openings.

2.3 FINISHES

A. Transparent/Stained Finished Woodwork: Finish architectural woodwork in shop unless otherwise indicated.

1. Wood Veneers: Plain sliced cherry as approved by Architect.

2. Veneering:

a. Matching between veneer pieces: Book matched.
b. Matching of panel faces: Balanced matched.
c. Matching of panels and components: Sequenced matched.

3. Sand work smooth; seal, stain and varnish concealed and semi-concealed surfaces of transparent finished woodwork; brush apply.
4. Finish: WI MoM/Premium Grade finish producing a dull rubbed effect, as approved by Architect. Match existing furnishing color an grain.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.

3.2 INSTALLATION

A. Install work consistent with specified quality grade, plumb, level, true and straight with no distortions.

1. Shim as required, using concealed shims.

B. Ensure mechanical and electrical items affecting architectural woodwork are properly placed, complete, and have been inspected by Architect prior to commencement of installation.

C. Secure work to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

D. Scribe and cut for accurate fit to other finished work.

E. Install architectural woodwork under supervision of factory-trained mechanics.

F. Attach architectural woodwork securely in place with uniform joints providing for thermal and building movements.

G. Acceptable Tolerances:

1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.

2. Adjoining Surfaces of Same Material: No variation permitted.

3. Offset with Abutting Materials: Maximum 1/32".

END OF SECTION

BATT INSULATION SYSTEMS

SECTION 07 21 00

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes the requirements for furnishing and installing the following:

1. Solid surfacing.

1.2 SUBMITTAL ITEMS

All submittals shall be made under the provisions of Section 01 33 00. Contractor initial submittal shall include all 'Submittal Items' requested below.

A. Shop Drawings

1. Show panel orientations, seam locations, width and location of any expansion, contraction or isolation joints in substrates and finished surface.

B. Product Data

1. Furnish manufacturers product data for each specified product.

C. Samples for verification

1. Furnish samples of the following items. Where products involve colors and texture variations, furnish sets showing full range of variations expected.

a. Pieces shall be at least 4" x 4" in each color of solid surfacing and solid surface veneer.

D. Warranty: Submit sample review copy of each type of warranty.

1.3 QUALITY ASSURANCE

A. Single source responsibility for materials: obtain each color, type, size, finish and variety from a single source with resources to provide products of consistent quality in appearance without delaying progress of the work.

B. Installers Qualifications: A minimum of two (2) years experience installing surfacing of the types specified and a minimum of three (3) installations of a magnitude similar to or larger than the work of this section.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Store flat, on pallets or solid supports in area of moderate temperature and allow material to obtain room temperature prior to cutting or fabrication.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Carry sheets vertically (on edge) to avoid impacting the material with other hard surfaces to prevent breakage or edge damage. Do not slide sheets face down over dirty work surfaces.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendation.

B. Maintain temperatures at 50-degrees F. or more in all areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.6 EXTRA MATERIALS

A. Furnish additional solid surfacing for replacement and maintenance, at the rate of approximately 5%, to the nearest full carton for each size, color, pattern and type installed. Identify each carton as to its contents.

1.7 WARRANTY

A. Provide manufacturers 10 year transferable limited warranty.

B. Warranty: Cover complete system for failure to meet specified requirements.

C. Warranty shall cover all but the following:

1. Accidents, abuse or misuse

2. Exposure to extreme heat

3. Improper maintenance

4. Improper adhesive, grout or caulk

5. Alteration or repair by anyone other than an authorized fabricator

PART 2 - PRODUCTS

2.1 SOLID POLYMER MATERIALS

A. Material: Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 & .6, Type Six, and Fed. Spec. WW-P-541E/GEN.

1. Material shall have minimum physical and performance properties specified in the following Section U.

2. Superficial damage to a depth of 0.010" (0.25 mm) shall be repairable by sanding and polishing.

2.2 ACCESSORY PRODUCTS

A. Joint adhesive:

1. Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.

B. Sealant:

1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-complaint (food zone – any type), UL-listed silicone sealant in colors matching components.

2.3 PERFORMANCE CHARACTERISTICS

PROPERTY	TYPICAL RESULT	TEST
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	1.5 x 10^{-6} psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	1.2 x 10^{-6} psi	ASTM D 790
Hardness	>85	Rockwell “M” Scale ASTM D 785
	56	Barcol Impressor ASTM D 2583
Thermal Expansion	3.02 x 10-5 in./in./°C (1.80 x 10-5 in./in./°F)	ASTM D 696
Gloss (60° Gardner)	5–75 (matte—highly polished)	ANSI Z124
Light Resistance	(Xenon Arc) No effect	NEMA LD 3-2000 Method 3.3
Wear and Cleanability	Passes	ANSI Z124.3 & Z124.6
Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6
Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G21 & G22
Boiling Water Resistance	No visible change	NEMA LD 3-2000 Method 3.5
High Temperature Resistance	No change	NEMA LD 3-2000 Method 3.6
Izod Impact (Notched Specimen)	0.28 ft.-lbs./in. of notch	ASTM D 256 (Method A)
Ball Impact Resistance: Sheets	No fracture—1⁄2 lb. ball 1⁄4" slab—36" drop 1⁄2" slab—144" drop	NEMA LD 3-2000 Method 3.8
Weatherability	ΔE^*_{94}<5 in 1,000 hrs.	ASTM G 155
Specific Gravity †	1.7	
Water Absorption	Long-term 0.4% (3⁄4") 0.6% (1⁄2") 0.8% (1⁄4")	ASTM D 570
Toxicity	99 (solid colors) 66 (patterned colors)	Pittsburgh Protocol Test (“LC50”Test)
Flammability	All colors (Class I and Class A)	ASTM E 84, NFPA 255 & UL 723
Flame Spread Index	<25	
Smoke Developed Index	<25	

2.4 FACTORY FABRICATION

A. Shop assembly:

1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer’s printed instructions and technical bulletins.

2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.

a. Reinforce with strip of solid polymer material, 2" wide.

3. Rout and finish component edges with clean, sharp returns.

a. Rout cutouts, radii and contours to template.

b. Smooth edges.

c. Repair or reject defective and inaccurate work.

B. Thermoforming:

1. Comply with manufacturer's data.

2. Heat entire component.

a. Material shall be uniform, between 275 and 325 degrees Fahrenheit during forming.

3. Form pieces to shape prior to seaming and joining.

4. Cut pieces to finished dimensions.

5. Sand edges and remove nicks and scratches.

2.5 COLOR AND FINISH

A. Color to be selected by Architect from the manufacturer's standard color chart.

B. Finish:

1. Provide surfaces with a uniform finish.

C. Color/Finish: Refer to Interior Design drawings.

PART 2 - EXECUTION

3.1 INSPECTION

A. Examine substrates and areas where tile will be installed, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed solid surfacing.

1. Verify that substrates for solid surfacing are firm, dry, clean and free from oil or waxy films and curing compounds.

2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind solid surfacing has been completed before installing solid surfacing.

3.2 INSTALLATION – GENERAL

A. Extend solid polymer work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise indicated. Terminate

work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

B. Accurately form intersections and returns. Perform cutting and drilling of solid surfacing without marring visible surfaces. Carefully cut edges of solid surfacing abutting trim, finish, or built-in items for straight aligned joints. Fit solid surfacing closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars or covers overlap solid surfacing.

C. Joints are to be hard seamed at all but inside corners. At inside corners, provide caulk joint, not to exceed 3/16" with color-matched silicone sealant.

D. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

1. Provide product in the largest pieces available.

2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.

a. Exposed joints/seams shall not be allowed.

3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.

4. Cut and finish component edges with clean, sharp returns.

5. Rout radii and contours to template.

6. Anchor securely to base cabinets or other supports.

7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.

8. Carefully dress joints smooth, remove surface scratches and clean entire surface.

9. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.

3.3 CLEANING

A. Upon completion of placement, clean solid polymer so it is free of foreign matter and polished to specified sheen.

B. Leave finished installation clean and free of cracked, chipped, broken, unbonded and otherwise defective solid surfacing work.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensure solid surfacing is without damage or deterioration at time of Substantial Completion.

B. Before final inspection, remove any protective coverings.

C. Remove adhesives, sealants and other stains.

END OF SECTION

BATT INSULATION SYSTEMS

SECTION 07 21 00

PART 1 – GENERAL

1.1 SUMMARY

1.1 Section Includes:

1. Provide thermal insulation system at roof, exterior walls and acoustic batt insulation at interior walls with accessories as required for complete installation.

1.2 SUBMITTALS

All submittals shall be submitted under the provisions of Section 01 33 00.

2.1 Product Data: Furnish manufacturer's literature for each type of insulation.

1. Indicate thermal insulation name and number as included in California Energy Commission's Directory of Certified Material.

2. Submit Underwriter's Laboratory approval numbers for required fire ratings; approvals of other laboratories contingent upon acceptance of applicable authorities.

3. Installation Instructions: Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers:

1. Knauf Insulation

2. Johns Manville/FSK-25 Thermal-Shield Insulation.

3. Owens-Corning Fiberglas Corp./Fiberglas FS-25 Insulation.

4. Certainteed.

5. Or accepted equal.

B. Materials

1. Exterior Wall Batt Insulation within wall cavity above existing ceiling line: R-19 Preformed kraft-faced fiberglass batts at all exterior walls.

2. Roof Batt Insulation: R-30 foil faced fiberglass batts at all building roofs.

3. Acoustic Batt Insulation at Interior Walls: R-11 unfaced.

4. Insulation Supports: Galvanized or electroplated steel wire supports with friction attachment to framing.

5. Nails or staples: Steel wire; electroplated; type and size to suit application.

6. Line Wire: Galvanized steel, 19 gauge wire.

7. Wire Mesh: 1 ½" x 17 gauge poultry netting.

8. Accessories: Furnish as recommended by insulation manufacturer for insulation types, substrates, and conditions involved.

C. Insulation shall comply with California standards for insulating material. Maximum flame spread rating of 25 and maximum smoke density per 2010 CBC Section 803.

1. Flame Spread/Smoke Density Rating: Maximum 25/450, ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate and adjacent materials are dry and ready to receive insulation; beginning installation signifies acceptance of conditions.

B. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected prior to commencement of installation.

3.2 INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Cut and trim insulation neatly, to fit spaces.

1. Backed Insulation: Use insulation free of ripped backs and edges.

C. Fit insulation tight within spaces and tight to and behind mechanical and electrical services within insulation plane; leave no gaps or voids; maintain integrity of thermal barrier.

D. Maintain minimum ventilating airspace as required by the Drawings.

E. Friction fit in place; use tape or friction supports as necessary to assure permanent installation.

1. Taping: Tape joints and tears in vapor retarder, including joints between insulation and surrounding construction, to ensure vapor-tight installation.

2. Penetration Supports: Cut or bend pins in locations accessible to maintenance personnel, to eliminate potential hazards from exposed pin points.

END OF SECTION

BATT INSULATION SYSTEMS

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5. Nails or staples: Steel wire; electroplated; type and size to suit application.

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8. Accessories: Furnish as recommended by insulation manufacturer for insulation types, substrates, and conditions involved.

C. Insulation shall comply with California standards for insulating material. Maximum flame spread rating of 25 and maximum smoke density per 2010 CBC Section 803.

1. Flame Spread/Smoke Density Rating: Maximum 25/450, ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate and adjacent materials are dry and ready to receive insulation; beginning installation signifies acceptance of conditions.

B. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected prior to commencement of installation.

3.2 INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Cut and trim insulation neatly, to fit spaces.

1. Backed Insulation: Use insulation free of ripped backs and edges.

C. Fit insulation tight within spaces and tight to and behind mechanical and electrical services within insulation plane; leave no gaps or voids; maintain integrity of thermal barrier.

D. Maintain minimum ventilating airspace as required by the Drawings.

E. Friction fit in place; use tape or friction supports as necessary to assure permanent installation.

1. Taping: Tape joints and tears in vapor retarder, including joints between insulation and surrounding construction, to ensure vapor-tight installation.

2. Penetration Supports: Cut or bend pins in locations accessible to maintenance personnel, to eliminate potential hazards from exposed pin points.

END OF SECTION

ELASTOMERIC SHEET ROOFING

SECTION 07 53 00

PART 1 GENERAL

1. 1 WORK INCLUDED

A. Fully adhered attached PVC sheet membrane roofing system.

B. Cover Board

C. Coated flashings and trim.

D. Rigid insulation at roof construction.

E. Tapered extruded polystyrene foam.

F. Walkway membrane (Traffic Pads).

1.2 REFERENCES

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Section 01 42 00 “References” for definitions, acronyms, and abbreviations.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards and Manuals:

1. ANSI/SPRI FX-1 – Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners
2. ASTM C203 – Standard Test Method for Breaking Load and Flexural Properties of Block Type Thermal Insulation.
3. ASTM C272 – Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
4. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
5. ASTM C1177/C1177M– Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
6. ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
7. ASTM D471 – Standard Test Method for Rubber Property – Effects of Liquids.
8. ASTM D751 – Standard Test Methods for Coated Fabrics.
9. ASTM D1204 – Standard Test Method for Linear Dimensional Changes of Non-Rigid Thermoplastic Sheathing or Film at Elevated Temperature.

10. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
11. ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics.
12. ASTM D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
13. ASTM D5884 – Standard Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes.
14. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
15. ASTM E96 – Standard Test Method for Water Vapor Transmission of Materials.
16. ASTM E408 – Standard Test Method for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
17. Factory Mutual Global (FMG) Approval Guide.
18. UL Roofing Materials and Systems Directory.

1.3 QUALITY ASSURANCE

A. Membrane Manufacturer: Prime membrane manufacturer, specializing in single ply roof membranes with five years experience.

B. Applicator: Company specializing in installation of single ply roof membranes approved by membrane manufacturer.

1.4 REGULATORY REQUIREMENTS

A. Underwriters Laboratories, Inc (UL) Class A Fire Hazard Classification.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 00 as modified herein. Submit shop drawings detailing special joint or termination conditions and conditions of interface with other materials.

B. Submit product data for sheet membrane, elastic flashing, joint cover sheet, and joint and crack sealants, with temperature range for application of membrane.

C. Submit manufacturer’s installation instructions under provisions of Section 01 33 00.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 60 00 “Product Requirements”.

B. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact.

C. Store products in weather protected environment, clear of ground and moisture.

D. Store insulation and cover board dry and protected from the elements. Store insulation on pallets and completely cover with a breathable material such as tarp or canvas. Remove or slit

temporary factory-applied packaging to prevent accumulation of condensation. Do not use wet or damaged insulation.

E. Store roofing membrane in the original undisturbed plastic wrap.

F. Store adhesives, sealants, and other curable materials in cool and dry location with temperatures between 60 and 90 degrees F. Do not store adhesive containers with opened lids due to the loss of solvent which occur from flash off.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing system during inclement weather.

B. Do not apply roofing system to damp or frozen substrate.

C. Take precautions to prevent wind blow-off or wind damage during the course of the roofing application.

D. Substrates to receive roofing system shall be thoroughly dry. Provide drying equipment should moisture occur.

1.8 PREINSTALLATION CONFERENCE

A. Meet with representatives of the Owner to establish a mutually agreeable schedule for roofing installation.

B. Convene a pre-installation conference one week prior to commencing work of this Section.

C. Require attendance of parties directly affecting work of this Section.

D. Review conditions of installation, installation procedures, and coordination required with related work.

1.9 MOCKUP

A. Provide mockup of installed membrane prior to commencement of work.

B. Mockup to represent conditions of finished work including internal and external corners, Seam jointing, attachment method, sealing and counterflashing cover, control and expansion joints.

1.10 EXTRA STOCK

A. Provide the Owner with 100 sq. ft. of roofing membrane along with the compatible hand held hot-air welding tool and written instructions for the repair of minor defects and punctures to the membrane; for his use.

1.11 WARRANTY

A. Comply with provisions of Section 01 70 00 “Execution and Closeout Requirements”.

B. Warranty installed membrane roofing system including labor and materials and loss of water-tightness caused by defective materials (including accessories) or workmanship, with no dollar limit, for 15 years. Effective warranty start date shall be at the time of final acceptance by County.

C. Warranty shall provide for the removal, replacement, repair, and making good without cost to the City, of defects due to defective materials or workmanship.

D. Repairs under warranty shall be made within three days after receiving notice of need for repairs from the City, weather permitting.

PART 2 PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products.

1. PVC Roofing Membrane System.
    a. Carlisle Syntec Inc.
    b. Firestone Building Products Co.
    c. GAF Materials Corp.
    d. John Mansville
    e. Or accepted equal.
2. Gypsum cover board.
    a. G-P Gypsum Corp.: DensDeck roof board.
    b. Or accepted equal.
3. Roof Insulation.
    a. Atlas Roofing Corp.
    b. Rmax, Inc.
    c. Firestone Building Products Co.
    d. GAF Materials Corp.
    e. John Mansville
    f. Or accepted equal.

B. Substitutions: Under provisions of Section 01 60 00, “Product Requirements”.

2.2 POLYVINYL-CHLORIDE ROOFING MEMBRANE - PVC

A. PVC Sheet: ASTM D 4434, Type III, fabric reinforced. Thickness: 80 mils, minimum.

2.3 AUXILIARY ROOFING MATERIALS – SINGLE PLY

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.

C. Sheet Flashing: Manufacturer's unreinforced sheet flashing of same material as sheet membrane.

D. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

E. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors.

F. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, prepunched.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

H. One Way Breather Vents: Amount as recommended by manufacturer.

I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, sealants, and other accessories.

2.4 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads sourced from membrane roofing system manufacturer.

2.5 COVER BOARD

A. Gypsum Board: ASTM C1177, glass-mat faced, water-resistant gypsum substrate, [1/4 inch].
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2.6 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II.

1. Provide 1” thick insulation boards with R Value greater than 6.

2.7 TAPERED INSULATION CRICKETS

A. Tapered Insulation: ASTM C 1289, provide factory-tapered insulation boards fabricated to slope of [1/2 inch per 12 inches] unless otherwise indicated.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer.

D. Urethane Adhesive: Manufacturer's two component urethane adhesive formulated to adhere insulation to substrate.

E. Wood Nailer Strips.

PART 3 EXECUTION

3.1 EXAMINATION

A. Report unacceptable conditions to the Engineer. Begin installation only when unacceptable conditions have been corrected and only when substrate is inspected and accepted by roofing installer and roofing system manufacturer.

B. Verify that surfaces and site conditions are ready to receive work.

C. Verify that deck is structurally sound to secure mechanical fastened single ply roofing system. Inspect roof deck for corrosion, rotting, warping, concrete spalling, etc. Repair or replace defective roof deck prior to installing the roofing system.

D. Verify that deck surfaces are dry to the touch and free of snow or ice.

E. Verify that deck is clean and smooth, free of noticeable high spots or depressions, and have a positive slope to drains or valleys.

F. Perform pullout tests as per ANSI/SPRI FX-1 at a minimum of 10 pullout tests for areas up to 500 squares, thereafter, add one test for every 2 percent of the field areas.

G. Verify that roof openings, curbs, pipes, sleeves, ducts and vents through roof are solidly set. Verify and ensure that all roof drain lines are clear.

3.2 PREPARATION

A. Protection: Protect roofing surface and adjacent work against damage to roofing work.

B. Review Material Safety Data Sheet and safety regulations recommended by OSHA.

C. Wood Nailers:

1. Install pressure treated wood nailers in appropriate size and location when required by the membrane manufacturer for a warrantable system.
2. Anchor to the roof deck at 2 feet maximum on center to resist a pullout force of 175 pounds per foot in any direction. Install fasteners within 6 inch of each end. Spacing and fastener embedment shall conform to Factory Mutual Loss Prevention Data Sheet 1-49.
3. Top of nailers shall be flush to the roof insulation.

D. PREPARATION OF SUBSTRATE

1. General: To prevent delays or interruptions, coordinate with other work to ensure that components to be incorporated into the roofing system are available as the work progresses. Examine substrates to which the roofing materials are to be applied to ensure that their condition is satisfactory for the roofing systems application. Do not permit voids greater than 1/4 inch width in the substrate. Substrates for roofing materials shall be dry and free of oil, dirt, grease, sharp edges and debris. Inspect substrates and correct defects before application of roofing membrane.
2. Determine the condition of the structural substrate. Areas with deteriorated or damaged decking or other materials shall have those affected materials removed and replaced.

3. Provide temporary water cut-offs at the end of each day. Maintain watertight condition of roof. Remove only that amount of roofing and flashing that can be made watertight with new materials in a one-day period or prior to the onset of inclement weather.
4. Cover decking with rigid insulation, and cover board, applied in accordance with manufacturer's instructions and as required resulting in a UL Class A roof system.

3.3 INSULATION INSTALLATION

A. Place insulation over clean roof deck in accordance with manufacturer's instructions.

B. Install insulation in specified thickness. Install additional thickness at crickets as required to meet requirements indicated on the drawings.

C. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

D. Apply no more insulation than can be covered with cover board and membrane in same day.

E. Tape joints of insulation in accordance with insulation manufacturer's instructions.

F. Stagger all joints when multiple layers or types of insulation are being installed.

3.4 GYPSUM COVER BOARD INSTALLATION

A. Place cover board over clean insulation.

B. Fasten with disk-type fasteners as recommended by cover board manufacturer.

C. Stagger all joints a minimum of 6 inches from underlying insulation joints.

3.5 ROOFING MEMBRANE PLACEMENT, ATTACHMENT and HOT AIR WELDING

A. General: Install membrane in accordance with manufacturer's instructions.

B. Sweep substrate of all loose debris before laying membrane.

C. Fully-Adhered Single-Ply Roofing System at All Surfaces.
1. Position membrane over the substrate.
2. Fold membrane sheet back so half the underside is exposed.
3. Stir bonding adhesive thoroughly scraping the sides and the bottom of the can (5 minutes minimum). Bonding surfaces must be dry and clean.
4. Apply bonding adhesive to the exposed underside of the membrane and the corresponding substrate area. Do not apply adhesive along the splice edge of the membrane to be hot air welded over adjoining sheet.
5. Apply adhesive evenly, without puddles using a plastic core medium nap roller to achieve continuous coating of both surfaces at a coverage rate recommended by adhesive manufacturer.
6. Due to solvent flash-off, condensation may form on freshly applied bonding adhesive when the ambient temperature is near the dew point. If condensation develops, possible surface contamination may occur and the application of bonding adhesive must be discontinued. Allow the surface to dry and apply a thin freshener coat to the previously coated surface when conditions allow for continuing.
7. Allow adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
8. Roll the coated membrane into the coated substrate while avoiding wrinkles.

9. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.
10. Fold back the unbonded half of the sheet in the same manner, overlapping edges a minimum of 2 inch to provide for a minimum of 1-1/2 inch hot air weld.
11. Install adjoining membrane sheets in the same manner, overlapping a minimum of 2 inch to provide a minimum of 1-1/2 inch hot air weld.
12. Protect completed sections of the roof so bonding adhesive will not discolor the membrane surface. Do not place bonding adhesive containers or their lids directly on the surface of the membrane.

D. Welding of Laps:
   1. General:
      a. Roofing membrane connection shall be hot air welded only.
      b. Surfaces to be welded shall be clean and dry.
   2. Hot Air Welding:
      a. Hot air weld the membrane sheets with an automatic hot air welding machine. Follow hot air welding machine manufacturer's instructions for use.
      b. Where use of automatic hot air welding machines is not practical, use a hand-held hot air welding machine. Preheat the nozzle tip and apply over the overlap area until the material reaches required temperature, immediately follow with a hand roller to press the heated membrane surfaces together with slow, even movements. Keep the roller within one inch of the nozzle tip. Seam strength may be tested when cool. For best results, test seams 8 hours after hot air welding.
   3. Quality Control of Seams: After seaming, check welded seams for continuity and integrity. Repair openings or "fishmouths" with a hand-held hot air tool fitted with a narrow nozzle tip and with a roller.
   4. Membrane lap edges that have been exposed to the elements for approximately 7 days or longer must be prepared with manufacturer-approved membrane cleaner. Prepare the surface where the cleaner has been applied as per manufacturer's instructions prior to hot air welding.

3.6 MEMBRANE FLASHING

A. Flash all vertical surfaces with reinforced membrane. Use non-reinforced membrane only at inside and outside corners, field fabricated pipe seals, scuppers, and sealant pockets where the use of premolded accessories are not practical. Terminate the flashing in accordance with manufacturer-approved detail.

B. Use bonding adhesive on vertical surfaces more than 12 inches high such as walls, curbs, and pipes. Bonding adhesive is not required for vertical surfaces terminated under a metal counter flashing less than 12 inches high. Bonding adhesive may be eliminated for flashing heights 18 inches or less when a coping or termination bar is used for vertical terminations.

3.7 OTHER RELATED WORK

A. Walkways: Heat weld walkway pads as directed by the manufacturer and as shown on the drawings.

B. At the underside of exposed decking, cover fastener tips of protruding fasteners with heat-shrink wrap tubing. Paint to match existing color or new paint where occurs.

3.8 FIELD QUALITY CONTROL

A. General: Comply with requirements of Section 01 40 00 “Quality Requirements”.

B. The manufacturer’s representative/technical inspector shall observe, conduct tests, and prepare test reports in accordance with the provisions of this Section at predetermined periods before, during, and after installation of the work – specifically at critical periods identified by roofing system manufacturer to ensure a completely warranted system.

C. The manufacturer’s representative/technical inspector and the testing agency shall conduct final roof inspection on completion of the work in this Section and submit report to Engineer. Notify Engineer 48 hours in advance of date and time of inspection.

3.9 CLEANING

A. Clean as recommended by manufacturer. Do not use materials or methods which may damage surface or surrounding construction.

B. Where traffic must continue over finished roof membrane, protect surfaces.

END OF SECTION

SHEET METAL FLASHING

SECTION 07 62 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide galvanized steel flashing and sheet metal including accessories as required for complete weather tight installation.

1. Flashing and sheet metal, reglets, and similar fabricated components.

2. Provide concealed sealants used in conjunction with installation of metal flashing and sheet metal.

3. Counterflashings at roof mounted mechanical equipment and vent stacks.

4. Provide miscellaneous sheet metal flashing and reglets not provided by other trades or suppliers.

a. Where reglets are to be installed in conjunction with other work, provide in adequate time for installation.

1.2 SYSTEM DESCRIPTION

A. Design Requirements: Allow for movement of components without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to 100 year seasonal temperature ranges.

1.3 REFERENCES

A. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual, Fifth Edition.

B. ANSI/ASTM B32 - Solder Metal.

C. ASTM A525 - Steel Sheet, Zinc Coated, Galvanized by the Hot-Dip Process.

D. FS O-F-506 - Flux, Soldering, Paste and Liquid.

E. FS QQ-S-571 - Solder, Tin Alloy.

F. FS SS-C-153 - Cement, Bituminous, Plastic.

G. NAAMM - Metal Finishes Handbook.

H. NRCA (National Roofing Contractors Association) - Roofing Manual.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in sheet metal flashing work with 5 years minimum experience.

1.5 SUBMITTALS

A. Shop Drawings

1. Clearly indicate dimensioning, layout, general construction details including closures, flashings, locations and types of sealants, anchorages, and method of anchorage.

B. Product Data

1. Submit product data for each specified item.
2. Describe material profile, jointing pattern, jointing details, fastening methods, and installation details.

WARRANTY

A. Special Warranty: Provide for correcting failure of metal flashing system to resist penetration of water and damage from wind.

1. Special Warranty Period: Five years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized Steel: ASTM A525, G90; core steel. 24 gage unless noted otherwise on Drawings.

B. Aluminum: ASTM B209 minimum thickness .0603".

2.2 ACCESSORIES

A. Flashing and Sheet Metal:

1. Provide heavier gage metal where recommended by SMACNA Manual for size of component.

2. Mill phosphatized where indicated to be field painted.

B. Manufactured Reglets: Snap-on type, for two piece flashing; metal to match flashing and sheet metal.

1. Manufacturers:

a. Fry Reglet Corp./Springlok System.
b. MM Systems Corp./Snap-Tite System.
c. W.P. Heckman Co./The Leading Edge Drive Lock System.
d. Substitutions: Refer to Section 01 25 13.

C. Solder and Fasteners: As recommended by SMACNA and complying with applicable codes and regulations; hot dipped galvanized minimum coating comparable to G90.

D. Reglets: 24 ga. G.I., Type MA W 1-1/2" wide top flange; manufactured by Fry or equal.

E. Concealed Sealant: Butyl type for use in conjunction with sheet metal; non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior concealed applications.

F. Bituminous Paint: Acid and alkali resistant type; black color; asbestos free.

G. Plastic Cement: Cutback asphaltic type; asbestos free.

H. Sealing Compound: Type recommended by roofing manufacturer; asbestos free.

2.3 FABRICATION

A. Fabricate sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

B. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

1. Fabricate corners and intersections in shop with solder joints; watertight fabrication.

C. Form sections in longest practical lengths; make allowance for expansion at joints.

D. Hem exposed edges on underside 1/2"; miter and seam corners. .

E. Backpaint flashings with heavy bodied bituminous paint to a minimum dry film thickness of 15 mil. where in contact with cementitious materials or dissimilar metals.

F. Form pitch pans watertight, with minimum 4" upstand and 4" flanges; form pans minimum 6" wider than item passing through roof membrane.

G. Form umbrella flashings with minimum 2" overhang, to shed water away from pitch pans.

H. Form material with standing seam. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.

I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install metal flashing and sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

1. Install tight in place, with corners square, surfaces true and straight in planes, and lines accurate to profiles as indicated on Drawings.

2. Install starter and edge strips, and cleats before starting installation.

3. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

4. Lap joints in direction of water flow.

5. Hold downspouts in position, clear of wall, by hangers spaced not more than 10'-0" on center; securely fasten hangers to wall without exposed damage to wall surface.

B. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces.

C. Provide expansion joints concealed within system.

D. Solder metal joints watertight for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

E. Use concealed fasteners, continuous cleat type, except where specifically approved by Architect.

1. Exposed fasteners may be used, where clearly indicated on shop drawings and approved by Architect, at areas not exposed at exterior walls nor in sight of interior spaces.

F. Apply sealing compound at junction of metal flashing and felt flashing.

G. Lock seams and end joints; fit flashing tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

H. Counter-flash mechanical and electrical items projecting through roof membrane.

I. Install sealants where required to prevent direct weather penetration.

J. Completed installation shall be free of rattles, noise due to thermal and air movement, and wind whistles.

END OF SECTION

SHEET METAL FLASHING

SECTION 07 62 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide galvanized steel flashing and sheet metal including accessories as required for complete weather tight installation.

1. Flashing and sheet metal, reglets, and similar fabricated components.

2. Provide concealed sealants used in conjunction with installation of metal flashing and sheet metal.

3. Counterflashings at roof mounted mechanical equipment and vent stacks.

4. Provide miscellaneous sheet metal flashing and reglets not provided by other trades or suppliers.

a. Where reglets are to be installed in conjunction with other work, provide in adequate time for installation.

1.2 SYSTEM DESCRIPTION

A. Design Requirements: Allow for movement of components without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to 100 year seasonal temperature ranges.

1.3 REFERENCES

A. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual, Fifth Edition.

B. ANSI/ASTM B32 - Solder Metal.

C. ASTM A525 - Steel Sheet, Zinc Coated, Galvanized by the Hot-Dip Process.

D. FS O-F-506 - Flux, Soldering, Paste and Liquid.

E. FS QQ-S-571 - Solder, Tin Alloy.

F. FS SS-C-153 - Cement, Bituminous, Plastic.

G. NAAMM - Metal Finishes Handbook.

H. NRCA (National Roofing Contractors Association) - Roofing Manual.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in sheet metal flashing work with 5 years minimum experience.

1.5 SUBMITTALS

A. Shop Drawings

1. Clearly indicate dimensioning, layout, general construction details including closures, flashings, locations and types of sealants, anchorages, and method of anchorage.

B. Product Data

1. Submit product data for each specified item.
2. Describe material profile, jointing pattern, jointing details, fastening methods, and installation details.

WARRANTY

A. Special Warranty: Provide for correcting failure of metal flashing system to resist penetration of water and damage from wind.

1. Special Warranty Period: Five years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized Steel: ASTM A525, G90; core steel. 24 gage unless noted otherwise on Drawings.

B. Aluminum: ASTM B209 minimum thickness .0603".

2.2 ACCESSORIES

A. Flashing and Sheet Metal:

1. Provide heavier gage metal where recommended by SMACNA Manual for size of component.

2. Mill phosphatized where indicated to be field painted.

B. Manufactured Reglets: Snap-on type, for two piece flashing; metal to match flashing and sheet metal.

1. Manufacturers:

a. Fry Reglet Corp./Springlok System.
b. MM Systems Corp./Snap-Tite System.
c. W.P. Heckman Co./The Leading Edge Drive Lock System.
d. Substitutions: Refer to Section 01 25 13.

C. Solder and Fasteners: As recommended by SMACNA and complying with applicable codes and regulations; hot dipped galvanized minimum coating comparable to G90.

D. Reglets: 24 ga. G.I., Type MA W 1-1/2" wide top flange; manufactured by Fry or equal.

E. Concealed Sealant: Butyl type for use in conjunction with sheet metal; non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior concealed applications.

F. Bituminous Paint: Acid and alkali resistant type; black color; asbestos free.

G. Plastic Cement: Cutback asphaltic type; asbestos free.

H. Sealing Compound: Type recommended by roofing manufacturer; asbestos free.

2.3 FABRICATION

A. Fabricate sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

B. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

1. Fabricate corners and intersections in shop with solder joints; watertight fabrication.

C. Form sections in longest practical lengths; make allowance for expansion at joints.

D. Hem exposed edges on underside 1/2"; miter and seam corners. .

E. Backpaint flashings with heavy bodied bituminous paint to a minimum dry film thickness of 15 mil. where in contact with cementitious materials or dissimilar metals.

F. Form pitch pans watertight, with minimum 4" upstand and 4" flanges; form pans minimum 6" wider than item passing through roof membrane.

G. Form umbrella flashings with minimum 2" overhang, to shed water away from pitch pans.

H. Form material with standing seam. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.

I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install metal flashing and sheet metal in accordance with SMACNA Architectural Sheet Metal Manual.

1. Install tight in place, with corners square, surfaces true and straight in planes, and lines accurate to profiles as indicated on Drawings.

2. Install starter and edge strips, and cleats before starting installation.

3. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

4. Lap joints in direction of water flow.

5. Hold downspouts in position, clear of wall, by hangers spaced not more than 10'-0" on center; securely fasten hangers to wall without exposed damage to wall surface.

B. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces.

C. Provide expansion joints concealed within system.

D. Solder metal joints watertight for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

E. Use concealed fasteners, continuous cleat type, except where specifically approved by Architect.

1. Exposed fasteners may be used, where clearly indicated on shop drawings and approved by Architect, at areas not exposed at exterior walls nor in sight of interior spaces.

F. Apply sealing compound at junction of metal flashing and felt flashing.

G. Lock seams and end joints; fit flashing tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

H. Counter-flash mechanical and electrical items projecting through roof membrane.

I. Install sealants where required to prevent direct weather penetration.

J. Completed installation shall be free of rattles, noise due to thermal and air movement, and wind whistles.

END OF SECTION

JOINT PROTECTION

SECTION 07 90 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide joint sealers, for interior and exterior joints not specified elsewhere, with backing rods and accessories as required for complete installation.

1. Joint sealers include sealants and caulking as indicated.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Select materials for compatibility with joint surfaces and indicated exposures.

2. Where not indicated, select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.

3. Comply with applicable limitations on volatile organic compound (VOC) emissions.

1.3 SUBMITTALS

All submittals shall be made under the provisions of Section 01 33 00.

A. Product Data

1. Submit product data for all specified products.

2. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, and color availability.

B. Installation Instructions

1. Submit manufacturer's installation instructions

2. Submit manufacturer's certificate under provisions of Section 01 33 00 that products meet or exceed specified requirements.

3. Furnish certification indicating installers are trained in proper use of specified products, qualified, and familiar with proper installation techniques.

C. Samples for Verification

1. Submit samples of specified products.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Firm with minimum five years successful experience on projects of similar type and size, using specified products.

1. Installers shall be familiar with proper application procedures to ensure maximum joint sealer expansion and contraction capabilities.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, cure time, and mixing instructions.

1.6 SITE CONDITIONS

A. Do not proceed with installation of joint sealers under unfavorable weather conditions.

B. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer.

C. Do not install solvent curing sealants in enclosed building spaces.

1.7 WARRANTY

A. Special Warranty: Repair or replace joint sealers that fail to perform as intended, because of leaking, crumbling, hardening, shrinkage, bleeding, sagging, staining and loss of adhesion.

1. Special Warranty Period: Three years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Elastomeric Sealants:

1. Single Component Low Modulus Silicone Sealant: ASTM C920 Type S, Class 25, Grade NS; minimum 50% expansion and compaction capability.

a. Provide at exterior locations not exposed to traffic.

b. Manufacturers:

1) General Electric Co./Silpruf, Silglaz or GESIL.
2) Dow Corning Corp./790 or 795.
3) Pecora Corp./864 Architectural Silicone.
4) Tremco/Spectrum 3.
5) Substitutions: Refer to Section 01 25 13.

2. Multi-Component Polyurethane Sealant: ASTM C920, Type M, Grade P, Class 25, self-leveling; minimum 25% expansion and compaction capability.

a. Provide at traffic bearing locations.

b. Manufacturers:

1) Pecora Corp./NR-200 Urexpan.
2) Tremco/Vulkem 245.
3) Sonneborn Division of ChemRex /SL 2
4) Substitutions: Refer to Section 01 25 13.

3. Mildew-Resistant Silicone Rubber Sealant: ASTM C920, Type S, Grade NS, Class 25, compounded with fungicide, specifically for mildew resistance and recommended for interior joints in wet areas.

    a. Provide at interior joints in wet areas.

    b. Manufacturers:

        1) General Electric Co./SCS 1702 Sanitary Sealant.
        2) Dow Corning Corp./786 Bathtub Caulk.
        3) Pecora Corp./863 #345 White.
        4) Tremco/Tremsil 200.
        5) Substitutions: Refer to Section 01 25 13.

B. Non-Elastomeric Sealants:

1. Acrylic-Emulsion Sealant: ASTM C834 acrylic or latex-rubber-modified acrylic sealant, permanently flexible, non-staining and non-bleeding; recommended for general interior exposure; compatible with paints specified in Section 09 91 90.

    a. Provide at general interior applications.

    b. Manufacturers:

        1) Pecora Corp./AC-20.
        2) Sonneborn Division of ChemRex/Sonolac.
        3) Tremco/Ultrem 1500
        4) Substitutions: Refer to Section 01 25 13.

C. Miscellaneous Materials:

1. Primers/Sealers: Non-staining types recommended by joint sealer manufacturer for joint surfaces to be primed or sealed.

2. Joint Cleaners: Non-corrosive types recommended by joint sealer manufacturer; compatible with joint forming materials.

3. Bond Breaker Tape: Polyethylene tape as recommended by joint sealer manufacturer where bond to substrate or joint filler must be avoided for proper performance of joint sealer.

4. Sealant Backer Rod: Compressible polyethylene foam rod or other flexible, permanent, durable non-absorptive material as recommended by joint sealer manufacturer for compatibility with joint sealer.

    a. Oversize backer rod minimum 30% to 50% of joint opening.

D. Colors: Provide colors indicated or as selected by Architect from manufacturer's full range of colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare joint surfaces in accordance with ASTM C1193 and as recommended by joint sealer manufacturer.

B. Clean joint surfaces immediately before installation of joint sealer; remove dirt, insecure materials, moisture and other substances that could interfere with bond of joint sealer.

C. Prime or seal joint surfaces where recommended by joint sealer manufacturer; do not allow primer/sealer to spill or migrate onto adjoining surfaces.

D. Ensure protective coatings on surfaces in contact with joint sealers have been completely stripped.

3.2 INSTALLATION

A. Comply with manufacturer's printed instructions and ASTM C1193, except where more stringent requirements are shown or specified.

B. Set sealant backer rods at proper depth or position in joint to coordinate with other work, including installation of bond breakers and sealant; do not leave voids or gaps between ends of backer rods.

1. Do not stretch, twist, puncture or tear backer rods.

C. Install bond breaker tape where required by manufacturer's recommendations to ensure joint sealers will perform properly.

D. Size materials to achieve required width/depth ratios.

E. Employ installation techniques that will ensure joint sealers are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of bond surfaces equally on opposite sides.

F. Joint Configuration: Fill sealant joint to a slightly concave surface, slightly below adjoining surfaces, unless otherwise indicated.

G. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture or dirt.

H. Install joint sealers to depths recommended by joint sealer manufacturer but within the following general limitations, measured at center (thin) section of bead.

1. Horizontal Joints: 75% width with minimum depth of 3/8".
2. Elastomeric Joints: 50% width with minimum depth of 1/4".
3. Non-Elastomeric Joints: 75% to 125% of joint width.

I. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces.

1. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

J. Cure joint sealers in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.

K. Maintain finished joints free of embedded matter, ridges and sags.

3.3 CLEANING AND REPAIRING

A. Clean all work and adjacent soiled surfaces.

B. Repair of replace defaced or disfigured finishes caused by work of this Section.

3.4 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

END OF SECTION

HOLLOW METAL FRAMES

SECTION 08 11 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide steel frames, including anchors and silencers.

1. Pressed steel frames include both door and window framing.

1.2 REFERENCES

A. Steel Door Institute (SDI): SDI-100 (ANSI/SDI A250.8) - Recommended Specifications - Standard Steel Doors and Frames.

B. National Association of Architectural Metal Manuf. (NAAMM): Hollow Metal Manual.

C. ASTM E152: Methods of Fire Test of Door Assemblies.

D. NFPA 105: Smoke Control Guide

E. ANSI 117.1: Handicap Code

F. Underwriters Laboratories: Standards as applicable to fire rated doors and frames.

1. Materials tested, labeled and inspected by Warnock Hersey International are acceptable upon approval of authorities.

G. All fire rated doors, frames, and windows shall conform to and be in compliance with the California Building Code as adopted. They shall bear an appropriate UL or WH label.

1.3 SUBMITTALS

All submittals shall be made under the provisions of Section 01 33 00.

A. Shop Drawings

1. Submit complete shop drawings listing openings numerically by architect's opening numbers showing product construction, sizes, anchors, reinforcing, cutouts, elevations, and finish.

2. Submit notes with shop drawings indicating items that vary from plans and specifications, have conflicts for label compliance, are not in compliance with standards referenced above, have door, frame, hardware or function conflicts, or require review and clarification by architect.

B. Installation Instructions

1. Submit installation instructions or field delivery receipt.

2. Instructions for installation, maintenance, and preparation for field painting supplied with delivery of material to jobsite.

C. Schedule: Prepared by supplier, using same reference numbers for details and openings as those on Drawings.

1.4 DELIVERY, STORAGE AND PRODUCT PROTECTION

A. Doors and Frames will be delivered to the job site undamaged with the doors properly protected by cardboard and plastic covering and shall be stored in upright positions, 4 inches off the floor or ground with proper separation for air circulation and shall be stored inside or under complete weather protection. Damage not acknowledged at delivery shall be considered job site damage and the responsibility of the contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Curries
2. Steelcraft
3. The Ceco Corporation

B. Or accepted equal.

2.2 MATERIALS

A. Frames:

1. Welded (pre-assembled) type; minimum 14 gage, galvanized.

a. Frames shall be full face welded, square, accurately sized and have a welded spreader bar at the base for field removal. Acceptable tolerances per SDI 117.

2. Door Silencers: Manufacturer's standard resilient type; removable for replacement.

B. Glazing Stops: Full flush type with glass centered in opening, unsecured side integral with unit, secured side fastened with flush, countersunk Allen type fasteners; minimum 16 gage.

C. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

a. Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high

2) Four anchors per jamb from 60 to 90 inches high

3) Five anchors per jamb from 90 to 96 inches hgh

4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high

5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

D. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

E. Door Louvers: Weatherproof Z-shaped blades with U-shaped frames; 1-3/8" thick; blades 1-1/2" on center; 16 gage welded construction.

1. Provide removable bird screens on interior faces, 1/2" x 1/2" bronze wire mesh.

2.3 FABRICATION

A. Conform to requirements of SDI (ANSI A250 Series) or NAAMM.

B. Reinforce and prepare frames to receive hardware.

1. Refer to Section 08 71 00 for hardware requirements.

2. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

3. Reinforce frames to receive nontemplated, mortised and surface-mounted door hardware.

4. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

C. Frames:

1. Welded Frames: Accurately form and cut mitered corners of welded type frames; weld on inside surfaces; grind welded joints to smooth uniform finish.

2. Head Reinforcement: Reinforce frames wider than 4'-0" with minimum 12 gage formed steel channels welded in place, flush with top of frames.

3. Doors at Glazed Panels: Reinforce jambs and heads of frames for doors which occur adjacent to glazed sidelights and partitions.

D. Door Silencers:

1. Place minimum three single bumpers on single door frames; space equally along strike jambs.

2. Place minimum of two single bumpers on double door frames; place on frame heads.

E. Provide jamb anchors per SDI-100 (ANSI/SDI 250.8) and NAAMM; weld floor jamb anchors in place.

F. Provide double doors tested and approved without astragals.

G. Edge Clearances:

1. Between Doors and Frames: Maximum 1/8" at head and jambs.
2. Door Sills (No Threshold): Maximum 3/8".
3. Door Sills (Threshold): Maximum 3/4" above finished floor.
4. Between Edges of Pairs of Doors: Maximum 1/8".

H. Finish: Comply with requirements of Section 09 90 00 for primer including application and compatibility with specified finishes.

1. Interior Units: Prime paint.

2. Exterior Exposed Units: Apply minimum A60 non-spangle galvanized coating, ASTM A924 and A653.

    a. Surface treat after galvanizing to remove oils and prepare for painting and apply one coat of primer; comply with requirements in Section 09 90 00 – Painting and Coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install frames in accordance with SDI-100 (ANSI/SDI A250.8) and ANSI/SDI A250.11 or NAAMM "Hollow Metal Manual" and with manufacturer's recommendations and installation instructions.

1. Install fire rated units in conformance with fire label requirements and NFPA 80.

B. Install frames plumb and square, and with maximum diagonal distortion of 1/16".

1. Coordinate hardware installation with requirements of Section 08 71 00.

2. Coordinate glass installation with requirements of Section 08 80 00.

C. Remove and replace frames damaged during delivery, storage, installation and construction.

1. Paste filler repair shall not be permitted.

D. After installation, touch-up scratched paint surfaces.

END OF SECTION

HOLLOW METAL FRAMES

SECTION 08 11 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide steel frames, including anchors and silencers.

1. Pressed steel frames include both door and window framing.

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C. ASTM E152: Methods of Fire Test of Door Assemblies.

D. NFPA 105: Smoke Control Guide

E. ANSI 117.1: Handicap Code

F. Underwriters Laboratories: Standards as applicable to fire rated doors and frames.

1. Materials tested, labeled and inspected by Warnock Hersey International are acceptable upon approval of authorities.

G. All fire rated doors, frames, and windows shall conform to and be in compliance with the California Building Code as adopted. They shall bear an appropriate UL or WH label.

1.3 SUBMITTALS

All submittals shall be made under the provisions of Section 01 33 00.

A. Shop Drawings

1. Submit complete shop drawings listing openings numerically by architect's opening numbers showing product construction, sizes, anchors, reinforcing, cutouts, elevations, and finish.

2. Submit notes with shop drawings indicating items that vary from plans and specifications, have conflicts for label compliance, are not in compliance with standards referenced above, have door, frame, hardware or function conflicts, or require review and clarification by architect.

B. Installation Instructions

1. Submit installation instructions or field delivery receipt.

2. Instructions for installation, maintenance, and preparation for field painting supplied with delivery of material to jobsite.

C. Schedule: Prepared by supplier, using same reference numbers for details and openings as those on Drawings.

1.4 DELIVERY, STORAGE AND PRODUCT PROTECTION

A. Doors and Frames will be delivered to the job site undamaged with the doors properly protected by cardboard and plastic covering and shall be stored in upright positions, 4 inches off the floor or ground with proper separation for air circulation and shall be stored inside or under complete weather protection. Damage not acknowledged at delivery shall be considered job site damage and the responsibility of the contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Curries
2. Steelcraft
3. The Ceco Corporation

B. Or accepted equal.

2.2 MATERIALS

A. Frames:

1. Welded (pre-assembled) type; minimum 14 gage, galvanized.

a. Frames shall be full face welded, square, accurately sized and have a welded spreader bar at the base for field removal. Acceptable tolerances per SDI 117.

2. Door Silencers: Manufacturer's standard resilient type; removable for replacement.

B. Glazing Stops: Full flush type with glass centered in opening, unsecured side integral with unit, secured side fastened with flush, countersunk Allen type fasteners; minimum 16 gage.

C. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

a. Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high

2) Four anchors per jamb from 60 to 90 inches high

3) Five anchors per jamb from 90 to 96 inches hgh

4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high

5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

D. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

E. Door Louvers: Weatherproof Z-shaped blades with U-shaped frames; 1-3/8" thick; blades 1-1/2" on center; 16 gage welded construction.

1. Provide removable bird screens on interior faces, 1/2" x 1/2" bronze wire mesh.

2.3 FABRICATION

A. Conform to requirements of SDI (ANSI A250 Series) or NAAMM.

B. Reinforce and prepare frames to receive hardware.

1. Refer to Section 08 71 00 for hardware requirements.

2. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

3. Reinforce frames to receive nontemplated, mortised and surface-mounted door hardware.

4. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

C. Frames:

1. Welded Frames: Accurately form and cut mitered corners of welded type frames; weld on inside surfaces; grind welded joints to smooth uniform finish.

2. Head Reinforcement: Reinforce frames wider than 4'-0" with minimum 12 gage formed steel channels welded in place, flush with top of frames.

3. Doors at Glazed Panels: Reinforce jambs and heads of frames for doors which occur adjacent to glazed sidelights and partitions.

D. Door Silencers:

1. Place minimum three single bumpers on single door frames; space equally along strike jambs.

2. Place minimum of two single bumpers on double door frames; place on frame heads.

E. Provide jamb anchors per SDI-100 (ANSI/SDI 250.8) and NAAMM; weld floor jamb anchors in place.

F. Provide double doors tested and approved without astragals.

G. Edge Clearances:

1. Between Doors and Frames: Maximum 1/8" at head and jambs.
2. Door Sills (No Threshold): Maximum 3/8".
3. Door Sills (Threshold): Maximum 3/4" above finished floor.
4. Between Edges of Pairs of Doors: Maximum 1/8".

H. Finish: Comply with requirements of Section 09 90 00 for primer including application and compatibility with specified finishes.

1. Interior Units: Prime paint.

2. Exterior Exposed Units: Apply minimum A60 non-spangle galvanized coating, ASTM A924 and A653.

    a. Surface treat after galvanizing to remove oils and prepare for painting and apply one coat of primer; comply with requirements in Section 09 90 00 – Painting and Coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install frames in accordance with SDI-100 (ANSI/SDI A250.8) and ANSI/SDI A250.11 or NAAMM "Hollow Metal Manual" and with manufacturer's recommendations and installation instructions.

1. Install fire rated units in conformance with fire label requirements and NFPA 80.

B. Install frames plumb and square, and with maximum diagonal distortion of 1/16".

1. Coordinate hardware installation with requirements of Section 08 71 00.

2. Coordinate glass installation with requirements of Section 08 80 00.

C. Remove and replace frames damaged during delivery, storage, installation and construction.

1. Paste filler repair shall not be permitted.

D. After installation, touch-up scratched paint surfaces.

END OF SECTION

WOOD DOORS

SECTION 08 14 00

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush wood doors, rated and non-rated.

B. Door glazing.

1.2 REFERENCES

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Section 01 42 00 “References” for definitions, acronyms, and abbreviations.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:

1. ANSI/WDMA I.S.1-A – Architectural Wood Flush Doors.
2. ASTM F152 – Standard Test Methods for Tension Testing of Nonmetallic Gasket Materials.
3. AWI Quality Standards for Wood Doors (AWI Section 1300 – Flush Wood Doors).
4. California Referenced Standard Code – SFM Standard 12-7-4, Fire Door Assembly Tests.
5. ITS Directory of Listed Products.
6. UL 10B – Fire Tests of Door Assemblies.
7. WI/AWI Architectural Woodwork Standards, including Supplemental Text.

1.3 SUBMITTALS

A. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, fire ratings, swings, undercuts required, special beveling, special blocking for hardware and identify cutouts for glazing and louvers.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics; factory machining criteria, factory finishing criteria.

C. Samples: Submit two samples of door veneer, 8” x 10” in size illustrating wood species, grain and color.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with WI, Section 9, Custom Grade.

1.5 REGULATORY REQUIREMENTS

A. Fire Door Construction: Conform to California State Fire Marshal Standard 12-7-4.

B. Fire-Rated Doors: All fire rated doors shall have metal labels (including “S” labels) permanently fastened to the hinge stile indicating the fire rating and Testing Agency name. Do not apply primer or finish over fire rating labels.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this Section.

1.7 DELIVERY, STORAGE AND HANDLING

A. Accept doors on site in manufacturer's packaging. Inspect for damage.

B. Comply with requirements in ANSI/WDMA I.S.1 A: How to store, handle, finish, install and maintain wood doors.

C. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.

D. Store flat on a level surface in a dry, well-ventilated building. Cover to keep clean but allow air circulation.

E. Handle with clean gloves and do not drag doors across one another or across other surfaces.

F. Do not subject door to abnormal heat, dryness or humidity.

G. Deliver in clean trucks and, in wet weather, under cover.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.9 COORDINATION

A. Coordinate the work with door opening construction, doorframe, door hardware, door glazing and door louver installation.

1.10 WARRANTY

A. Provide warranty to the following term:

1. Interior Solid Core Doors: Lifetime.

B. Include coverage for delamination of veneer, warping or twisting (not to exceed 1/4” in any face including diagonal) or other defects. Warranty shall cover replacement of door plus costs of hanging and finishing.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Western Oregon Door, Inc.

B. Marshfield Door Systems

C. Mohawk Flush Doors, Inc.

D. VT Industries.

E. Graham.

F. Or accepted equal.

2.2 DOOR CONSTRUCTION

A. All doors shall be 1-3/4” thickness, unless noted otherwise.

B. Solid, non-rated particleboard core: WI Section 12, 5- or 7-ply; Custom Grade standards shall prevail.

C. Solid, 20-minute rated particleboard core: WI Section 12, 5- or 7-ply, Custom Grade.

D. Solid, 45-, 60- and 90-minute rated mineral core: WI Section 12. Stile edges shall be a minimum of 1” before trim on hinge side and 3/4” on lock side, including 1/4” outer edge band of hardwood.

E. Faces: Plain sliced, stain grade cherry veneer for custom finish to match existing wood doors. Use solid stock for exposed edges to match face veneer. Face veneers for pairs of doors shall be selected for color and grain match. Face veneers shall not be less than 1/50” at 12% MC after factory sanding. Crossbanding shall be hardwood, MDF will not be allowed as a veneer substrate (crossband). Thin veneers are not acceptable.

F. Top and bottom rails shall be a minimum of 2-1/4” before trimming, mill option species solid lumber for 20 minute rated and non-rated doors.

G. Provide solid firestop blocking on fire-rated doors with surface mounted hardware or closers, for attachment with screws in lieu of through-bolts.

H. Fire Resistive Doors with 20 minute Fire Rating (positive pressure): Construction shall have fire rating of not less than 20 minutes when tested in accordance with SFM Standard 12-7-4.

I. Fire Resistive Doors with 3/4 Hour or Longer Fire Ratings (positive pressure): Meet requirements of SFM Standard 12-7-4, UL 10 (b)-80 and ASTM F152 for fire rating noted.

2.3 ADHESIVE

A. Facing Adhesive: Type I – waterproof.

2.4 ACCESSORIES

A. Glass Glazing: Comply with wood door manufacturer's written instructions.

B. Glazing Stops: Anemostat Model LoPro, Air Louver, or accepted equal. Factory primed, galvanized steel; mitered corners; prepared for countersink style screws. Sizes as indicated on the Drawings. Install glazing stop fasteners on the non-secure side of doors. Finish in custom color as selected by Architect

1. At fire-rated doors, fire-rating of glazing stops shall match door fire-rating.

2.5 FABRICATION

A. Fabricate non-rated doors in accordance with WI/AWI Architectural Woodwork Standards requirements.

B. Provide blocking at top of door for closer for attachment with screws.

C. Bond edge banding to cores.

D. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

E. Glass Cutouts: Provide cutouts for glass of size and shape indicated.

F. Louver Cutouts: Provide cutouts for louvers of size and shape indicated.

G. Factory seal top and bottom rails before shipment.

H. Bevel both stiles 1/8” in 2” (3° bevel) and undersize doors 1/4” in width so that they swing freely and do not hinge bind.

2.6 FINISH

A. All doors shall be factory pre-finished, equal to WI Section 5, System #3, or accepted equal. Transparent finish, stain color and tone as selected by Architect and accepted on submitted sample. Apply seal coat at all edges of doors prior to final installation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify frame opening conditions.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install rated and non-rated doors in accordance with WI Section 12 requirements, SFM Standard 12-7-4, and UL or Intertek Testing Services (ITS) requirements.

B. Where required, trim non-rated door width by cutting equally on both jamb edges.

C. Where required, trim door height by cutting bottom edge to a maximum of 3/4” above finished floor or threshold.

D. Pilot drill screw and bolt holes.

E. Machine cut for hardware. Core for handsets and cylinders.

F. Coordinate installation of doors with installation of frames specified in Section 08 11 13 “Hollow Metal Doors and Frames”, hardware specified in Section 08 71 00 “Door Hardware”, glazing as specified in Section 08 81 00 “Glass Glazing”, and louvers as specified in this Section.

3.3 INSTALLATION TOLERANCES

A. Maximum Diagonal Distortion (Warp): 1/4” measured with straight edge or taught string, corner to corner, over an imaginary 36” x 84” surface area.

B. Maximum Vertical Distortion (Bow): 1/4” measured with straight edge or taught string, top to bottom, over an imaginary 36” x 84” surface area.

3.4 ADJUSTING

A. Adjust door for smooth and balanced door movement, and wipe clean.

END OF SECTION

ALUMINUM WINDOWS

SECTION 08 52 00

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum Window Systems.

1.2 REFERENCES

A. ASTM International (ASTM):
1. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
2. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
3. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
4. ASTM E 987 - Standard Test Methods for Deglazing Force of Fenestration Products.
5. ASTM E 2068 - Standard Test Method for Determination of Operating Force of Sliding Windows and Doors

B. American Architectural Manufacturers Association (AAMA): AAMA/WDMA/CSA 101/I.S.2/A440 - Standard/Specification for Windows, Doors and Unit Skylights.

C. American Architectural Manufacturers Association (AAMA): AAMA 609 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum.

D. American National Standards Institute (ANSI): ANSI/AAMA 101.88 - Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Doors.

E. Glass Association of North America (GANA): GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Certified test laboratory reports to show compliance with requirements.
2. Manufacturer's standard head, jamb and sill details.
3. Installation methods.
4. Cleaning and maintenance instructions.

B. Shop Drawings: Provide shop drawings indicating details of construction and installation including but not limited to window location chart, window schedule, size, muntin type and design, window elevations, sections and details of multiple window assemblies, hardware, glazing details and interface with adjacent construction.

C. Verification Samples: For each product specified, two samples, representing colors and finishes to be installed.

D. Manufacturer's Certificates: Submit certified independent testing agency reports indicating window units meet or exceed specified performance requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years' experience in producing aluminum windows of the type specified.
   1. Manufacturer must be certified through the PPG Certified Window Fabricator and the Guardian Select Window Fabricator programs.

B. Installer Qualifications: Minimum 2 years' experience installing similar windows.

C. Performance: Comply with AAMA standards and ANSI/AAMA 101.88.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Modify mock-up as required to produce acceptable work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards. Protect from damage.

1.6 SEQUENCING AND SCHEDULING

A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.7 WARRANTY

A. Warranty: Provide manufacturer's standard limited warranty for materials and workmanship.
   1. Aluminum Window Warranty Period: 10 years
   2. Standard Insulating Glass Warranty Period:10 years

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. All Weather Architectural Aluminum

B. Milgard

C. Or accepted equal

2.2 THERMAL BREAK ALUMINUM WINDOWS WITH 2-1/4 INCH FRAME DEPTH; FILL AND DEBRIDGE

A. Aluminum Windows: Series 920 by Milgard or accepted equal.

   1. Window Type:
      A. Fixed window

      B. Awning Window.

2. Compliance: FW-HC75

3. Construction:
   A. Integral Extrusion Walls:
      1) Wall Thickness: 0.094 inches (2.39 mm).
      2) Nominal Web Thickness: 1/8 inch.
   B. Lite is retained from the exterior.
   C. Full perimeter aluminum snap in glazing stops.
   D. Full length pull in flat vinyl gasket.
   E. Corners of Frame and Ventilators: Mitered and welded; muntin and intermediate bars attached to cross joints and abutting sash sections.

4. Thermal Break: Pour and debridge, two part polyurethane.

5. Weatherstripping: Two rows of santoprene, 64A durometer black bulb insert inserted in extruded slot at perimeter of vent and opening; replaceable in field.

2.3 FINISHES

A. Single Color Frames:
   1. Clear Anodized Finish

2.4 Insulated Glazing Units:

A. Insulated Glass Units: ASTM E 774, Class A, 1 inch (25 mm) thick overall except 1120/1520 series, which are ¾ inch (19mm) thick.
B. Glazing Type: [Clear/SunCoat® Low-E, argon gas filled] [Clear/SunCoatMAX™ Low-E] [Clear/Hardcoat Low-E, argon gas filled].
C. Spacer Bar: [Warm edge foam spacer].

PART 3 EXECUTION

3.1 PREPARATION

A. Do not proceed with installation until substrates have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

B. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   1. Verify that openings are dimensionally correct and within allowable tolerances and substrates are plumb, level, and clean.
   2. Verify that anchoring surface is in accordance with approved shop drawings.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's written instructions and recommendations. Adjust for proper operation after installation.

3.3 FIELD QUALITY CONTROL

A. Repair or replace window units not meeting specified performance requirements; re-test an equal quantity of windows.

3.4 CLEANING AND PROTECTION

A. Cleaning:
   1. Clean sealants, caulking, and other materials from surfaces, including adjacent work.
   2. Clean window frames, casings, and glass using materials and methods recommended by the window and glass manufacturer that do not cause defacement of work.
   3. Clean using methods which comply with AAMA 609.
   4. Clean glass using methods which comply with GANA 01-0300.

B. Protect installed products until completion of project.

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

END OF SECTION

DOOR HARDWARE

SECTION 08 71 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide hardware for hollow metal, aluminum and wood doors.

1.2 QUALITY ASSURANCE

A. Access for Persons with Disabilities: Comply with California Code of Regulations, Title 24, and Americans with Disabilities Act Accessibility Guidelines (ADAAG).

B. Supplier: Recognized builders hardware supplier with minimum five years successful experience in scheduling and furnishing hardware; factory-authorized to distribute specified hardware.

1. Provide services of architectural hardware consultant to supervise hardware supply, as directed.

2. Coordinate work of this Section with others directly affected.

3. Send templates within 10 days of hardware schedule approval.

C. Products: Provide each type of hardware (hinges, pivots, locksets, latchsets, closers, trim) from single manufacturer unless otherwise indicated in Hardware Schedule.

D. Existing hardware that is to be removed and re-used is to be maintained in the current condition. Any existing hardware that is damaged during construction is to be replaced.

1.3 REFERENCES

A. ANSI A115 and A115W Series: Door and Frame Preparation Standards.

B. ANSI A156.1 through A156.20: Standards for various hardware items.

C. National Fire Protection Association: NFPA 80, 101,105.

D. California Code of Regulations: Title 24, Part 2, California Building Code.

E. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

1.4 SUBMITTALS

A. Hardware Schedule: Prepare a vertical schedule of hardware:

1. Door numbers must be in numerical sequence.

2. List each opening, door size, door hand, door and frame material, description of to and from, manufacturer’s numbers and finish.

3. Hardware supplier shall retype schedule when changes occur during the project and supply new schedules, at no additional expense.

B. Shop Drawings: Indicate locations and mounting heights of hardware.

1. Supply templates to door and frame manufacturers for proper and accurate sizing and locations of cut-outs for hardware.

C. Product Data: Submit catalog cuts for each type of hardware.

1. Keying Schedule: Coordinate with the Architect.

1.5 KEYING CONFERENCE

A. Upon receipt of approved Hardware Schedule, architectural hardware consultant shall attend keying conference with Owner and Architect.

1.6 WIRELESS ENTRY LICENSES

A. Provide (25) licenses and training to enroll (25) users to the ENGAGE cloud-based mobile and web application for NDE Series wireless locksets.

1.7 OPERATION AND MAINTENANCE DATA

A. Provide manufacturer's parts list and maintenance instructions for each type of hardware supplied and necessary wrenches and tools required for proper maintenance of hardware.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware in manufacturer's original packages, marked for intended opening and use.

B. Pack complete with necessary screws, bolts, keys, instructions, and installation template, if necessary, for spotting mortising tools.

C. Upon delivery, furnish complete list of hardware for checking, clearly marked to correspond with marking on each package.

1. Review list for completeness and accuracy.

1.9 WARRANTY

A. Provide 1-year warranty covering products and workmanship. Warranty period for closers shall be 10 years.

1.10 MAINTENANCE MATERIALS

A. Contractor will provide the owner with all wrenches and tools which were included with hardware including extra screws.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide complete hardware with accessories as required for doors and applications indicated.

B. Acceptable Manufacturers: Provide manufacturers specified and manufacturers listed in Hardware Schedule, with references to catalog numbers and designations.

C. Templates: Furnish templates or physical hardware items to manufacturers concerned sufficiently in advance to avoid delay in Work.

D. Reinforcing Units: Furnished by door manufacturer, coordinated by hardware manufacturer.

E. Fasteners: Furnish as recommended by manufacturer and as required to install secure hardware.

1. Finish: Match hardware.

2. Furnish screws for items applied on gypsum board sufficiently long to provide solid connection to framing or backing

F. Electrical and Mechanical: Make provisions and coordinate requirements for mechanical and electrical devices in connection with hardware.

2.2 HARDWARE ITEMS

A. Review Drawings for hardware group locations and door types; where not fully covered in Hardware Schedule, comply with following general requirements; inform the owner where conflicts occur.

1. Provide hardware items with accessories complete to function as intended.

B. Hinges and Butts: ANSI A156.1; comply with following unless otherwise indicated.

1. Acceptable Manufacturers:

a. Ives.
b. Stanley Hardware Division of Stanley Works. (Hardware Schedule symbol: “ST”).
c. C. McKinney
d. Or accepted equal.

2. Provide minimum 3 hinges to 90" high, 4 hinges to 120" high for each door leaf, unless otherwise indicated.

3. Provide nonferrous butts with non-removable pins at exterior and locked outswinging doors, non-rising at interior doors; stainless steel where labeled; steel butts at labeled interior doors.

4. Provide ball bearing or oilite bearing hinges at doors with closers.

5. Tips: Flat button tips with matching plug.

C. Locking Devices: Provide of metal matching specified finish; interior parts of steel and zinc-dichromate plating, to resist rusting and corrosion; do not supply plastic, die-cast or aluminum mechanisms.

1. Acceptable Manufacturers:

a. Sargent
b. Schlage Lock Co.
c. Or accepted equal.

2. Type:

a. Mortise Locksets: ANSI A156.13, Series 1000, Grade 1, Mortise Type with 6 pin tumbler cylinders, except where otherwise indicated in Hardware Schedule.

b. Cylindrical Locksets: ANSI A156.2, Series 4000, Grade 1, Bored Type (cylindrical) with 6 pin tumbler cylinders, except where otherwise indicated in Hardware Schedule.

3. Lockset and Latchset Design: Solid lever with escutcheon, as selected by Architect.

4. Backset: 2-3/4".

5. Strikes: Furnish standard strikes with extended lips where required to protect trim from being marred by latch bolt; verify type of cutouts provided in metal frames.

D. Cylinders, Keys, and Keying: Hardware manufacturers shall provide for grand master, master key alike or key different keying as directed by the owner.

1. Provide cylinders of extruded brass bar material.

2. Provide construction cylinders for doors requiring locking during construction; construction cylinders shall be removed and replaced just prior to owner occupancy.

3. Submit keys for final use to owner; provide not less than two keys for each lockset, five of each type and level of masterkey, five grand master keys, all stamped “DO NOT DUPLICATE”; and 5% extra blanks.

4. Hardware manufacturers shall key and register lock cylinders.

5. Key Control System: Provide complete key control system with identification and storage capacity suitable for Project.

E. Other Hardware: Provide as indicated, as specified, as included in Hardware Schedule, and as required for complete installation.

1. Acceptable Manufacturers:

PRODUCT	MANUFACTURER	APPROVED SUBSTITUTIONS
HINGES	STANLEY	McKINNEY, HAGER
LOCKS & LATCHES	SARGENT	NONE
CYNLINDERS	SCHLAGE “C” (VERIFY)	
PANICS	SARGENT	NONE
CLOSERS	SARGENT	LCN 4040XP
OVERHEAD STOPS	RIXSON	GLYNN JOHNSON, SARGENT
WALLSTOPS	IVES	ROCKWOOD, TRIMCO
FLOORSTOPS	TRIMCO	ROCKWOOD, IVES
KICKPLATES	TRIMCO	ROCKWOOD, IVES
AUTO DOOR BOTTOMS	PEMKO	NGP, ZERO
SEALS	PEMKO	NGP, ZERO

2. Weatherstripping: Provide continuous weatherstripping at top and sides of exterior doors.

3. Sound Gasketting: Continuous at top and sides of doors, where indicated.

2.3 FINISHES

A. Finishes are identified in the Hardware Schedule included in this Section, but generally brushed chrome unless otherwise noted.

PART 3- EXECUTION

3.1 INSTALLATION

A. Install finish hardware specified under this Section; coordinate with manufacture and installation of doors and frames.

B. Fit hardware prior to painting, then remove for painting of doors and frames before final installation of hardware.

C. Install hardware in accordance with manufacturer's instructions and DHI installation guide for doors and hardware.

D. Fasteners: Use only manufacturers supplied fasteners. Drill and tap at metal and pilot holes at wood. No tek type screws are acceptable.

E. Installers qualifications

1. Approved by supplier.

F. Install finish hardware before painting for accurate fit and then remove for painting and reinstall after final painting.

G. Adjust closers to conform with ADA and California Title 24.

H. Hardware supplier shall visit jobsite prior to ordering hardware to verify compatibility of new hardware specified on existing doors and frames.

I. No extra cost will be allowed because of changes or corrections necessary to facilitate installation of hardware.

3.2 MOUNTING POSITIONS

A. Heights given are center line heights from finished floor.

1. Locks and Latches: 38" to center of lever.

2. Door Pulls: 42" to center of grip.

3. Push Plate: 42"; coordinate with pull location.

4. Push-Pull Bar: 42" to center of bar.

5. Top Hinge: To jamb manufacturer's standard, but not greater than 10" from head of frame to center line of hinge.

6. Bottom Hinge: To jamb manufacturer's standard, but not greater than 12-1/2" from floor to center line of hinge.

7. Intermediate Hinges: Equally spaced between top and bottom hinges and from each other.

8. Hinge Mortise on Door Leaf: 1/4" to 5/16" from stop side of door.

9. Dead Bolt: Not more than 44" from floor to operating lever.

B. Comply with recommendations of Builders Hardware Manufacturers Association, subject to approval, for heights of items not indicated.

3.3 ADJUSTMENT

A. After air supply is turned on, qualified hardware supplier's or manufacturer's representatives shall inspect installation and make adjustments.

1. Adjust closers, locks, and critical operational hardware.

2. Deliver instructions for maintenance and future adjustments to the owner's representative.

3.4 CERTIFICATION

A. At the completion of the Project and prior to final closeout, the hardware consultant shall visit the project and inspect all hardware installed. Consultant shall advise the owner by letter that all hardware is per specification, properly installed and correctly adjusted, or note matters that require correction. Failure to perform these obligations after notification shall result in the hiring of an outside consultant, at Contractor's expense.

3.5 HARDWARE SCHEDULE

A. The Hardware Schedule establishes a type and standard of quality.

B. Examine Drawings and Specifications and furnish proper hardware for door openings, whether listed or not.

C. Bring omissions to attention of the Architect prior to bid opening for instructions; otherwise, list will be considered complete; no extras will be allowed.

D. Hardware Schedule by Groups:

GROUP 1 DOOR 502A.1

3	EA	HINGES FBB168 4.5 X 4.5 NRP	652	STANLEY
1	EA	CLASSROOM SECURITY LOCK SC-8238 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 P10 WDXMS	EN	SARGENT
1	EA	FLOOR STOP 1214H	626	TRIMCO
1	EA	KICKPLATE K0050 10 X 34 CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 2 DOOR 502B.1

3	EA	HINGES FBB168 4.5 X 4.5	652	STANLEY
1	EA	CLASSROOM SECURITY LOCK SC-8238 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 P10 WDXMS	EN	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 3 DOOR 502D.1, 502U.2, 502X.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	PASSAGE 8215 LNJ	626	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 4 DOOR 502E.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	STOREROOM LOCK SC-8204 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CONC. OVERHEAD STOP 1-X36 @ 90DEG	630	RIXSON
1	EA	KICKPLATE L0050 10 X 2LDW CSK	630	TRIMCO
3	EA	SILENCERS SR64	GRAY	IVES

GROUP 5 DOOR 502F.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	CLASSROOM LOCK SC-8237 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CONC. OVERHEAD STOP & HOLD 1-X26 @ 90DEG	630	RIXSON
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
3	EA	SILENCERS SR64	GRAY	IVES

GROUP 6 DOOR 502G.1, 502H.1, 502J.1, 502K.1, 502M.1, 502N.1, 502Q.1, 502R.1, 502Y.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	OFFICE LOCK SC-8205 LNJ (VERIFY KWY)	626	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 7 DOOR 502T.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	CLASSROOM LOCK SC-8237 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 O WDXMS	EN	SARGENT
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	EA	AUTO DOOR BOTTOM 434ARL	ALUM	PEMKO
1	SET	GASKET S44D	DUR	PEMKO

GROUP 8 DOOR 502U.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	DOUBLE LOCKING SC-8259 LNJ (VERIFY KWY)	626	SARGENT
1	EA	WALLSTOP WS407VCX	630	IVES
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	EA	AUTO DOOR BOTTOM 434ARL	ALUM	PEMKO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 9 DOOR 502V.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	CLASSROOM LOCK SC-8237 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 P10 WDXMS	EN	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	EA	AUTO DOOR BOTTOM 434ARL	ALUM	PEMKO
1	SET	GASKET S44D	DUR	PEMKO

GROUP 10 DOOR 502Z.1

3	EA	HINGES FBB168 4.5 X 4.5 NRP	652	STANLEY
1	EA	CLASSROOM SECURITY LOCK SC-8238 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 P10 WDXMS	EN	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 34 CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 11 DOOR 502Z.2

3	EA	HINGES FBB168 4.5 X 4.5 NRP	652	STANLEY
1	EA	PANIC SC-8813F ETJ (VERIFY KWY)	630	SARGENT
1	EA	CLOSER 281 P10 WDXMS	EN	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 34 CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 12 DOOR 502Z.3

3	EA	HINGES FBB168 4.5 X 4.5	652	STANLEY
1	EA	CLASSROOM SECURITY LOCK SC-8238 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 O WDXMS	EN	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 34 CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

END OF SECTION

DOOR HARDWARE

SECTION 08 71 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide hardware for hollow metal, aluminum and wood doors.

1.2 QUALITY ASSURANCE

A. Access for Persons with Disabilities: Comply with California Code of Regulations, Title 24, and Americans with Disabilities Act Accessibility Guidelines (ADAAG).

B. Supplier: Recognized builders hardware supplier with minimum five years successful experience in scheduling and furnishing hardware; factory-authorized to distribute specified hardware.

1. Provide services of architectural hardware consultant to supervise hardware supply, as directed.

2. Coordinate work of this Section with others directly affected.

3. Send templates within 10 days of hardware schedule approval.

C. Products: Provide each type of hardware (hinges, pivots, locksets, latchsets, closers, trim) from single manufacturer unless otherwise indicated in Hardware Schedule.

D. Existing hardware that is to be removed and re-used is to be maintained in the current condition. Any existing hardware that is damaged during construction is to be replaced.

1.3 REFERENCES

A. ANSI A115 and A115W Series: Door and Frame Preparation Standards.

B. ANSI A156.1 through A156.20: Standards for various hardware items.

C. National Fire Protection Association: NFPA 80, 101,105.

D. California Code of Regulations: Title 24, Part 2, California Building Code.

E. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

1.4 SUBMITTALS

A. Hardware Schedule: Prepare a vertical schedule of hardware:

1. Door numbers must be in numerical sequence.

2. List each opening, door size, door hand, door and frame material, description of to and from, manufacturer’s numbers and finish.

3. Hardware supplier shall retype schedule when changes occur during the project and supply new schedules, at no additional expense.

B. Shop Drawings: Indicate locations and mounting heights of hardware.

1. Supply templates to door and frame manufacturers for proper and accurate sizing and locations of cut-outs for hardware.

C. Product Data: Submit catalog cuts for each type of hardware.

1. Keying Schedule: Coordinate with the Architect.

1.5 KEYING CONFERENCE

A. Upon receipt of approved Hardware Schedule, architectural hardware consultant shall attend keying conference with Owner and Architect.

1.6 WIRELESS ENTRY LICENSES

A. Provide (25) licenses and training to enroll (25) users to the ENGAGE cloud-based mobile and web application for NDE Series wireless locksets.

1.7 OPERATION AND MAINTENANCE DATA

A. Provide manufacturer's parts list and maintenance instructions for each type of hardware supplied and necessary wrenches and tools required for proper maintenance of hardware.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware in manufacturer's original packages, marked for intended opening and use.

B. Pack complete with necessary screws, bolts, keys, instructions, and installation template, if necessary, for spotting mortising tools.

C. Upon delivery, furnish complete list of hardware for checking, clearly marked to correspond with marking on each package.

1. Review list for completeness and accuracy.

1.9 WARRANTY

A. Provide 1-year warranty covering products and workmanship. Warranty period for closers shall be 10 years.

1.10 MAINTENANCE MATERIALS

A. Contractor will provide the owner with all wrenches and tools which were included with hardware including extra screws.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide complete hardware with accessories as required for doors and applications indicated.

B. Acceptable Manufacturers: Provide manufacturers specified and manufacturers listed in Hardware Schedule, with references to catalog numbers and designations.

C. Templates: Furnish templates or physical hardware items to manufacturers concerned sufficiently in advance to avoid delay in Work.

D. Reinforcing Units: Furnished by door manufacturer, coordinated by hardware manufacturer.

E. Fasteners: Furnish as recommended by manufacturer and as required to install secure hardware.

1. Finish: Match hardware.

2. Furnish screws for items applied on gypsum board sufficiently long to provide solid connection to framing or backing

F. Electrical and Mechanical: Make provisions and coordinate requirements for mechanical and electrical devices in connection with hardware.

2.2 HARDWARE ITEMS

A. Review Drawings for hardware group locations and door types; where not fully covered in Hardware Schedule, comply with following general requirements; inform the owner where conflicts occur.

1. Provide hardware items with accessories complete to function as intended.

B. Hinges and Butts: ANSI A156.1; comply with following unless otherwise indicated.

1. Acceptable Manufacturers:

a. Ives.
b. Stanley Hardware Division of Stanley Works. (Hardware Schedule symbol: “ST”).
c. C. McKinney
d. Or accepted equal.

2. Provide minimum 3 hinges to 90" high, 4 hinges to 120" high for each door leaf, unless otherwise indicated.

3. Provide nonferrous butts with non-removable pins at exterior and locked outswinging doors, non-rising at interior doors; stainless steel where labeled; steel butts at labeled interior doors.

4. Provide ball bearing or oilite bearing hinges at doors with closers.

5. Tips: Flat button tips with matching plug.

C. Locking Devices: Provide of metal matching specified finish; interior parts of steel and zinc-dichromate plating, to resist rusting and corrosion; do not supply plastic, die-cast or aluminum mechanisms.

1. Acceptable Manufacturers:

a. Sargent
b. Schlage Lock Co.
c. Or accepted equal.

2. Type:

a. Mortise Locksets: ANSI A156.13, Series 1000, Grade 1, Mortise Type with 6 pin tumbler cylinders, except where otherwise indicated in Hardware Schedule.

b. Cylindrical Locksets: ANSI A156.2, Series 4000, Grade 1, Bored Type (cylindrical) with 6 pin tumbler cylinders, except where otherwise indicated in Hardware Schedule.

3. Lockset and Latchset Design: Solid lever with escutcheon, as selected by Architect.

4. Backset: 2-3/4".

5. Strikes: Furnish standard strikes with extended lips where required to protect trim from being marred by latch bolt; verify type of cutouts provided in metal frames.

D. Cylinders, Keys, and Keying: Hardware manufacturers shall provide for grand master, master key alike or key different keying as directed by the owner.

1. Provide cylinders of extruded brass bar material.

2. Provide construction cylinders for doors requiring locking during construction; construction cylinders shall be removed and replaced just prior to owner occupancy.

3. Submit keys for final use to owner; provide not less than two keys for each lockset, five of each type and level of masterkey, five grand master keys, all stamped “DO NOT DUPLICATE”; and 5% extra blanks.

4. Hardware manufacturers shall key and register lock cylinders.

5. Key Control System: Provide complete key control system with identification and storage capacity suitable for Project.

E. Other Hardware: Provide as indicated, as specified, as included in Hardware Schedule, and as required for complete installation.

1. Acceptable Manufacturers:

PRODUCT	MANUFACTURER	APPROVED SUBSTITUTIONS
HINGES	STANLEY	McKINNEY, HAGER
LOCKS & LATCHES	SARGENT	NONE
CYNLINDERS	SCHLAGE “C” (VERIFY)	
PANICS	SARGENT	NONE
CLOSERS	SARGENT	LCN 4040XP
OVERHEAD STOPS	RIXSON	GLYNN JOHNSON, SARGENT
WALLSTOPS	IVES	ROCKWOOD, TRIMCO
FLOORSTOPS	TRIMCO	ROCKWOOD, IVES
KICKPLATES	TRIMCO	ROCKWOOD, IVES
AUTO DOOR BOTTOMS	PEMKO	NGP, ZERO
SEALS	PEMKO	NGP, ZERO

2. Weatherstripping: Provide continuous weatherstripping at top and sides of exterior doors.

3. Sound Gasketting: Continuous at top and sides of doors, where indicated.

2.3 FINISHES

A. Finishes are identified in the Hardware Schedule included in this Section, but generally brushed chrome unless otherwise noted.

PART 3- EXECUTION

3.1 INSTALLATION

A. Install finish hardware specified under this Section; coordinate with manufacture and installation of doors and frames.

B. Fit hardware prior to painting, then remove for painting of doors and frames before final installation of hardware.

C. Install hardware in accordance with manufacturer's instructions and DHI installation guide for doors and hardware.

D. Fasteners: Use only manufacturers supplied fasteners. Drill and tap at metal and pilot holes at wood. No tek type screws are acceptable.

E. Installers qualifications

1. Approved by supplier.

F. Install finish hardware before painting for accurate fit and then remove for painting and reinstall after final painting.

G. Adjust closers to conform with ADA and California Title 24.

H. Hardware supplier shall visit jobsite prior to ordering hardware to verify compatibility of new hardware specified on existing doors and frames.

I. No extra cost will be allowed because of changes or corrections necessary to facilitate installation of hardware.

3.2 MOUNTING POSITIONS

A. Heights given are center line heights from finished floor.

1. Locks and Latches: 38" to center of lever.

2. Door Pulls: 42" to center of grip.

3. Push Plate: 42"; coordinate with pull location.

4. Push-Pull Bar: 42" to center of bar.

5. Top Hinge: To jamb manufacturer's standard, but not greater than 10" from head of frame to center line of hinge.

6. Bottom Hinge: To jamb manufacturer's standard, but not greater than 12-1/2" from floor to center line of hinge.

7. Intermediate Hinges: Equally spaced between top and bottom hinges and from each other.

8. Hinge Mortise on Door Leaf: 1/4" to 5/16" from stop side of door.

9. Dead Bolt: Not more than 44" from floor to operating lever.

B. Comply with recommendations of Builders Hardware Manufacturers Association, subject to approval, for heights of items not indicated.

3.3 ADJUSTMENT

A. After air supply is turned on, qualified hardware supplier's or manufacturer's representatives shall inspect installation and make adjustments.

1. Adjust closers, locks, and critical operational hardware.

2. Deliver instructions for maintenance and future adjustments to the owner's representative.

3.4 CERTIFICATION

A. At the completion of the Project and prior to final closeout, the hardware consultant shall visit the project and inspect all hardware installed. Consultant shall advise the owner by letter that all hardware is per specification, properly installed and correctly adjusted, or note matters that require correction. Failure to perform these obligations after notification shall result in the hiring of an outside consultant, at Contractor's expense.

3.5 HARDWARE SCHEDULE

A. The Hardware Schedule establishes a type and standard of quality.

B. Examine Drawings and Specifications and furnish proper hardware for door openings, whether listed or not.

C. Bring omissions to attention of the Architect prior to bid opening for instructions; otherwise, list will be considered complete; no extras will be allowed.

D. Hardware Schedule by Groups:

GROUP 1 DOOR 502A.1

3	EA	HINGES FBB168 4.5 X 4.5 NRP	652	STANLEY
1	EA	CLASSROOM SECURITY LOCK SC-8238 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 P10 WDXMS	EN	SARGENT
1	EA	FLOOR STOP 1214H	626	TRIMCO
1	EA	KICKPLATE K0050 10 X 34 CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 2 DOOR 502B.1

3	EA	HINGES FBB168 4.5 X 4.5	652	STANLEY
1	EA	CLASSROOM SECURITY LOCK SC-8238 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 P10 WDXMS	EN	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 3 DOOR 502D.1, 502U.2, 502X.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	PASSAGE 8215 LNJ	626	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 4 DOOR 502E.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	STOREROOM LOCK SC-8204 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CONC. OVERHEAD STOP 1-X36 @ 90DEG	630	RIXSON
1	EA	KICKPLATE L0050 10 X 2LDW CSK	630	TRIMCO
3	EA	SILENCERS SR64	GRAY	IVES

GROUP 5 DOOR 502F.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	CLASSROOM LOCK SC-8237 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CONC. OVERHEAD STOP & HOLD 1-X26 @ 90DEG	630	RIXSON
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
3	EA	SILENCERS SR64	GRAY	IVES

GROUP 6 DOOR 502G.1, 502H.1, 502J.1, 502K.1, 502M.1, 502N.1, 502Q.1, 502R.1, 502Y.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	OFFICE LOCK SC-8205 LNJ (VERIFY KWY)	626	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 7 DOOR 502T.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	CLASSROOM LOCK SC-8237 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 O WDXMS	EN	SARGENT
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	EA	AUTO DOOR BOTTOM 434ARL	ALUM	PEMKO
1	SET	GASKET S44D	DUR	PEMKO

GROUP 8 DOOR 502U.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	DOUBLE LOCKING SC-8259 LNJ (VERIFY KWY)	626	SARGENT
1	EA	WALLSTOP WS407VCX	630	IVES
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	EA	AUTO DOOR BOTTOM 434ARL	ALUM	PEMKO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 9 DOOR 502V.1

3	EA	HINGES FBB179 4.5 X 4.5	652	STANLEY
1	EA	CLASSROOM LOCK SC-8237 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 P10 WDXMS	EN	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 2LDW CSK	630	TRIMCO
1	EA	AUTO DOOR BOTTOM 434ARL	ALUM	PEMKO
1	SET	GASKET S44D	DUR	PEMKO

GROUP 10 DOOR 502Z.1

3	EA	HINGES FBB168 4.5 X 4.5 NRP	652	STANLEY
1	EA	CLASSROOM SECURITY LOCK SC-8238 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 P10 WDXMS	EN	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 34 CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 11 DOOR 502Z.2

3	EA	HINGES FBB168 4.5 X 4.5 NRP	652	STANLEY
1	EA	PANIC SC-8813F ETJ (VERIFY KWY)	630	SARGENT
1	EA	CLOSER 281 P10 WDXMS	EN	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 34 CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

GROUP 12 DOOR 502Z.3

3	EA	HINGES FBB168 4.5 X 4.5	652	STANLEY
1	EA	CLASSROOM SECURITY LOCK SC-8238 LNJ (VERIFY KWY)	626	SARGENT
1	EA	CLOSER 281 O WDXMS	EN	SARGENT
1	EA	WALLSTOP WS407CVX	630	IVES
1	EA	KICKPLATE K0050 10 X 34 CSK	630	TRIMCO
1	SET	SEALS S44D	DUR	PEMKO

END OF SECTION

GLAZING

SECTION 08 80 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide miscellaneous glass and glazing for hollow metal work, windows and doors not provided elsewhere including accessories as required for complete installation.

1.2 REFERENCES

A. Glass Association of North America (GANA): Glazing Manual and Sealant Manual.

1.3 SYSTEM DESCRIPTION

A. Safety Glass Standard: CPSC 16 CFR 1201, ANSI Z97.1, and California Building Code Chapter 24.

1.4 SUBMITTALS

A. All submittals shall be submitted under the provisions of Section 01 33 00.

B. Product Data: Furnish for each type of glass, and each type of exposed glazing material.

C. Samples: Furnish two 12 x 12 samples for each glazing type.

1.5 WARRANTY

A. Special Warranties

1. Special Warranty Period: Two years.

PART 2 – PRODUCTS

2.1 GLAZING MATERIALS

A. Tempered Safety Glass: Select glazing quality, clear float glass, fully tempered, ASTM C1048, Kind FT; nominal thickness 1/4"; safety glass.

1. Manufacturers:

a. Ford Glass Division.
b. PPG Industries, Inc.
c. Substitutions: Refer to Section 01 25 13

2. Locations: Provide at doors and at window openings where indicated on drawings and required by applicable codes and federal requirements.

B. Glazing Sealant: ASTM C920, Type S, Grade NS, elastomeric one-component silicone glazing sealants as recommended by sealant manufacturer for application involved.

1. Manufacturers:

a. Dow Corning Corp.
b. General Electric Co.
c. Pecora Corp.
d. Substitutions: Refer to Section 01 25 13.

2. Color: As selected by Architect from manufacturer's full range of available colors.

C. Setting Blocks: 70-90 durometer hardness; 4" long by 3/8" thick by 1/4" high standard setting blocks.

D. Spacer Shims: Silicone compatible, 50 durometer hardness; 3" long by 3/32" thick by 1/4" high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean glazing channels and framing members to receive glass immediately before glazing; remove coatings not firmly bonded to substrate.

B. Apply primer to joint surfaces where recommended by sealant manufacturer.

3.2 INSTALLATION

A. Comply with GANA Glazing Manual and Sealant Manual and glazing manufacturer instructions.

1. Do not allow glass to touch metal surfaces.

2. Comply with NFPA 80 for glass in fire rated openings.

B. Place setting blocks at quarter points in thin course of sealant.

C. Install removable stops with glass centered in space with spacer shims at 2'-0" intervals on both sides of glass, 1/4" below sightline.

D. Sealant at Glazing: Fill gap between glass and stops with sealant to depth equal to bite of frame on glass but not more than 3/8" below sightline.

1. Apply sealant to uniform and level line, flush with sightline; tool or wipe sealant surface for smooth appearance; at exterior locations tool sealant so water is carried away from glass.

3.3 CLEANING

A. Mark glass after installation by crossed streamers attached to framing and held away from glass; do not apply markers to surface of glass.

B. Remove nonpermanent labels immediately after sealant cures; cure sealants for high early strength and durability.

C. Remove and replace glass that is broken, chipped, cracked, abraded or damaged during construction period, including natural causes, accidents and vandalism.

END OF SECTION

GYPSUM BOARD ASSEMBLIES

SECTION 09 21 16

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide gypsum board systems including gypsum board, joint treatment, acoustical accessories, and general accessories for complete installation.

1.2 REFERENCES

A. ASTM C754: Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard.

B. ASTM C840: Application and Finishing of Gypsum Board.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Perform gypsum board systems work in accordance with recommendations of ASTM C754 and ASTM C840 unless otherwise specified.

1. Loads: Comply with California Building Code requirements for design of metal framing for gypsum board systems.

a. Deflection: Maximum L/240 typical, L/360 where plaster or tile is indicated.

2. Seismic Requirements: Comply with code requirements for seismic bracing.

B. Systems Responsibility: Provide products manufactured by or recommended by manufacturer of gypsum board to maintain single-source responsibility for system.

C. Openings: Obtain dimensions and locations from other trades and provide openings and enclosures for accessories, specialties, equipment, and ductwork.

1.4 SUBMITTALS

All submittals shall be made under the provisions of Section 01 33 00.

A. Product Data

1. Provide product data on metal framing, gypsum board, joint tape, and decorative finish.

2. Furnish manufacturer's certification indicating products comply with Contract Documents and applicable codes.

1.5 PROJECT CONDITIONS

A. Do not begin installation of interior gypsum board until space is enclosed, space is not exposed to other sources of water, and space is free of standing water.

B. Maintain areas to receive gypsum board at minimum 50 degree F for 48 hours prior to application and continuously after application until drying of joint compound is complete; comply with ASTM C840.

C. Immediately remove from site gypsum board for interior use exposed to water, including gypsum board with water stains, with signs of mold, and gypsum board with mildew.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. United States Gypsum Co., USG Corp.

B. Georgia-Pacific Corp.

C. National Gypsum Co.

D. Or accepted equal.

2.2 MATERIALS

A. Gypsum Board - Standard

1. ASTM C1396, TYPE X, FIRE RATED, 5/8” thick paper faced gypsum panels with tapered edges.

B. Moisture Resistant Gypsum Board

1. Equal to Georgia Pacific Corp. “Dens-Armor Plus High Performance” 5/8” thick fiberglass faced, treated gypsum panels with tapered edges. Fire rated Type X.

C. Gypsum Board Accessories: Comply with ASTM C840.

1. Gypsum board sealer: Provide one Coat "Hamilton Prep Coat Plus" prior to application of gypsum board texture.

2. Provide protective coated steel corner beads and edge trim; type designed to be concealed in finished construction by tape and joint compound.

3. Corner Beads: Manufacturer's standard metal beads.

4. Edge Trim: “J”, "L", "LK", or "LC" casing beads – manufacturer’s standard.

5. Reinforcing Tape, Joint Compound, Adhesive, Water, Fasteners: Types recommended by system manufacturer and conforming to ASTM C475.

a. Typical Joint Compound: Chemical hardening type for bedding and filling, ready-mixed or powder vinyl type for topping.

6. Control Joints: Back to back casing beads.

a. Back control joints with 4 mil thick polyethylene air seal.

7. Reveals: Extruded aluminum special trim pieces in manufacturer's standard or custom shapes to conform to configurations and dimensions indicated.

    a. Manufactures:

        1) Fry Reglet Corp./Drywall Moldings.
        2) MM Systems Corp./Drywall Moldings.
        3) Gordon Inc./Final Forms I Drywall Trims.
        4) Substitutions: Refer to Section 01 62 00.

D. Gypsum Board Texture: Equal to USG “Sheetrock Brand” ready mixed wall and ceiling spray texture.

E. Acoustic Sealant: Serious Energy “Quiet Seal Pro”, non-hardening, gun grade sealant per ASTM C834.

F. Electrical Box Pads: Provide at outlet, switch and telephone boxes in all walls.

PART 3 - EXECUTION

A. Gypsum Board Installation: Install in accordance with ASTM C840 and manufacturer's recommendations.

1. Use screws when fastening gypsum board to furring and to framing.

2. Erect gypsum board with ends and edges occurring over firm bearing.

    a. Ensure joints of second layer do not occur over joints of first layer in double layer applications.

3. Place control joints to be consistent with lines of building spaces and as directed by Architect.

    a. Provide where system abuts structural elements.
    b. Provide at dissimilar materials.
    c. Lengths exceeding 30'-0" in partitions.
    d. Ceiling areas exceeding 50'-0" or 2500 square feet.
    e. Wings of "L", "U" and "T" shaped ceilings.

4. Place corner beads at external corners; use longest practical lengths.

5. Place edge trim where gypsum board abuts dissimilar materials.

6. Tape, fill, and sand exposed joints, edges, corners and openings to produce surface ready to receive finishes; feather coats onto adjoining surfaces.

7. Finishing: Comply with Gypsum Association (GA) “Levels of Gypsum Board Finish”.

    a. GA Level 4 (Typical): Provide three coat finishing and sanding is required for surfaces indicated to be painted; provide flush, smooth joints and surfaces ready for applied paint finishes.
    b. Texture: Smooth.

8. Remove and replace defective work.

END OF SECTION

NON-STRUCTURAL METAL FRAMING

SECTION 09 22 16

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section includes metal stud framing and accessories.

1.2 REFERENCES

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

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:

1. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A924/A924M – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
3. ASTM C645 – Standard Specification for Nonstructural Steel Framing Members.
4. ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
5. ASTM C1513 – Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
6. SSPC Paint 20 – Zinc Rich Primers.

1.3 SYSTEM DESCRIPTION

A. Interior Walls: Metal stud framing system with batt type acoustic insulation and interior gypsum board

B. Maximum Allowable Deflection:

1. 1:120 span at gypsum board finish.
2. 1:240 span ceramic tile finishes.

C. Wall and Ceiling Systems:

1. Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

1.4 SUBMITTALS

A. Shop Drawings:

1. Indicate component details, stud layout, framed openings, anchorage to structure, type and location of fasteners and accessories or items required of other related work.
2. Describe method for securing studs to tracks, splicing and for blocking and reinforcement to framing connections.

B. Product Data: Submit data describing standard framing member materials and finish, product criteria, load charts and limitations.

C. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C754.

B. Comply with 2010 CBC, Chapter 22A, Section 2210A.

C. Form, fabricate, install, and connect components in accordance with ML/SFA 540.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Company specializing in performing Work of this Section.

PART 2 PRODUCTS

2.1 METAL FRAMING SYSTEM

A. Manufacturers:

1. Clark/Western Building Systems
2. Dietrich Industries, Inc.
3. Marino/Ware
4. CEMCO
5. Or accepted equal.

2.2 COMPONENTS

A. Framing System Components: ASTM C645.

1. 16 Gauge and heavier, F_y = 50 ksi
2. 18 Gauge and lighter, F_y = 33 ksi Minimum.

B. Studs and Joists: ASTM A653/A653M non-load bearing rolled steel, channel shaped, punched for utility access, depths and gauges and spacing as indicated on the drawings.

C. Tracks and Headers: Same material and thickness as studs, bent leg retainer notched to receive studs. Ceiling Runners: With extended leg retainer.

D. Slotted Track: Slotted track system for positive attachment of metal studs to track, for Head of Wall expansion joint movement (cyclic) and static Joint System in fire-rated construction, as detailed and required on Drawings, in compliance with UL 2079 cyclical movement ± 1/2 inch overall 1” movement: Slp-Trk as manufactured by Dietrich Industries, Inc.

1. Forming Steel shall conform to ASTM A653, Grade 33 with a minimum yield point of 33,000 psi.
2. Formed Steel shall be galvanized in accordance with ASTM A924 for a Class G60 by the hot dip process.

3. Slotted track shall be provided in standard widths and gauges, as required and indicated on Drawings. Down standing legs shall be nominally 2-1/2" and shall be provided with 1-1/2" slots at 1" on center.
4. Fasteners:
    a. For attachment of studs to slotted track, minimum No. 8 corrosion resistant by 1/2 inch waferhead screws.
    b. For attachment of Slotted Track to overhead structural element, as provided for the structural details affecting the work.

E. Furring and Bracing Members: Minimum 18 gauge steel in sizes and shapes as indicated on Drawings and to suit application..

F. Fasteners: ASTM C1513, self-drilling, self-tapping corrosion resistant screws.

G. Sheet Metal Backing: 16 gauge.

H. Anchorage Devices: As indicated on the drawings.

I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type II Organic zinc rich.

PART 3 EXECUTION

3.1 EXAMINATION

A. Coordination and project conditions.

B. Verify rough-in utilities are in proper location.

3.2 INSTALLATION

A. Align and secure top and bottom runners as indicated on Drawings.

B. Place two beads of acoustic sealant between runners and substrate, studs and adjacent construction, to achieve acoustic seal.

C. Place two beads of acoustic sealant between studs and adjacent vertical surfaces to achieve acoustic seal.

D. Framing at openings shall be as shown on Drawings. Install intermediate studs at same spacing as wall studs.

E. Install studs vertically at 16" unless otherwise noted on drawings.

F. Install joists horizontally at 16" unless otherwise noted on drawings.

G. Align stud web openings horizontally.

H. Secure studs to tracks as indicated on Drawings.

I. Stud splicing not permissible.

J. Fabricate corners using minimum of three studs.

K. Double stud at wall openings and door and window jambs, not more than 2" from each side of openings.

L. Brace stud framing system rigid.

M. Coordinate erection of studs with requirements of door frames and window frames; install supports and attachments.

N. Backing/Blocking: Shall be provided for all wall and ceiling finishes and for the supporting and anchorage of products, fixtures and equipment for all trades, including, but not limited to, toilet partitions, toilet room accessories, casework, mirrors, trim, applied wall finishes, artwork, wall bumpers, downspout straps, plumbing and electrical fixtures, etc. Coordinate size, type and location of backing and supports with manufacturer or supplier of items requiring backing/blocking.

O. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Install extended leg ceiling runners.

P. Coordinate placement of insulation in stud spaces after stud frame erection.

3.3 ERECTION TOLERANCES

A. Maximum Variation From Indicated Position: 1/8” in 10’ (non-cumulative).

B. Maximum Variation From Plumb: 1/8” in 10’ (non-cumulative).

END OF SECTION

ACOUSTIC CEILINGS

SECTION 09 51 13

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide acoustical ceiling systems with exposed suspended metal grid system, trim, and accessories as required for complete finished installation.

1.2 SYSTEM DESCRIPTION

A. Seismic Design Requirements: Comply with California Building Code requirements for seismic bracing of ceiling suspension system, and with ASTM E580.

1. Ceiling Struts: Provide struts as detailed on Drawings and as required by code, placed maximum 12'-0" on center in both directions and within 6'-0" of each wall.

2. Slack Wires: Provide safety slack wires, two per fluorescent fixture on diagonally opposite corners and a single wire for each recessed down light.

B. Fire Performance Characteristics: Provide products listed by Underwriters Laboratories (UL) or other independent testing laboratory acceptable to applicable authorities.

1. Flame Spread/Smoke Density: Provide products meeting code requirements for maximum 25 flame spread and maximum 25 smoke density.

1.3 REFERENCES

A. ASTM C635: Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636: Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

C. ASTM E580: Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint.

1.4 SUBMITTALS

A. Product Data: Furnish manufacturers' literature.

B. Shop Drawings: Clearly indicate grid layout and related dimensioning, junctions with other work and ceiling finishes, and inter-relation of mechanical and electrical items related to system.

C. Samples: Furnish samples of exposed grid finish and each type of ceiling unit.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Firm with minimum three years successful experience in projects of similar type and scope; acceptable to manufacturer of acoustical units.

1.6 SITE CONDITIONS

A. Do not install ceilings until building is enclosed, sufficient heat is provided, dust-generating activities have terminated and overhead mechanical work is completed, tested and approved.

1. Do not allow acoustical ceiling units to be exposed to moisture; immediately remove acoustical ceiling units with stains, units with signs of mold, and units with mildew.

B. Allow wet work to dry prior to commencement of installation.

C. Maintain uniform temperatures of minimum 60 degrees F and humidity of 20% to 40% prior to, during and after installation.

1.7 EXTRA STOCK

A. Provide 5% cartons of extra tile of each type used for the Owners maintenance use at no additional cost

PART 2 - PRODUCTS

2.1 MATERIALS

A. Suspension System: Comply with ASTM C635, as applicable to type of suspension system required for type of ceiling units indicated.

1. Manufacturers:

a. Armstrong World Industries, Inc.
b. Chicago Metallic Corp.
c. USG, Interiors, Inc./Donn.
d. Substitutions: Refer to Section 01 25 13.

2. Exposed Grid System: Narrow, 9/16” nominal face width, direct hung aluminum or steel ‘T’ exposed grid system.

3. Attachment Devices: Size for 5 times design load indicated in ASTM C635, Table 1, Direct Hung.

4. Hanger Wires: 12 gauge.

5. Straps, Tubes and Angles: Provide galvanized steel as required to meet state and local requirements for seismic design loads.

6. Structural Class: intermediate-duty system, minimum.

7. Edge Molding: Manufacturer's standard angle molding for edges and penetrations of ceiling, with single flange of molding exposed.

8. Finish of Exposed Items: Match Armstrong, Blizzard White ZW.

9. Maximum Allowable Deflection: L/360.

B. Lay-In Panels: ASTM E1264 type and form as indicated on Drawings.

1. Manufacturers:

a. Armstrong World Industries, Inc.

b. USG Interiors, Inc.
c. Or accepted equal.

2. Typical Throughout Building where shown on drawings.

a. Typical Field Lay-In Panels: Armstrong. ULTIMA HIGH NRC. 15/16” Beveled Tedular. Color white. Or accepted equal.

b. Size: 2’-0” x 2’-0” x ¾”.

c. Finish: Standard washable white painted finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Furnish layouts for inserts, clips and other supports required to be installed by other trades for support of acoustical ceilings.

1. Install inserts, clips, and supports where not previously installed and where additional supports are required for complete installation.

B. Measure ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling; do not use less than half width units at borders.

C. Coordinate with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment and partition systems.

3.2 INSTALLATION

A. Installation of all suspended acoustical ceilings shall comply with installation requirements outlined in CBC (Title 24 Part 2), Chapter 25A.

B. Install acoustical ceiling systems in accordance with manufacturer's recommendations and ASTM C636.

1. Finished Ceilings: True to lines and levels and free from warped, soiled or damaged grid or acoustical units.

C. Install ceiling systems in a manner capable of supporting superimposed loads, with maximum permissible deflection of 1/8" in 10'-0".

D. Install after major above-ceiling work is complete; coordinate location of hangers with other work.

1. Ensure suspension system is located to accommodate fittings and units of equipment that is to be placed after installation of ceiling grid.

E. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers and related carrying channels as required to span required distance.

F. Install ceiling suspension system to resist seismic loads as required by state and local codes, including extra hanger wires and compression supports for ceilings and light fixtures.

G. Hang system independently of walls, columns, ducts, pipes and conduit. Where suspension system members are spliced, avoid visible displacement of the longitudinal axis or face plane of adjacent members.

H. Do not support lighting fixtures from or on main runners or cross runners if weight of fixture causes total dead load to exceed deflection capability.

1. Support fixture loads independently or provide supplementary hangers located within 6" of each corner.

I. Do not install fixtures so main runners and cross runners are eccentrically loaded; where fixture installation would produce rotation of runners, provide stabilizer bars.

J. Install edge moldings at intersection of ceiling and vertical surfaces, using maximum lengths, straight, true to line and level; miter corners.

1. Provide edge moldings at junctions with other ceiling finishes.

K. Where required form expansion joints to accommodate movement and maintain visual closure without distorting system.

L. Fit acoustic units in place, free from damaged edges or defects detrimental to appearance and function.

1. Lay directionally patterned units one way with pattern as directed.

2. Fit border units neatly against abutting surfaces.

M. Install system level, in uniform plane and free from twist, warp and dents.

N. Install hold-down clips where required by applicable codes and where ceiling is within 20'-0" of an exterior door.

O. Adjustment: Adjust sags or twists that develop in ceiling system and replace any part that is damaged or faulty.

END OF SECTION

SECTION 09 65 00

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide resilient tile flooring and accessories as required for complete finished installation.

2. Luxury Vinyl Tile (LVT)

1.2 SYSTEM DESCRIPTION / PERFORMANCE REQUIREMENTS

A. Resilient Tile Flammability: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/cm^2 or higher.

B. Resilient Tile Slip Resistance: Provide materials tested under ASTM D2047, James Slip Test with minimum 0.6 rating for floors.

1.3 SUBMITTAL ITEMS

A. Product Data: Furnish manufacturer's product literature and installation instructions **including the manufacturer's maximum acceptable relative humidity (RH) percentage(s) and maximum pH level for each type and style of resilient flooring to be installed.**

B. Samples: Furnish samples of each type of flooring color and pattern.

1.4 PROJECT CONDITIONS

A. Ensure floor surfaces are smooth and flat with maximum variation of 1/8" in 10'-0".

B. Maintain minimum 70 degree F air temperature at flooring installation area for three days prior to, during, and for 24 hours after installation.

1. Store flooring materials in area of application; allow three days for material to reach same temperature as area.

C. Perform Vapor emission and pH testing prior to installation of flooring.

PART 2 - PRODUCTS

2.1 MATERIALS (FLOORING)

A. Luxury Vinyl Tile (LVT):

1. Manufacturers:
   a. Mannington Mills Inc.
   b. Armstrong World Industries, Inc.

c. Or accepted equal.

2. Color and Pattern: As selected by Architect from manufacturer's full range of available colors based on Mannington –Amtico Collection

D. Edge Strips: Homogeneous vinyl or rubber, tapered or bullnose edge, color as selected by Architect.

E. Sub-Floor Leveling Filler: Portland base cement Web-Crete 95 (as manufactured by Bostik or equal) designed for providing thin solid surface for leveling and minor ramping of subsurface to adjacent floor finishes.
   a. Use material capable of being applied and feathered out to adjacent floor without spalling.

F. Primer: As recommended by flooring manufacturer for specified material application.

G. Sealer and Wax: Type recommended by flooring manufacturer for material type and location.

H. Adhesives: Waterproof nontoxic types as recommended by flooring manufacturer for specified material and application.

PART 3 – EXECUTION

3.1 PREPARATION

A. Conform to manufacturer's recommendations for preparation and to ASTM F710. Remove ALL defective materials, and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, etc.

B. Remove sub-floor ridges and bumps; Repair all cracks, expansion joint, control Joints, and open surface honeycombs and fill in accordance with Manufacturers recommendations.

C. Clean floor and apply, trowel and float filler to leave a smooth, flat hard surface; prohibit traffic until filler is cured.

3.2 INSTALLATION – FLOORING

A. Flooring Installation: Conform to manufacturer's recommendations and installation instructions.

B. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.

C. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation; spread only enough adhesive to permit installation of flooring before initial set.

D. Set flooring in place and press with heavy roller to ensure full adhesion.

E. Lay flooring with joints parallel to building lines to produce symmetrical pattern.

F. Install minimum 1/2 tile at room and area perimeter.

G. Terminate resilient flooring at centerline of door openings where adjacent floor finish is dissimilar.

H. Install edge strips at unprotected and exposed edges where flooring terminates.

I. Scribe flooring to walls, columns, floor outlets and other appurtenances, to produce tight joints.

J. Consult with Architect for floor pattern desired in each area.

K. Edge Strips: Install where edge of tile would otherwise be exposed; butt to flooring without gaps; set in adhesive.

3.3 CLEAN-UP AND PROTECTION

A. Remove excess adhesive from floor, base and wall surfaces without causing damage.

B. Clean, seal and wax floor surfaces in accordance with manufacturer's recommendations.

a. Prohibit traffic from floor for 48 hours after installation.

END OF SECTION

RESILIENT BASE

09 65 13

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide contoured resilient base, and accessories as required for complete installation.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/cm^2 or higher.

1.3 SUBMITTALS

A. Product Data: Furnish manufacturer's product literature.

B. Samples: Furnish samples of each base color and type.

1.4 PROJECT CONDITIONS

A. Maintain minimum 70 degree F air temperature at installation area for 3 days prior to, during, and for 24 hours after installation.

B. Store materials in area of application; allow three days for material to reach same temperature as area.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Resilient Base: Meeting performance requirements of ASTM F 1861 Standard Specification for Resilient Wall Base, Type TP Group 1.

1. Type: Extruded rubber.

2. Manufacturers:
   a. Johnsonite, Inc.
   b. Burke
   c. Or accepted equal.

3. Base:

   a. Johnsonite “Millwork Contoured Wall Base” profile: Outline – 5/16” thick x 3 ½” tall wall base.

   b. Provide base in 8 pieces.

   c. Pre-formed corners.

4. Colors: As selected by Architect from manufacturer's full range of available colors.

B. Primers and Adhesives: Water-resistant nontoxic types recommended by base manufacturer for specified material and application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Apply to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required.

1. Fit joints tight and vertical; maintain minimum measurement of 18" between joints.

B. Miter internal corners; use molded sections for external corners and exposed ends.

C. Install base on solid backing, adhere tightly to wall and floor surfaces; fill voids along top edge of base with manufacturer's recommended adhesive filler.

D. Scribe and fit to door frames and other obstructions.

E. Install straight and level to variation of plus or minus 1/8" over 10'-0".

3.2 CLEAN-UP

A. Remove excess adhesive from floor, base and wall surfaces without causing damage.

B. Clean surfaces in accordance with manufacturer's recommendations.

END OF SECTION

RESILIENT BASE

09 65 13

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide contoured resilient base, and accessories as required for complete installation.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/cm^2 or higher.

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E. Install straight and level to variation of plus or minus 1/8" over 10'-0".

3.2 CLEAN-UP

A. Remove excess adhesive from floor, base and wall surfaces without causing damage.

B. Clean surfaces in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 09 84 19

ACOUSTICAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Back-Mounted Acoustical Wall Panels.

B. Installation Accessories.

1.2 REFERENCES

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Section 01 42 00 “References” for definitions, acronyms, and abbreviations.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:

1. ASTM C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
2. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 REGULATORY REQUIREMENTS

A. Conform to Uniform Building Code for Class “A” rating for fabric covered panels in accordance with ASTM E84. Flame Spread: 25 or less; Smoke Developed: 80 or less.

1.4 SUBMITTALS

A. Shop drawings including wall elevations, dimensions, joint locations, anchorage details.

B. Product Data: Manufacturer's catalog information edited to indicate specific products and related accessories to be provided for this Project.

C. Submit four samples 12” x 12” in size illustrating materials and finish, color, and texture of surface, core material, edge, corner details, and wall mounting hardware for Architect’s acceptance.

D. Maintenance Data: Recommended procedures for normal cleaning and removal of stains. Include precautions in use of cleaning materials that may be detrimental to surfaces.

E. Manufacturer's installation instructions.

1.5 MAINTENANCE DATA

A. Include maintenance information on regular cleaning and stain removal.

1.6 WARRANTY

A. Materials shall be warranted against defects and workmanship for a period of five years from the date of substantial completion.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

1. Do not deliver materials to the building until the completion of wet work, such as concrete, plastering, painting is done and the building is completely enclosed.

B. Protect products against damage during delivery and handling.

C. Store all items in a clean, dry indoor storage area, protected from damage and in accordance with manufacturer's instructions.

D. Maintain temperature in storage area above 40 degrees F. without excessive humidity.

E. Do not install damaged material.

1.8 ENVIRONMENTAL CONDITIONS

A. Do not install acoustical panels until the building space is enclosed and weather-tight, and work above ceilings completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near final occupancy.

B. Install under same temperature, humidity conditions that will normally exist when building is occupied.

C. Maintain temperature of all areas to receive acoustical wall treatment at 70 degrees F. for 72 hours before, during and 48 hours after application.

D. Remove material from packaging and allow to acclimatize in area of installation 24 hours before application.

1.9 EXTRA MATERIALS

A. Deliver extra materials equal to 5 percent of each type of acoustical material.

B. All cartons shall be new, unopened, packaged with protective covering for storage, and identified with appropriate labels.

PART 2 PRODUCTS

2.1 ACCEPTABLE PRODUCTS AND MANUFACTURERS

A. Basis-of-Design Product: Sonic Series, Ultra High-Impact Acoustical Panels by Lamvin Inc., Oceanside, CA, 800-446-6329. Provide the named product or accepted equal by one of the following:

1. Tectum, Inc.
2. Wall Technology.
3. Or accepted equal.

2.2 MATERIALS – WALL PANELS

A. Fabricate panels to sizes and configurations indicated on Drawings; attach facing materials to cores to produce installed panels with visible surfaces fully covered and free of wrinkles, sags, blisters, seams, adhesive or other foreign matter and wrapped two inches to the back.

1. Fabricate panels in factory to exact sizes required to fit wall surfaces based on field measurements of completed substrates indicated to receive wall panels.
2. Where square corners are indicated, tailor corners.
3. Dimensional tolerances of finished units: ±1/16".

B. Acoustical wall panels: Facing material laminated to front face, edges and back border of dimensionally stable, rigid glass fiber board core; with edges chemically hardened to reinforce panel perimeter against warpage and damage.

C. Panel Characteristics:

1. Thickness: 1”.
2. Acoustical Core: 6-7 lb. density, rigid fiberglass.
3. Core Facing: Perforated co-polymer plastic, 1/16-inch thick, 3/32-inch diameter holes on 5/32 inch staggered centers with 33% open area.
4. Edge Detail: Square; chemically hardened edges to reinforce panel perimeter against warping and damage.
5. Panel Width: See drawings.
6. Panel Height: See drawings.
7. Fabric: Guilford of Maine, style FR701 2100. Bonded directly to panel face with all edges wrapped a minimum of 1-1/2” to the back of the panel to ensure a flat, wrinkle-free surface with tailored corners. Minimum four colors as selected by Architect.
8. Class A flame spread rating (ASTM E84Tunnel Test).
9. Mounting: Concealed spline mounting.
10. NRC: 0.85 to 0.95 for 1 inch acoustical core thickness (ASTM C423).

PART 3 EXECUTION

3.1 INSPECTION

A. Verify that surfaces and internal wall blocking are ready to receive work, and dimensions are as indicated on shop drawings.

B. Examine surfaces scheduled to receive acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of work. Do not proceed with work until unsatisfactory conditions have been corrected.

C. Beginning of installation means acceptance of substrate construction.

3.2 INSTALLATION

A. See that substrate is acceptable for the successful completion of the work of this Section prior to starting work.

B. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels and scribed to fit adjoining work accurately at borders and penetrations.

C. Comply with panel manufacturer’s written instructions for installation of panels using type of mounting accessories indicated or, if not indicated, as recommended by manufacturer.

D. All fastening devices shall be concealed in completed installation.

E. Wall panels shall be securely affixed by concealed spline method of attachment.

F. Clips shall engage vertical kerfs on the edges of the wall panels. Apply adhesive where necessary.

G. Field cut edges shall be covered by means of on-site fabric wrapping.

H. Prior to final inspection and/or occupancy of the building by the County, review installation and replace all damaged panels, leaving installation complete and ready for occupancy by the County without further work.

3.3 CLEANING

A. Clip any loose threads; remove pulls and extraneous materials.

B. Clean exposed surfaces of acoustical wall panels to remove dust and any other foreign materials and trim edge moldings to comply with manufacturer's instruction for cleaning and touch-up of minor finish damage.

C. Remove surplus materials, rubbish and debris resulting from installation on completion of work, and leave the area of installation in a neat clean condition.

D. Replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, as directed by the County.

3.4 PROTECTION

A. Provide required protection for the acoustical wall panels, including temperature, humidity limitations and dust control so that the work will be without damage and deterioration at the time of acceptance by the County.

END OF SECTION

PAINTING AND COATING

SECTION 09 91 00

PART 1 GENERAL

1.1 WORK INCLUDED

A. Provide painting and finishing of exposed items and surfaces.

a. Specified surface preparation, priming and coats of paint are in addition to shop-priming and surface treatment specified under other sections of work.

b. Painting and finishing includes field finishing of all exterior and interior items not listed as "Surfaces not to be Painted" unless clearly indicated otherwise.

c. Painting and finishing includes field finishing of select shop finished items where indicated as required to match adjacent surfaces, such as mechanical grilles and registers.

d. Field paint exposed bare and covered pipes, ducts, and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work in occupied spaces.

1.2 SURFACES NOT TO BE PAINTED

A. Gaskets and Hardware at doors.
B. Prefinished items including finished metal surfaces, unless noted otherwise.
C. Walls and ceiling in concealed areas and generally inaccessible areas.
D. Moving parts of operating mechanical and electrical units
E. Code-required Labels: Keep equipment identification and fire rating labels free of paint.
F. Plastic smoke stops and weather stripping at doors.

1.3 SUBMITTALS

A. Product Data: Submit product data on all finishing products.

B. Safety Data Sheets: Submit Safety Data Sheets for all painting materials.

C. Samples for Verification:

1. Submit two samples 8-1/2 x 11 inch in size illustrating range of colors, textures and level of gloss finish for each surface-finishing product scheduled.

2. Submit manufacturer's application instructions.

3. Submit color charts in duplicate for all paints, stains and special coatings.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Furnish materials approved for use by applicable air quality management district for limitations of volatile organic compounds for architectural or special coatings as applicable.

B. Products shall meet or exceed the following Federal Specifications:
1. Alkyd Enamel – TT-E-489 QPL
2. Zinc Oxide Primer – TT-P-641

C. Provide manufacturers 5 year written performance guarantee for elastomeric paint and application error (materials and labor).

1.5 REGULATORY REQUIREMENTS

1. Conform to code for flame/fuel/smoke rating requirements for finishes.

2. Conform to requirements of the Environmental Protection Agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, with:

1. Name of material, color and sheen.
2. Manufacturer's name, stock number and date of manufacture.
3. Contents by volume, for major pigment and vehicle constituents.
4. Thinning and application instructions.

1.7 SITE CONDITIONS

A. Apply water-base paints when temperature of surfaces and surrounding air are between 50 and 90 degrees F.

B. Apply solvent-thinned paints when temperature of surfaces and surrounding air are between 45 and 95 degrees F.

C. Do not apply paint in rain, fog or mist; or when relative humidity exceeds 85 percent; or to damp or wet surfaces.

D. Painting may be continued during inclement weather if areas to be painted are enclosed and heated within temperature limits specified.

E. Provide additional temporary ventilation during interior application of paints to eliminate volatile organic compound (VOC) emissions from interior spaces as quickly as possible.

1.8 EXTRA STOCK

A. Provide a one gallon container of each color and surface texture to the Owner.

B. Label each container with color, texture, and room locations, in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Kelly-Moore.

B. Fuller-O'Brien Corp.

C. Sherwin-Williams Co.

D. Dunn-Edwards Corp.

E. Or Accepted Equal

2.2 MATERIALS

A. Definition: "Paint" as used herein means coating systems including primers, emulsions, enamels, stains, sealers and fillers, whether used as prime, intermediate or finish coats.

1. Provide top line quality commercial grade paints.

B. Colors and Finishes:

1. Prior to commencement of painting work, Architect will furnish color numbers or chips for surfaces to be painted.

a. Multiple brush-out samples will be required for each paint finish.

2. Final acceptance of colors will be on wall samples applied on site.

3. Color pigments: Pure, non-fading, applicable types to suit substrates and service indicated; no lead content permitted.

1. Finish Coat Coordination: Provide finish coats which are compatible with prime paints used.

a. Review other Specification sections in which prime paints are provided; ensure compatibility of total coatings systems.

b. Upon request from other trades furnish information on characteristics of finish materials proposed for use.
c. Provide barrier coats over incompatible primers or remove and re-prime as required.

d. Notify Architect in writing of any anticipated problems in use of specified coating systems with substrates primed by others.

C. Material Quality: Materials not bearing manufacturer's identification as a best-grade product shall not be acceptable.

1. Use of proprietary names in color selection is not intended to imply exclusion of equivalent products of other manufacturers.

2. Provide undercoat paints produced by same manufacturer as finish coats; use only thinners approved by paint manufacturer, and use only within recommended limits.

3. Provide finish coats capable of being washed with mild detergent without loss of color, sheen, or pigments.

D. Volatile Organic Compound (VOC) Emissions: Select materials that generate least amount of pollution; consider pollution and volatile organic compound (VOC) emissions generated during manufacturing, transport, installation, use, and disposal.

1. Avoid materials that contain ozone depleting chemicals and that emit potentially harmful volatile organic compound (VOC) emissions.

2. Avoid materials that can leach harmful chemicals into ground water; do not allow potentially harmful chemicals to enter sewers nor storm drains.

3. Select materials that can be reused or recycled and materials with significant percentage of recycled content; set specific recycled content percentages for individual materials; avoid materials difficult to recycle.

PART 3 – EXECUTION

3.1 PREPARATION

A. Inspection: Examine areas and conditions under which painting work is to be applied.

1. Start of painting work indicates acceptance of surfaces and conditions of surfaces and conditions within any particular area.

2. Where exposed items or surfaces are not specifically mentioned in Schedules, paint same as adjacent similar materials or areas.

3. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to a durable paint film.

B. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified for substrate condition.

C. Correct minor defects and clean surfaces which affect work of this Section.

D. Remove hardware, accessories, and items in place and not to be painted, or provide protection prior to surface preparation and painting; after painting reinstall removed items.

E. Clean surfaces before applying paint; remove oil and grease prior to mechanical cleaning; program cleaning so contaminants from cleaning process do not fall onto wet, newly painted surfaces.

F. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair.

G. Cementitious Materials: Prepare by removing efflorescence, chalk, dirt, grease, oils, and by roughening as required to remove glaze.

1. Determine alkalinity and moisture content of surfaces to be painted.

2. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, neutralize before application of paint.

3. Do not paint over surfaces where moisture content exceeds manufacturer's printed directions.

H. Wood: Clean wood surfaces of dirt, oil, and other foreign substances; sandpaper smooth surfaces exposed to view, and dust off.

1. Scrape and clean seasoned knots and apply thin coat of recommended knot sealer, before application of priming coat.

2. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job; prime edges, ends, faces, undersides, and backsides of wood.

3. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler; sandpaper smooth when dry.

I. Ferrous Metals: Touch up shop-applied prime coats wherever damaged using same type of primer as applied in shop or barrier coat compatible with finish paint.

1. Bare Surfaces: Clean surfaces that are not galvanized or shop-coated, of oil, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

2. Galvanized Surfaces: Clean free of oil and surface contaminants, using non-petroleum based solvent; primer and touch-up primer to be zinc-rich primer.

J. Mix painting materials in accordance with manufacturer's directions.

K. Store materials in tightly covered containers; maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

L. Stir materials before application to produce mixture of uniform density, and stir as required during application; do not stir surface film into material, if necessary, strain material before using.

3.2 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by work of this Section.

C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

3.3 APPLICATION

A. Apply paint in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and type of material being applied.

1. Apply additional coats when stains or blemishes show through final coat, until paint is a uniform finish, color and appearance.

2. Provide extra attention to assure dry film thickness at corners and crevices is equivalent to that of flat surfaces.

3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces; paint surfaces behind permanently-fixed equipment and furniture with prime coat only.

4. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

5. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

6. Finish doors on tops, bottoms and side edges same as faces.

7. Sand lightly between each succeeding enamel coat and each varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated or prepared for painting as soon as practicable after preparation.

1. Allow time between successive coatings to permit proper drying.

2. Do not recoat until paint feels firm and does not deform or feel sticky under moderate thumb pressure.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.

D. Prime Coats: Apply to items not previously primed; recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.

E. Finish Coats: Provide even texture; leave no laps, irregularity in texture, skid marks, or other surface imperfections.

F. Completed Work: Match approved samples for color, texture and coverage; remove, refinish or repaint work not accepted.

3.4 PAINTING SYSTEMS

A. Interior Work: Provide the following paint systems:

1. Gypsum Board – Eggshell sheen.
   a. One Coat “Hamilton Prep-Coat Plus" prior to application of gypsum board texture.
   b. One coat PVA primer
   c. Two coats acrylic latex.

2. Steel - Unprimed: Semigloss sheen.
   a. One coat rust inhibitive primer.
   b. Two coats acrylic latex enamel, semi-gloss.

3. Steel - Primed: Semigloss sheen.
   a. One additional coat of rust inhibitive primer.
   b. Two coats acrylic latex enamel, semi-gloss.

4. Steel - Galvanized: Semigloss sheen.
   a. One coat galvanized metal primer.
   b. Two coats acrylic latex enamel, semi-gloss.

B. Sheens: Comply with ASTM D523, reflectance of paint.

1. Flat: 1-10.
2. Satin: 15-30.
3. Eggshell: 30-45.
4. Semigloss: 45-75.
5. Gloss: 75-100.

APPLICATION	TYPE	MPI Gloss Level	Dunn Edwards	Glidden Professional/Devoe	Sherwin Williams	Kelly Moore
PRIMERS						
Interior Gypsum Board	PVA	G1	W101	1030	B28W40	971

					0	
Interior Ferrous Metal	Alkyd	G1	BRPR00	4160	B66-310	1711
Interior Galvanized Metal	Acrylic	G1	UGPR00 or W8	4020	B66W1	1722
FINISHES						
Interior Gypsum Board, Ferrous Metal, and Galvanized Metal	Latex Enamel	G5	SPMA50	1406	B31W251	1650
Interior Gypsum Board	Latex Enamel	G3	SPMA30	1402	B20W251	1686

3.5 CLEAN-UP, PROTECTION AND REPAIR

Clean-Up: During progress of work, remove discarded paint materials, rubbish, cans and rags from site at end of each work day.

1. Clean glass and paint-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.

B. Protection: Protect work of other trades, whether to be painted or not; correct damage by cleaning, repairing or replacing, and repainting, as acceptable to the County.

1. Provide "Wet Paint" signs to protect newly-painted finishes.
2. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces or defaced painted surfaces.

3.6 FIELD QUALITY CONTROL

A. Owner reserves right to invoke material testing procedure at any time during field painting.

B. If test results show material being used does not comply with specified requirement, Contractor may be directed to remove non-complying work, pay for testing, and repaint surfaces.

END OF SECTION

SIGNAGE

SECTION 10 14 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide general signage as indicated complete with attachment devices and accessories as required for complete installation.

B. Provide signage for all concealed items requiring maintenance or operation.

1.2 QUALITY ASSURANCE

A. Access for Persons with Disabilities: Provide signs for assuring access for persons with disabilities in accordance with state and federal regulations.

1. California Regulations: Comply with California Code of Regulations, Title 24, Part 2.

2. Federal Regulations: Comply with Americans with Disabilities Act Accessibility Guidelines (ADAAG).

1.3 SUBMITTALS

A. Shop Drawings: Furnish listing of sign types, lettering and locations, along with overall dimension of each sign.

B. Product Data: Furnish manufacturer's literature, indicate each sign type, style, available colors and method of attachment.

C. Samples: Provide one typical restroom sign in style, type, and finishes selected.

1.4 DELIVERY, STORAGE AND HANDLING

A. Package separately or in like groups of names, labeled as to names enclosed; include installation template, attachment system and installation instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ASI Sign Systems Inc.

B. Mohawk Engraving Company, Incorporated.

C. Best Sign Systems Inc.

D. Cameo, California Metal Enameling Co.

E. Vomar Products, Inc.

F. Impact Architectural Signs, Inc. (Exterior Building Identification).

G. Or Accepted Equal.

2.2 MATERIALS

A. Sign Type: Sub-surface process with dimensional letters.

B. 1/8” non-glare acrylic with solid, custom/color printed on the second surface.

C. 1/32” thick dimensional characters and symbols chemically welded to acrylic signage.

1. Character Type: Raised characters on signs shall be 1/32 inch (0.8mm) minimum above their background. Characters shall be sans serif uppercase, and shall not be italic, oblique, script, highly decorative, or of other unusual forms.

2. Character Size: Character height measured vertically from the baseline of the character shall be 5/8 inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter “I”.

3. Finish and Contrast: Contrast between characters, symbols and their background must be 70% minimum and have a non-glare finish. 1143A.5.1.

4. Proportions: Raised characters on signs shall be selected from fonts when the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.

5. Braille: California Grade 2 Braille shall be used wherever Braille is required in other portions of these standards. Braille signage parameters to follow CBC 2016 1143A.7 and Table 1143A.7.1.

2.3 SIGNAGE TYPES

A. Braille Exit Door Signs: Conforming to ADAAG requirements for signs for permanent rooms, with raised and Braille characters; concealed mounting system.

1. Colors: As selected by Architect.

2. Size and Style: As indicated on Drawings.

B. Emergency Evacuation Signs: Silk-screened polycarbonate with screening on back and with Braille information conforming to ADAAG and California requirements.

1. Information: Provide sign system with information as required by applicable authorities for emergency egress.

2. Silk-Screen Colors: As selected by Architect.

a. Silk-screen Lacquer: Similar to Advanced Screen Products/Industrial Gloss Lacquer Silk-screen Ink; colors as selected by Architect.

3. Size and Style: As indicated on Drawings and acceptable to applicable authorities.

4. Attachment: Method subject to Architect approval.

C. Concealed item signs: Laminated colored plastic core color contrasting to exterior face color; total thickness 0.125”

1. Lettering: Engraved through face material to expose core.

2. Colors: As selected by Architect.

3. Size and Style: Typical room sign 1/2”x1 1/2”.

4. Location: Provide one sign for item conceal within walls, floors, or ceilings that will require maintenance.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Install signs in accordance with manufacturer recommendations and installation instructions, free from distortions and defects.

B. Entry Signs: Install per Drawings.

END OF SECTION

FIRE EXTINGUISHERS & CABINETS

SECTION 10 44 16

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide portable fire extinguishers and cabinets for portable fire extinguishers with accessories as required for complete installation.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fire Extinguishers:

1. Typical: Provide 2A-10BC multi-purpose dry chemical type fire extinguisher.

B. Fire Extinguisher Cabinets: Provide fully recessed mounting.

1. Manufacturers:

a. J.L. Industries/Ambassador Series.
b. Larsen's Mfg. Co./Architectural Series.
c. Potter-Roemer/Alta Series.
d. Or Accepted Equal.

2. Cabinet Depth: Provide cabinets designed for space available in walls with fire extinguisher cabinets, and of sufficient depth to house 2A-10BC multi-purpose dry chemical type fire extinguisher.

3. Trim: Manufacturer's standard edge trim for specified models.

4. Metal Gages: Provide manufacturer's standard gages for cabinets specified.

5. Construction: Mitered and welded one-piece tubular door frames; weld joints and grind smooth; manufacturer's standard steel box with white baked enamel interior finish and primed exterior finish.

a. Steel Doors and Trim: Vertical Duo style, prime coat finished.
b. Door Hardware: Manufacturer’s standard; door to open 180 degrees.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine substrates and conditions under which fire extinguisher cabinets are to be installed.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinets in locations and at mounting height to comply with requirements of governing authorities; prepare recesses in walls as required.

B. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

1. Wherever exact location of units is not shown, locate as directed by the County.

C. Install appropriate fire extinguisher in each cabinet.

3.3 IDENTIFICATION

A. After installation and finishing is completed, silk screen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable.

B. Letter size, style and location as selected by Architect.

END OF SECTION

FIRE EXTINGUISHERS & CABINETS

SECTION 10 44 16

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide portable fire extinguishers and cabinets for portable fire extinguishers with accessories as required for complete installation.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fire Extinguishers:

1. Typical: Provide 2A-10BC multi-purpose dry chemical type fire extinguisher.

B. Fire Extinguisher Cabinets: Provide fully recessed mounting.

1. Manufacturers:

a. J.L. Industries/Ambassador Series.
b. Larsen's Mfg. Co./Architectural Series.
c. Potter-Roemer/Alta Series.
d. Or Accepted Equal.

2. Cabinet Depth: Provide cabinets designed for space available in walls with fire extinguisher cabinets, and of sufficient depth to house 2A-10BC multi-purpose dry chemical type fire extinguisher.

3. Trim: Manufacturer's standard edge trim for specified models.

4. Metal Gages: Provide manufacturer's standard gages for cabinets specified.

5. Construction: Mitered and welded one-piece tubular door frames; weld joints and grind smooth; manufacturer's standard steel box with white baked enamel interior finish and primed exterior finish.

a. Steel Doors and Trim: Vertical Duo style, prime coat finished.
b. Door Hardware: Manufacturer’s standard; door to open 180 degrees.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine substrates and conditions under which fire extinguisher cabinets are to be installed.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinets in locations and at mounting height to comply with requirements of governing authorities; prepare recesses in walls as required.

B. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

1. Wherever exact location of units is not shown, locate as directed by the County.

C. Install appropriate fire extinguisher in each cabinet.

3.3 IDENTIFICATION

A. After installation and finishing is completed, silk screen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable.

B. Letter size, style and location as selected by Architect.

END OF SECTION

WINDOW SHADES

SECTION 12 24 00

PART 1 - GENERAL

1.1 DESCRIPTION

A. Cloth shades, manual and electrically operated, are specified in this section. Window shades shall be furnished complete, including brackets, fittings and hardware.

1.2 QUALITY CONTROL

A. Manufacturer's Qualification: Window shade manufacturer shall provide evidence that the manufacture of shades are a major product, and that the shades have performed satisfactorily on similar installations.

1.3 SUBMITTALS

A. Samples:

1. Shade cloth, each type, 600 mm (24 inch) square, including cord and ring, showing color, finish and texture.

B. Manufacturer's literature and data; showing details of construction and hardware for:

1. Cloth and window shades

1.4 APPLICABLE PUBLICATIONS

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

B. Federal Specifications (Fed. Spec.):

AA-V-00200B	Venetian Blinds, Shade, Roller, Window, Roller, Slat, Cord, and Accessories

C. American Society for Testing and Materials (ASTM):

A167-99(R2009)	Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
B221/B221M-08	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
D635-10	Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

PART 2 - PRODUCTS

2.1 MATERIALS

A. Shade Cloth: translucent. As indicated in drawings.

B. Stainless Steel: ASTM A666

C. Extruded Aluminum: ASTM B221/B221M.

2.2 WINDOW SHADES

A. Mecho Shade Corporation and Lutron Electronics Co., manual operated window shade systems. For type see Drawings.

B. Systems: Provide all shades, manual operated, as complete units produced by one manufacturer, including hardware, accessory items, mounting brackets, fastenings AND fascia.

C. Manual Shade Operating System: Manual type chain operated roller shade system with adjustable slip clutch.

D. Fabrics: Manufacturer's standard fire resistant glass cloth fabrics meeting applicable federal and state fire resistance requirements. Color and pattern as indicated, as selected by Architect from manufacturer's full range of colors and patterns where not otherwise indicated.

2.3 FABRICATION

A. Fabricate shades to fit measurements of finished openings obtained at site.

B. Cloth Window Shades: 3% openness. Rolling type, constructed of shade cloth mounted on rollers. Shade cloth shall have plain sides, and with hem at bottom to accommodate wood slat. Separate shades are required for each individual sash within opening. Length of shades shall exceed height of window approximately 300 mm (12 inches) measured from head to sill, in addition to material required to make up hem:

1. Provide rollers with spindles, nylon bearings, tempered steel springs, and all other related accessories required for positive action. Provide rollers of diameter recommended by shade manufacturer. Staple shade cloth to wood rollers to prevent wrinkling or folding, and on line parallel to axis of rollers so that shade will hang plumb. Space staples not over 90 mm (3-1/2 inches) on centers. Use of tacks is prohibited.

2. Cords shall be of sufficient length to permit shades to be drawn to bottom of opening with ends looped and held with cord rings. Attach cords to hems through metal eyelets in center of slats in bottom hems.

PART 2 - EXECUTION

3.1 INSTALLATION

A. Cloth Window Shades: Mount window shades on end of face brackets, set on metal gussets, or casing of windows as required. Provide extension face brackets where necessary at mullions.

1. Locate rollers in level position as high as practicable at heads of windows to prevent infiltration of light over rollers.

2. Where extension brackets are necessary, on mullions or elsewhere, for alignment of shades, provide metal lugs, and rigidly anchor lugs and brackets.

3. Place brackets and rollers so that shades will not interfere with window and screen hardware.

END OF SECTION

COMMON WORK RESULTS FOR PLUMBING

SECTION 22 05 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. Product Data: Submit brochures for the following materials to the Architect in accordance with the provisions of Division 1 of these specifications.

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

1.5 QUALITY ASSURANCE

A. Codes and Standards:

1. All governing Codes, Ordinances and Agencies, in accordance with the provisions of Division 1 of these specifications.

B. Warranty: In accordance with the provisions of Division 1 of these specifications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in PLUMBING SPECIALTIES Section 221119.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:
   a. Cascade Waterworks Mfg. Co.
   b. Dresser Industries, Inc.; DMD Div.
   c. JCM Industries.
2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:
   a. Eslon Thermoplastics, or equal.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:
   a. Thompson Plastics, Inc., or equal.

D. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:
   a. NIBCO INC., or equal.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:
   a. Epco Sales, Inc.
   b. Watts Industries, Inc.; Water Products Div.
   c. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:
    a. Epco Sales, Inc.
    b. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:
    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Pipeline Seal and Insulator, Inc.
2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:
    a. Calpico, Inc.
    b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:
    a. Precision Plumbing Products, Inc.
    b. Sioux Chief Manufacturing Co., Inc.
    c. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:
    a. Calpico, Inc.
    b. Metraflex Co.
    c. Thunderline “Line-Seal”.
2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening. Polished chrome-plated with set screw.

PART 3 EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as closely as practical to routing indicated on plans.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:
   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

c. Insulated Piping: One-piece, stamped-steel type with spring clips.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

f. Bare Piping in Equipment Rooms: One-piece, cast-brass type.

g. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

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 above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/2 inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.

b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

Q. Aboveground, Exterior-Wall Pipe 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with approved firestop materials, equal to Hilti.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

GENERAL DUTY VALVES FOR PLUMBING PIPING

SECTION 22 05 23

PART 1 GENERAL

1.1 WORK INCLUDED

A. GENERAL-DUTY VALVES FOR PLUMBING PIPING consists of furnishing transportation, labor, materials, and equipment to furnish and install the following general-duty valves:

1. Ball valves.
2. Check valves.
3. Gate valves.

1.2 RELATED WORK

A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 of these specifications.

B. COMMON WORK RESULTS FOR PLUMBING - Section 220500

C. IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT - Section 220553

D. DOMESTIC AND RECYCLED WATER PIPING - Section 221116

1.3 REFERENCES

A. American Society of Mechanical Engineers (ASME)

B. American Water Works Association (AWWA)

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. Codes and Standards:

1. All governing Codes, Ordinance and Agencies, in accordance with the provisions of Division 01 of these specifications.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valved dimensions and design criteria.
2. ASME B31.9 for building service piping valves.

C. NSF Compliance: NSF 61-G for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 PRODUCTS

2.1 VALVES, GENERAL

A. Refer to Valve Applications Article in this Section for applications of valves.

B. Bronze valves shall be made with dezincification-resistant materials.

1. Valves for potable water must comply with California Lead Free Law.
2. Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤ 0.25%. Source: California Health Safety Code (116875).
3. All valves must be 3rd party certified.

C. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

D. Ferrous Valves: NPS 2-1/2” and larger with flanged ends, unless otherwise indicated.

E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

G. Valve Actuator Types:

1. Handwheel: For valves other than quarter-turn types.
2. Handlever: For quarter-turn valves NPS 6 and smaller, except plug valves.
3. Locking Handlever: All valves used in recycled water piping shall be provided with locking handlevers.

H. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With non-rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeves that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.

I. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.
2. Solder Joint: With sockets according to ASME B16.18.

3. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. 2 ½ in. and smaller: Two-Piece, Bronze Ball Valves, Dezincification resistant lead free bronze body with full-port, stainless steel ball and trim; TFE seats; and 600-psig minimum cold working pressure rating and blowout-proof stem, MSS SP-110, NSF-61-G. Provide with locking lever handle feature where used in recycled water piping.

1. Manufacturers:

a. Conbraco Industries, Inc.; Apollo Division: Model 77CLF-100 Series

b. NIBCO INC., Model T-685-66-LF

B. 3 in. and larger: Two-Piece, Bronze Ball Valves: Dezincification resistant lead free bronze body with standard-port, chromium-plated ball and trim; RPTFE seats; and 600-psig minimum cold working pressure rating and blowout-proof stem. Provide with locking lever handle feature where used in recycled water piping.

1. Manufacturers:

a. Conbraco Industries, Inc.; Apollo Division: Model 70LF-100 Series

2.3 BRONZE CHECK VALVES

A. 3 in. and smaller: Y-pattern, Class 125, Bronze, Horizontal Swing Check Valves: Dezincification resistant lead free bronze body with renewable nonmetallic disc and bronze seat, MSS SP-80.

1. Manufacturers:

a. Conbraco Industries, Inc.; Apollo Division: Model 61Y-LF Series

b. NIBCO INC., Model T-413-Y-LF

2.4 BRONZE GATE VALVES

A. 3 in and smaller: Bronze Alloy construction, screw-in bonnet, Non-rising stem, Lead-Free bronze body with bronze solid wedge, dezinctification Resistant, MSS SP-80.

1. Manufacturers:

a. NIBCO INC., Model S or T-113-LF

b. Conbraco Industries, Inc.; Apollo Division: Model 30-LF Series.

2.5 DUCTILE-IRON GATE VALVES

A. 4” and larger: Class 125, Bolted Bonnet, non-rising stem, resilient-wedge, flanged ends, 300 psi, epoxy coated inside and outside, ductile iron body, Lead-Free.

1. Manufacturers:

a. NIBCO INC., Model F-619-RWS

2.6 SPRING-LOADED CHECK VALVES

A. In-Line Check Valve: 2 in. and smaller; Lead-Free Bronze body, threaded, stainless steel spring, 400 psi CWP.

1. Manufacturers:

a. NIBCO, INC., Model T-413-Y-LF.

b. Conbraco Industries, Inc., Apollo Division: Model CVB-61-100-LF Series.

B. Dual Check Valve: 2 in. and smaller; Lead-Free composite body, corrosion resistant internal parts, two (2) independently operated in-line spring-loaded modular checks.

1. Manufacturers:

a. Wilkins Model 705-XL.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or gate valves.
2. Throttling Service: Ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves:

1. Ball Valves: NPS 2 ½ in. and Smaller; Bronze Lead-Free Ball Valves, Two-piece, Full-Port, 600-psig CWP rating with stainless steel ball. NPS 3 in and larger; Bronze Lead-Free Ball Valves, Two-piece, standard-port, 600 psi CWP rating with chromium-plated ball.
2. Swing Check Valves, NPS 3 and Smaller: Lead-Free, “Y”-Pattern, Class 125, bronze.
3. Swing Check Valves, NPS 4 and Larger: Type II, Class 125, ductile iron.
4. Spring-Loaded Check Valves, NPS 2 and Smaller: Class 125, Bronze, stainless steel spring.
5. Gate Valves, NPS 3 in. and smaller: Lead-Free, Bronze, non-rising stem, Lead-Free, Class 125. NPS 4 in. and larger; Ductile iron body, Lead-Free, epoxy coated, flanged ends.

D. Recycled Water Piping: Valves shall be the same as for domestic water piping except as follows:

1. Recycled Water Control Valves: Lever handle valves equipped with a locking feature and painted purple to match the mylar wrapping tape.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

SECTION 22 05 29

PART 1 GENERAL

1.1 WORK INCLUDED

A. Hangers and supports for plumbing piping and equipment consists of furnishing transportation, labor, materials and equipment to furnish and install the following:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

1.2 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 22 Section "Noise, Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.
4. Pipe positioning systems.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Welding shall be performed only by qualified welders, and shall comply with ASME Boiler Construction Code, ANSI Code and State of California requirements.

B. Codes and Standards:

1. All governing codes, ordinances and agencies, in accordance with the provisions of Division 1 of these specifications.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.
3. Hilti Inc.
4. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Hilti Inc.
4. Tolco Inc.
5. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. ERICO/Michigan Hanger Co.
2. Pipe Shields, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:
   a. Hilti, Inc.
   b. ITW Ramset/Red Head.
   c. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Hilti, Inc.
c. ITW Ramset/Red Head.
d. Powers Fasteners.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: 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.

1. Manufacturers:
a. ERICO/Michigan Hanger Co.
b. MIRO Industries.

C. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
5. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
6. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
7. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
8. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
9. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
10. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
11. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
12. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
13. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
14. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
15. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
16. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
10. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
11. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Section "Roof Accessories" for curbs.

H. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

P. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: 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. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in 09

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

NOISE, VIBRATION AND SEISMIC CONTROL OF PLUMBING PIPING AND EQUIPMENT

SECTION 22 05 48

PART 1 GENERAL

1.1 WORK INCLUDED

A. Noise, vibration and seismic control of plumbing piping and equipment consists of furnishing transportation, labor, materials, and equipment to furnish and install the following:

1. Isolators
2. Seismic Restraints

1.2 RELATED DOCUMENTS

A. Drawings and General provisions of the Contract, including General and Supplementary Conditions and Division 1 of these specifications.

1.3 DESCRIPTION

A. Work Included: Isolation of domestic hot and cold water lines, circulation pumps, and water heaters.

1.4 QUALITY ASSURANCE

A. Codes and Standards

1. All governing Codes, Ordinances and Agencies in accordance with the provisions of Division 1 of these specifications.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATORS

A. Type A: Neoprene pad. Waffle, ribbed, or other forms. Typically 1/4 to 5/16 inch thick. Durometers of 40 to 65. Static deflections from 0.01 to 0.07 inches. Nominal design 40 durometer for 0.05 inches static deflection. Provide steel load distribution plates. Size of pad to be specified by isolator supplier based on load per pot. Mason W and WM, Vibrex R, or equivalent.

B. Type D: Is a molded neoprene element enclosed by a ductile housing. The isolator may be utilized in compression, shear or tension. The isolator shall provide seismic restraint in any direction up to 1.0g. The isolator shall be Mason Industries "BR" or approved equal.

C. Type I: Spring hangers. Steel spring with neoprene cap in steel hanger frame. Static deflection range 1.2 to 2.0 inches nominal. Designed to preclude contact of hanger rods with frame (30 degree misalignment.) Mason 30, Vibex RMSA, or equivalent.

D. Type T: Trisolators. Sheet metal sleeve with felt insert to be installed at attachment points of hangers or piping. Semco, Elcen, Elmdor/Stoneman or equivalent shop- fabricated device.

E. Vibration Isolation for Domestic Hot and Cold Water Plumbing Lines.

1. Riser Support: 0.06 inch deflection Type A neoprene pads with load- distribution pads under riser clamps.
2. Horizontal Piping: Minimum 3/8 inch felt between pipe and clevis hanger.
3. Miscellaneous Attachments: Trisolators.
4. Seismic Restraints: Suspended piping - cables as required by code.
5. Vibration Isolation: Isolate plumbing lines within the vicinity of pumps. Plumbing line isolators shall have a static deflection equal to that of the pump isolation.

F. Vibration Isolation for Boiler.

1. 0.06 inch deflection Type A neoprene pads.

G. Vibration Isolation for In-Line Circulation Pumps (Floor Mounted).

1. 0.3-inch deflection housed neoprene mounts, type D.

H. Vibration Isolation for In-Line Circulation Pumps (Hung From Above).

1. 1 inch deflection spring hangers, type I.

I. Seismic Restraints: Suspended piping cables as required by Code.

PART 3 EXECUTION

3.1 INSTALLATION

A. Vibration Isolation: In accordance with the manufacturer's directions.

B. Seismic Restraint: In accordance with the requirements of all applicable Code and Standards, and manufacturers recommendations.

END OF SECTION

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

SECTION 22 05 53

PART 1 GENERAL

1.1 WORK INCLUDED

A. Identification for plumbing piping and equipment consists of furnishing transportation, labor, materials, and equipment to furnish and install the following:

1. Pipe labels.
2. Valve tags.

1.2 RELATED DOCUMENTS

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

B. COMMON WORK RESULTS FOR PLUMBING - Section 220500

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 QUALITY ASSURANCE

A. Codes and Standards:

1. All governing codes, ordinances and agencies, in accordance with the provisions of Division 1 of these specifications.

PART 2 PRODUCTS

2.1 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/4 inches high for pipe sizes 2-1/2 to 6 inches, 3/4 inch high for pipe sizes 1-1/2 to 2 inches and 1/2 high for pipe sizes 1/2 to 1-1/4 inches.

3. Color Field Length: At least 12 inches for pipe sizes 2-1/2 to 6 inches and 8 inches for pipe sizes 1/2 to 2 inches.

4. Non-potable water systems shall have the words “CAUTION: NON-POTABLE WATER, DO NOT DRINK” in upper case lettering.

2.2 VALVE TAGS

A. Valve Tags: Provide a valve tag consisting of a 2 in. dia., 20 ga. brass disk for each valve with 1/2 in. letters identifying service designation. Fasten tags in place with continuous chain around valve stem.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Domestic Water Piping:
   a. Background Color: Green.
   b. Letter Color: White.
2. Industrial Cold Water Piping:
   a. Background Color: Yellow
   b. Letter Color: Black

3. Sanitary Waste and Storm Drainage Piping:
   a. Background Color: Green.
   b. Letter Color: White.

3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units.

END OF SECTION

PLUMBING PIPING INSULATION

SECTION 22 07 19

PART 1 GENERAL

1.1 WORK INCLUDED

A. PLUMBING PIPING INSULATION consists of furnishing transportation, labor, materials, and equipment to furnish and install piping insulation including preformed, rigid and flexible pipe insulation; field-applied jackets; accessories and attachments; and sealing compounds.

1.2 RELATED WORK

A. COMMON WORK RESULTS FOR PLUMBING - Section 220500

B. HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT - Section 220529

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM International)

1.4 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

1.5 QUALITY ASSURANCE

A. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

B. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

C. Codes and Standards:

1. All governing Codes, Ordinances and agencies, in accordance with the provisions of Division 1 of these specifications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT Section.

B. Coordinate clearance requirements with piping Installer for insulation application.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Glass Fiber Insulation:

1. Johns-Manville
2. Pittsburgh-Corning Corporation

B. Closed-Cell Phenolic-Foam Insulation:

1. Kooltherm Insulation Products, Ltd.

2.2 INSULATION MATERIALS

A. Glass Fiber Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.

1. Preformed Pipe Insulation, without Jacket: Comply with ASTM C552, Type II, Class 1.
2. Preformed Pipe Insulation, with Jacket: Comply with ASTM C552, Type II, Class 2.
3. Closed-Cell Phenolic-Foam Insulation: Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C1126, Type III, Grade 1.

B. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.
2. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system.
3. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
4. Adhesive: As recommended by insulation material manufacturer.

D. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- thick, high-impact, ultraviolet-resistant PVC.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

E. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B209, 3003 alloy, H-14 temper.

1. Finish and Thickness: Smooth finish, 0.010 inch thick.
2. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.
3. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 ounces per square yard.

1. Tape Width: 4 inches.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A666, Type 304; 0.020 inch thick.
2. Galvanized Steel: 0.005 inch thick.
3. Aluminum: 0.007 inch thick.
4. Brass: 0.010 inch thick.
5. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches on center.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.
   a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Firestopping and fire-resistive joint sealers are specified in FIRESTOPPING Section.

T. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 GLASS FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches on center.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of the same thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of cellular-glass insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
2. Apply insulation to flanges as specified for flange insulation application.
3. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches on center.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same material and thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer’s written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of phenolic-foam insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered segments of phenolic-foam insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.

1. Draw jacket material smooth and tight.
2. Apply lap or joint strips with the same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Apply jackets with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

C. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

D. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches on center and at end joints.

3.7 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Fire-suppression piping.
4. Drainage piping located in crawl spaces, unless otherwise indicated.
5. Below-grade piping, unless otherwise indicated.
6. Chrome-plated pipes and fittings, unless potential for personnel injury.
7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.8 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.9 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot, tempered and recirculated hot water.

1. Operating Temperature: 60 to 165 degrees F.
2. Insulation Material: Cellular glass fiber, with jacket.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Copper Pipe, 1/2 in and 3/4 inch: 1 inch thick.
   b. Copper Pipe, 1 in to 1-1/2 inch: 1-1/2 inch thick.
   c. Copper Pipe, 2 inch and larger: /2 inches thick.
4. Field-Applied Jacket: Foil and paper at mechanical rooms where piping is exposed.
5. Vapor Retarder Required: Yes.
6. Finish: None.

B. Service: Condensate drain.

1. Operating Temperature: 35 to 60 degrees F.
2. Insulation Material: Closed-cell phenolic foam.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Copper Pipe, 1/2 inch to 1 inch: 1/2 inch thick.
   b. Copper Pipe, 1-1/4 inches and larger: 1/2 inch thick.
4. Finish: None.

END OF SECTION

DOMESTIC WATER PIPING

SECTION 22 11 16

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. Water Service

1. The entire installation shall be in accordance with the rules and regulations of the Local Water Department.
2. Extend domestic cold and hot water to new plumbing fixtures as required.

1.3 SUMMARY

A. Section Includes:

1. Aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Escutcheons.
3. Sleeves and sleeve seals.
4. Wall penetration systems.

B. Related Section:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.5 SUBMITTALS

A. Product Data: For the following products:

1. Dielectric fittings.
2. Escutcheons.
3. Sleeves and sleeve seals.
4. Water penetration systems.

B. Water Samples: Specified in "Cleaning" Article.

C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Domestic water piping.

2. HVAC ductwork.
3. Technology (i.e., projectors, screens, etc.)

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COLD WATER

A. 4” and Larger

1. Pipe: Schedule 40, galvanized steel, threaded.
2. Fittings: 125# galvanized, flanged, cast iron.

B. 3” and Smaller

1. Pipe: Hard Temper, Type “L” copper, with solder joints.
2. Fittings: Wrought copper with solder joints.

C. 2” and Smaller Underground Piping

1. Pipe: Soft Drawn, Type “K” copper, with solder joints.
2. Fittings: Wrought copper with solder joints.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. EPCO Sales, Inc.
   b. Hart Industries International, Inc.
   c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   d. Zurn Plumbing Products Group; Wilkins Water Control Products.
2. Description:
   a. Pressure Rating: 150 psig at 180 deg F.
   b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. Capitol Manufacturing Company.
   b. EPCO Sales, Inc.
   c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
   a. Factory-fabricated, bolted, companion-flange assembly.
   b. Pressure Rating: 150 psig.
   c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous

2.5 ESCUTCHEONS

A. Refer to Section 22 05 00.

2.6 SLEEVES

A. Refer to Section 22 05 00.

2.7 SLEEVE SEALS

A. Refer to Section 22 05 00.

2.8 GROUT

A. Refer to Section 22 05 00.

PART 3 EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

H. Rough-in domestic water piping for water-meter installation according to University’s requirements.

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping adjacent to equipment and specialties to allow service and maintenance.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

R. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

S. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 and Smaller: Fitting-type coupling.
2. NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges:

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to existing water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.

3.7 ESCUTCHEON INSTALLATION

A. Refer to Section 22 05 00.

3.8 SLEEVE INSTALLATION

A. Refer to Section 22 05 00.

3.9 SLEEVE SEAL INSTALLATION

A. Refer to Section 22 05 00.

3.10 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
   b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.13 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:
      i. Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SANITARY WASTE AND VENT PIPING

SECTION 22 13 16

PART 1 GENERAL

1.1 WORK INCLUDED

A. SANITARY WASTE AND VENT PIPING consists of furnishing transportation, labor, materials, and equipment to furnish and install the following for soil, waste, and vent piping inside the building:

1. Pipe and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

B. COMMON WORK RESULTS FOR PLUMBING - Section 220500

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM International)

B. American Water Works Association (AWWA)

C. Cast Iron Soil Pipe Institute (CISPI)

D. Sheet Metal and Air Condition Contractor's National Association (SMACNA)

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be in conformance with the SMACNA Guidelines.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Codes and Standards:

1. All governing Codes, Ordinances and Agencies in accordance with the provisions of Division 1 of these specifications.

PART 2 PRODUCTS

2.1 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings:

1. Soil, waste, vent and storm drain piping to 5 feet outside building: Cast-iron soil pipe and fittings conforming to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74 for all pipe and fittings. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the Engineer. Wrap all underground piping per paragraph 3.3 G, 1 herein.
    a. Manufacturers:
        i. Tyler Pipe
        ii. A.B. & I.
        iii. Charlotte Pipe and Foundry

B. Shielded Couplings: ASTM C1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Above Ground: Type 300 Series stainless steel, "No-Hub" standard duty, shielded couplings as approved by the Cast Iron Soil Pipe Institute, CISPI-310-85 with stainless steel corrugated shield, stainless steel bands and tightening devices and ASTM C564 rubber sleeve. Equivalent to Tyler.
2. Below Ground: Type 304 stainless steel, "No-Hub" by the Cast Iron Soil Pipe Institute, CISPI-310-85 with stainless steel shield, stainless steel band and tightening devices and ASTM C564 rubber sleeve. Equivalent to Husky HD-2000.
    a. Manufacturers:
        i. Clamp-All Corporation
        ii. Husky Technologies.
        iii. Tyler Pipe; Soil Pipe Division

PART 3 EXECUTION

3.1 EXCAVATION

A. Refer to EARTHWORK and TRENCHING AND BACKFILLING Sections for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Soil and waste piping shall be hubless cast-iron soil pipe and fittings; standard-duty shielded, stainless-steel couplings; and hubless-coupling joints.

B. Vent piping shall be hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in civil drawings.

B. Basic piping installation requirements are specified in COMMON WORK RESULTS FOR PLUMBING Section 220500.

C. Install seismic restraints on piping. Seismic-restraint devices are specified in NOISE, VIBRATION AND SEISMIC CONTROLS OF PLUMBING PIPING AND EQUIPMENT Section 220548.

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in PLUMBING SPECIALTIES Section 221119.

F. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

G. Install cast-iron soil piping in conformance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Where soil is corrosive install 8 mil. polyethylene encasement on underground piping in conformance with ASTM A674 or AWWA C105/ANSI AZ1.5. Backfill with clean sand a minimum of 4 inches all around pipe and fittings.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Install soil and waste drainage piping at 2 percent minimum slope, unless otherwise indicated on Drawings:

J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in COMMON WORK RESULTS FOR PLUMBING Section 220500.

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in NOISE, VIBRATION AND SEISMIC CONTROLS Section 220548.

B. Pipe hangers and supports are specified in HANGERS AND SUPPORTS FOR PLUMBING PIPING & EQUIPMENT Section 220529. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs in conformance with to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Hangers and Supports Section.

D. Support vertical piping and tubing at base and at each floor.

E. Horizontal cast-iron no-hub piping: Provide hangers or supports at each side of a no-hub fitting.

F. Install hangers for cast-iron soil piping with maximum horizontal spacing and minimum rod diameters in accordance with the requirements of the California Plumbing Code.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by the CPC.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by the CPC.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by the CPC.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of the authorities having jurisdiction or, in absence of published procedures, in accordance with the requirements of the California Plumbing Code.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

ELECTRIC WATER HEATERS

SECTION 22 33 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following electric water heaters:

1. Commercial, storage electric water heaters.
2. Compression tanks.
3. Water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to SMACNA Guidelines.

1. The term “withstand” means “the unit will remain in place without separation of any part from the device when subjected to the seismic forces specified”.

1.4 SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Operation and Maintenance Data: For electric water heaters to include in emergency, operation, and maintenance manuals.

C. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. 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.

D. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

F. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period(s): From date of Substantial Completion:
   a. Commercial Electric Water Heaters:
      i. Storage Tank: Three years.
      ii. Controls and Other Components: Three years.
   b. Compression Tanks: One year.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 COMMERCIAL ELECTRIC WATER HEATERS

A. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.

1. Manufacturers:
   a. Bradford White Corporation.
   b. Lochinvar Corporation.
   c. A.O. Smith.
2. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement, glass lined.
   a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
      i. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      ii. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Extruded high density.
   b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   c. Insulation: Comply with ASHRAE/IESNA 90.1.
   d. Jacket: Steel with enameled finish.
   e. Heating Elements: Medium watt density with zinc-plated copper sheath.
   f. Temperature Control: Adjustable thermostat.
   g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
   h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
4. Special Requirements: NSF 5 construction.
5. Capacity and Characteristics:
   a. As indicated on Plumbing Drawings.

2.3 COMPRESSION TANKS

A. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

1. Manufacturers:
   a. AMTROL Inc.
   b. Watts Regulator Co.
   c. Wessels Co.
2. Construction:
   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.
3. Capacity and Characteristics:
   a. Working-Pressure Rating: 150 psig.
   b. Capacity Acceptable: 2 gal. minimum.
   c. Air Precharge Pressure: 55 psig.

2.4 WATER HEATER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.

C. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches above the floor.

D. Water Heater Restraint System: Heavy duty water heater seismic restraint system for wall mounting. Install per Manufacturer's direction and detail on plan.

E. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Prepare test reports.

PART 3 EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install commercial water heaters on concrete bases.

1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install seismic restraints for commercial water heaters. Anchor to substrate.

D. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap above floor sink.

E. Install water-heater drain piping as indirect waste to spill by positive air gap over floor sinks. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for hose-end drain valves.

F. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

G. Fill water heaters with water.

H. Charge compression tanks with air.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment and connect wiring according to Division 26 Section "General Electrical Specification."

3.3 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and instantaneous electric water heaters. Refer to Division 01 Section "Closeout Procedures, Demonstration and Training."

END OF SECTION

PLUMBING FIXTURES

SECTION 22 40 00

PART 1 GENERAL

1.1 WORK INCLUDED

A. PLUMBING FIXTURES consists of furnishing transportation, labor, materials, and equipment to furnish and install the following plumbing fixtures and related components:

1. Sinks

1.2 RELATED WORK

A. PLUMBING SPECIALTIES - Section 221119

B. COMMON WORK RESULTS FOR PLUMBING - Section 220500

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

C. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Manufacturer's Literature: Submit brochures on all materials and equipment to the Architect.

B. Other Submittals:

1. Operations and Maintenance Manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Codes and Standards:

1. All governing codes, ordinances and agencies, in accordance with the provisions of Division 1 of these specifications.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sink: As specified.

2.2 PLUMBING FIXTURES AND TRIMS

A. Sink (S-1): Kitchen sink.

1. Stainless steel.
   a. Just, Elkay, Kohler or American Standard
2. Faucet: Chrome deck-mounted 1.8 gpm max flow.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install wall-mounting fixtures with tubular waste piping attached to supports.

E. Install under counter-mounting fixtures and attached to casework.

F. Install fixtures level and plumb according to roughing-in drawings.

G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install toilet seats on water closets.

L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

M. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

N. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

P. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.

Q. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Engineer.

END OF SECTION

BASIC MECHANICAL MATERIALS AND METHODS

SECTION 23 05 00

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. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.
12. Protection of ducts, pipes, and equipment during construction.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.

2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SHOP DRAWINGS AND SUBMITTAL DATA

A. Refer to Contract Documents and Divisions 00 and 01 for requirements.

B. Refer to individual Mechanical Sections for submittals required.

C. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Narrative and Specifications on submittals.

D. Prior to the installation of any systems, Contractor shall submit to the Owner coordinated shop drawings indicating major elements, components, and systems of mechanical equipment including access panel and door locations in relationship with other building components and systems installation, such as but not limited to Division 21, 26 and structural system. Indicate if sequence and coordination of installation are important.

E. If the equipment submitted under Divisions 22 and 23 requires changes in material or labor from that required in the contract plans and Specifications, such changes shall be clearly indicated and submitted as shop drawings.

F. Any approved changes in piping, wiring, controls, or installation procedures required by the equipment manufacturer shall be made at no additional cost to the Owner, and with no reduction in scope.

G. Submit Product Data for the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

H. Submit Welding certificates.

1.5 SERVICE MANUALS

A. Upon completion of the installation, and as a condition of its acceptance, prepare and submit an Operating and Maintenance Manual to the Owner for review. The Contractor shall compile the manual from information supplied by equipment manufacturers and from test and balance data furnished. Each manual shall contain:

1. Complete instructions on the operation of mechanical equipment, including control settings, switch positions, timer operation, etc.
2. Complete instructions regarding the maintenance of mechanical equipment including periods and frequencies of inspections, lubricants required; and exact description of performance of such maintenance and full description of inspections and corrections to make a step-by-step basis.
3. Copy of control and wiring diagrams.

4. Complete nomenclature of replaceable parts, their part numbers, and the name and ad-dress of the nearest vendor.
5. Copy of guarantees and warranties issued for components of the systems, showing dates of expiration. Such dates shall not be sooner than the expiration of the completed installation guarantee specified herein.
6. Copy of the Test and Balance Reports.
7. Name, address and telephone number of the Contractor employed for work under this Division.

B. Submit 3 copies of manuals in hardback binders.

1.6 RECORD DRAWINGS

A. Refer to General and Supplementary Conditions and Divisions 00 and 01 Specification Sections for additional requirements.

B. Two complete sets of hard copy mechanical drawings and an electronic file (CD) in AutoCad shall be provided as record drawings, which shall be separate, clean, prints reserved for the purpose of showing a complete picture of the work as actually installed.

C. Reproducible Drawings:

1. At the completion of his work, the Contractor shall secure, at his cost, a set of reproducible prints and shall copy his record “as installed” data thereon.
2. The Contractor shall certify to the completeness and accuracy of the “as installed” information indicated on the reproducible prints with his signature.
3. On or before the date of the final inspection, the set of reproducible prints along with one print thereof and one set of the marked-up “Record Drawings” shall be delivered to the Owner.
    a. Contractor shall also provide an electronic copy of the “Record Drawings” produced on AutoCad 2008 or later in “dwg” format. (Contractor shall secure a set of contract drawing files to place the “as installed” data on.)
4. These drawings shall be for record purposes for Owner’s use and are not considered Shop Drawings.

1.7 MANUFACTURER’S DIRECTIONS

A. In all cases where manufacturers of articles used in this Contract furnish directions covering points not shown on drawings or specified, such directions shall be followed.

1.8 CODES

A. Code Compliance: All work performed under this Division of the Specification must comply with the latest edition of all applicable codes including but not limited to:

1. California Code of Regulations (CC&R) - Title 24.
2. Current Humboldt County amendments to California Codes.

B. Minimum Requirements: The requirements of the drawings and Specifications are the minimum that will be allowed under this Division.

1.9 PERMITS, LICENSES AND INSPECTIONS

A. Permits: The Contractor shall pay for all permits required by work under this Division.

B. Inspections: Work shall be regularly inspected and certificates of approval shall be delivered to the Owner.

1.10 DRAWINGS

A. Coordination with Other Trades:

1. Check with other sections of the Specifications so that no interferences shall occur and in order that grade lines may be established for the work.
2. Installed work which interferes with the work of other trades shall be removed and rerouted at the discretion of the Owner.
3. No extras will be allowed for changes made necessary by interference with the work of other trades.

1.11 EMERGENCY REPAIRS

A. The Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the Contractor's guarantee bond or relieving the Contractor of his responsibility during the bonding period.

1.12 DAMAGE RESPONSIBILITY

A. The Contractor shall be responsible for damage to the grounds, buildings, or equipment, and the loss of refrigerants, or gases caused by leaks or breaks in pipes or equipment furnished or installed under this work.

1.13 SPECIAL TOOLS

A. If any part of equipment furnished under these Specifications requires a special tool for assembly, adjustment, setting or maintenance thereof and such tool is not readily available on the commercial tool market, it shall be furnished with equipment as a standard accessory.

1.14 SYSTEM ACCEPTANCE

A. Final Review: The Contractor shall request a final review prior to system acceptance after:

1. Completion of the installation of all systems required under the Contract Documents.
2. Submission and acceptance of service manuals.
3. Satisfactory operation of all systems for a period of one week.

B. Acceptance shall be contingent on completion of final review and correction of all deficiencies.

1.15 PRELIMINARY OPERATIONS AND EMERGENCY REPAIRS

A. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis or make emergency repairs without voiding the guarantee or relieving the Contractor of his responsibilities.

1.16 WARRANTY

A. Warranty Coverage: Furnish warranty covering all Work in accordance with general requirements of the Contract.

B. Materials, Equipment, Apparatus, and Labor: Provide new materials, equipment, apparatus and labor to replace defective or faulty Work as directed by the Owner.

C. Services: This guarantee also applies to services such as Instructions, Adjusting, Testing, Noise, Balancing, etc.

D. Extended Warranty: Provide the Owner with a line item option for a five-year parts and labor warranty for the entire mechanical system.

E. Refer to Divisions 00 and 01 for additional requirements.

1.17 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.18 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.19 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified, unless otherwise noted.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BcuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.

b. Dresser Industries, Inc.; DMD Div.

c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.

d. JCM Industries.

e. Smith-Blair, Inc.

f. Viking Johnson.

g. Straub

2. Aboveground Pressure Piping: Pipe fitting.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.

b. Central Plastics Company.

c. Eclipse, Inc.

d. Epco Sales, Inc.

e. Hart Industries, International, Inc.

f. Watts Industries, Inc.; Water Products Div.

g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Available Manufacturers:

a. Capitol Manufacturing Co.

b. Central Plastics Company.

c. Epco Sales, Inc.

d. Watts Industries, Inc.; Water Products Div.

e. Elkhart orCTS, Copper by Steel Flange.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Central Plastics Company.

d. Pipeline Seal and Insulator, Inc.

e. Lamons

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Calpico, Inc.

b. Lochinvar Corp.

c. Southern Specialties.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Perfection Corp.

b. Precision Plumbing Products, Inc.

c. Sioux Chief Manufacturing Co., Inc.

d. Victaulic.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Thunderline Link Seal

b. Calpico, Inc.

c. Metraflex Co.

d. Innerlynx

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

E. PVC Pipe: ASTM D 1785, Schedule 40.

F. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:
    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: Split-Plate, Stamped Steel Type, cast-brass type with polished chrome-plated finish.
    c. Insulated Piping: Split-Plate, Stamped Steel Type, stamped-steel type with spring clips.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-Plate, Stamped Steel Type, cast-brass type with polished chrome-plated finish.
    e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-Plate, Stamped Steel Type, stamped-steel type.
    f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-Plate, Stamped Steel Type, cast-brass type with polished chrome-plated finish.
    g. Bare Piping in Unfinished Service Spaces: Split-Plate, Stamped Steel Type, cast-brass type with polished chrome-plated finish.
    h. Bare Piping in Equipment Rooms: Split-Plate, Stamped Steel Type, cast-brass type.
    i. Bare Piping at Floor Penetrations in Equipment Rooms: Split-Plate, Stamped Steel Type, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs except slab on grade.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs if required for fireproofing.

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 above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Sheet Sleeves: For pipes smaller than NPS 6.

b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 for flashing.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron “wall pipes” for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC non-pressure Piping: Join according to ASTM D 2855.
6. PVC to ABS non-pressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple or flange fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. At the time of rough installation or during storage of equipment and until final startup, protect and cover equipment with plastic and tape to reduce the amount of dust and debris which may collect in the equipment.

3.5 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 9.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

3.7 RECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.9 CUTTING AND PATCHING

A. Sleeves and Inserts: Provide all sleeves, inserts, and openings necessary for the installation of the mechanical work.

B. Openings:

1. Special forming, recesses, chases, and curbs, as necessary for the proper reception and installation of the mechanical equipment, as shown on the drawings, will be provided in the structure under other Divisions.
2. The Contractor shall examine all drawings to ascertain that proper provisions have been made for the work. If such provisions are not made in time, the Contractor shall bear all extra costs incurred in later cutting and patching to accommodate this work.

3.10 OPERATIONAL TESTS

A. Systems shall be operable and capable of maintaining continuous uninterrupted operational service during the operating and demonstration periods of operation.

B. All control systems shall be completely operable with calibration complete and settings properly adjusted.

C. Tests:

1. Pressure tests shall be performed as specified in Section “Testing, Adjusting, and Balancing.”
2. After all systems have been completely installed, connections made and tests completed, Contractor shall make arrangements with the Owner to operate the systems for a period of seven (7) calendar days.
3. The Contractor shall notify the Owner in writing when the operation period may start and the time for this period shall be scheduled by mutual agreement.

3.11 LOW VOLTAGE, DIVISIONS 23 & 23 SYSTEM SEAMLESS INTEGRATION

A. “Seamless Integration” between among various systems is required by these specifications. Affected systems include, but are not limited to the following:

1. Fire Alarm/Life Safety.
2. Security.
3. Electrical Systems.

B. The Contractor shall have overall responsibility for the coordination of all required interfaces, seamless integration’s and compatibility of systems. The Contractor shall ensure that the systems interfaces and integrations are complete, comply with all applicable codes and regulations, and are compatible. The Contractor shall ensure that the integrations include all required software, system modifications and exchange of protocol.

C. The Contractor shall include in the bid all associated costs, to implement the seamless integration’s, covered in the work of the affected systems and/or trades.

3.12 DUCTWORK PROTECTION DURING CONSTRUCTION

A. At the time of rough installation or during storage on the construction site and until final startup of the heating and cooling equipment, all ducts and other related air distribution component openings shall be covered with tape and plastic to reduce the amount of dust and debris which may collect in the system. Systems that are operational during construction shall be provided with filtration at the supply diffusers to avoid dust and debris from entering the space during duct maintenance.

END OF SECTION

BASIC MECHANICAL MATERIALS AND METHODS

SECTION 23 05 13

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Rotor: Random-wound, squirrel cage.

E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating.

G. Insulation: Class F.

H. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

METERS AND GAGES

SECTION 23 05 19

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. Thermometers.
2. Gages.
3. Test plugs.
4. Flowmeters.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Product Certificates: For each type of thermometer gage flowmeter, signed by product manufacturer.

C. Operation and Maintenance Data: For flowmeters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Palmer - Wahl Instruments Inc.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Case: Die-cast aluminum or brass, 9 inches long.

C. Tube: Blue reading, organic-liquid filled, with magnifying lens. No Mercury.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 DUCT-TYPE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Miljoco Corp.
2. Palmer - Wahl Instruments Inc.
3. Trerice, H. O. Co.
4. Weiss Instruments, Inc.

B. Case: Die-cast aluminum, 7 inches long.

C. Tube: Red or blue reading, organic liquid filled, with magnifying lens. No Mercury.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass or plastic.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Metal, for installation in mounting bracket and of length to suit installation.

H. Mounting Bracket: Flanged fitting for attachment to duct and made to hold thermometer stem.

I. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Marsh Bellofram.
5. Miljoco Corp.
6. NANMAC Corporation.
7. Noshok, Inc.
8. Palmer - Wahl Instruments Inc.
9. REO TEMP Instrument Corporation.

10. Tel-Tru Manufacturing Company.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

B. Manufacturers: Same as manufacturer of thermometer being used.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Eugene Ernst Products Co.
5. KOBOLD Instruments, Inc.
6. Marsh Bellofram.
7. Miljoco Corp.
8. Noshok, Inc.
9. Palmer - Wahl Instruments Inc.
10. REO TEMP Instrument Corporation.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type, drawn steel or cast aluminum, 4 or 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red metal.
7. Window: Glass.
8. Ring: Brass.

9. Accuracy: Grade A, plus or minus 1 percent of middle half B, plus or minus 2 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Remote-Mounting, Dial-Type Pressure Gages: ASME B40.100, indicating-dial type.

1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inchdiameter with holes for panel mounting.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red metal.
7. Window: Glass.
8. Ring: Brass.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

D. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

2.6 WAFER-ORIFICE FLOW METERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Inc.; ABB Instrumentation.
2. Armstrong Pumps, Inc.
3. Badger Meter, Inc.; Industrial Div.
4. Bell & Gossett; ITT Industries.

B. Description: Differential-pressure-design orifice insert for installation between pipe flanges; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.

C. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.

D. Pressure Rating: 300 psig.

E. Temperature Rating: 250 deg F.

F. Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.

G. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.

H. Portable Indicators: Differential-pressure type calibrated for connected flowmeter element and having two 12-foot hoses in carrying case.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of range.

I. Operating Instructions: Include complete instructions with each flowmeter.

2.7 VENTURI FLOWMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps, Inc.
2. Badger Meter, Inc.; Industrial Div.
3. Bailey-Fischer & Porter Co.
4. Flow Design, Inc.
5. Hyspan Precision Products, Inc.
6. Victaulic Co. of America.

B. Description: Differential-pressure design for installation in piping; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.

C. Construction: Bronze, brass, or factory-primed steel; with brass fittings and attached tag with flow conversion data.

D. Pressure Rating: 250 psig.

E. Temperature Rating: 250 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged or welded.

H. Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.

1. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter elemenScale: Gallons per minute.
2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.

I. Portable Indicators: Differential-pressure type calibrated for connected flowmeter element and having two 12-foot hoses in carrying case.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of range.

J. Operating Instructions: Include complete instructions with each flowmeter.

2.8 TURBINE FLOWMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Badger Meter, Inc.; Industrial Div.
2. Bailey-Fischer & Porter Co.
3. Data Industrial Corp.
4. ONICON Incorporated.
5. Thermo Measurement Ltd.

B. Description: Insertion type for inserting turbine into piping and measuring flow directly in gallons per minute.

C. Construction: Bronze or stainless-steel body; with plastic turbine or impeller and integral direct-reading scale.

D. Pressure Rating: 150 psig minimum.

E. Temperature Rating: 180 deg F minimum.

F. Display: Visual instantaneous rate of flow, with register to indicate total volume in gallons.

G. Accuracy: Plus or minus 2-1/2 percent.

2.9 PITOT-TUBE FLOWMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dieterich Standard Inc.
2. Meriam Instruments Div.; Scott Fetzer Co.
3. Preso Meters Corporation.
4. Taco, Inc.
5. Veris Industries.

B. Description: Insertion-type, differential-pressure design for inserting probe into piping and measuring flow directly in gallons per minute.

C. Construction: Stainless-steel probe of length to span inside of pipe; with integral transmitter and direct-reading scale.

D. Pressure Rating: 150 psig minimum.

E. Temperature Rating: 250 deg F minimum.

F. Display: Visual instantaneous rate of flow, with register to indicate total volume in gallons.

G. Integral Transformer: For low-voltage power connection.

H. Accuracy: Plus or minus 1 percent for liquids and gases.

2.10 FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brooks Instrument Div.; Emerson Electric Co.
2. Dwyer Instruments, Inc.
3. Ernst Gage Co.
4. Eugene Ernst Products Co.
5. McCrometer, Inc.OPW Engineered Systems; Dover Corp.
6. Penberthy, Inc.

B. Description: Instrument for installation in piping systems for visual verification of flow.

C. Construction: Bronze or stainless-steel body; with sight glass and plastic pelton-wheel indicator, and threaded or flanged ends.

D. Pressure Rating: 125 psig.

E. Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the following locations:

1. Inlet and outlet of each hydronic zone excluding reheat coil at VAV boxes.

2. Inlet and outlet of each hydronic coil in air-handling units, water-cooled units and built-up central systems.

B. Provide the following temperature ranges for thermometers:

1. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
2. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.
3. Air Ducts: Minus 40 to plus 110 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

B. Install dry-case-type pressure gages at chilled- and condenser-water inlets and outlets of chillers.

C. Install dry-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.

C. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.

D. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.

E. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

F. Install remote-mounting pressure gages on panel.

G. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).

H. Install needle-valve and syphon fitting in piping for each pressure gage for steam.

I. Install test plugs in tees in piping.

J. Install flow indicators, in accessible positions for easy viewing, in piping systems.

K. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.

L. Install flowmeter elements in accessible positions in piping systems.

M. Install differential-pressure-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions.

N. Install wafer-orifice flowmeter elements between pipe flanges.

O. Install permanent indicators on walls or brackets in accessible and readable positions.

P. Install connection fittings for attachment to portable indicators in accessible locations.

Q. Install flowmeters at discharge of hydronic system pumps and at inlet of hydronic air coils.

R. Mount meters on wall if accessible; if not, provide brackets to support meters.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

3.5 ADJUSTING

A. Calibrate meters according to manufacturer’s written instructions, after installation.

B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 23 05 19

VALVES

SECTION 23 05 23

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 general-duty valves:

1. Bronze ball valves.
2. Ferrous-alloy butterfly valves.
3. Bronze check valves.
4. Bronze gate valves.
5. Cast-iron gate valves.
6. Bronze globe valves.
7. Cast-iron globe valves.
8. Chainwheel actuators.

B. Related Sections include the following:

1. Division 2 piping Sections for general-duty and specialty valves for site construction piping.
2. Division 21 fire-suppression piping and fire pump Sections for fire-protection valves.
3. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and charts.
4. Division 23 Section "HVAC Instrumentation and Controls" for control valves and actuators.
5. Division 23 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NRS: Nonrising stem.
4. OS&Y: Outside screw and yoke.
5. PTFE: Polytetrafluoroethylene plastic.
6. SWP: Steam working pressure.
7. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.

1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
3. Basis-of-Design Product: The design for each valve is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

C. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

D. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.

E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

G. Valve Actuators:

1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Handwheel: For valves other than quarter-turn types.
3. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

H. Valves in Insulated Piping: Valves shall have 2-inch stem extensions and the following features:

1. Gate Valves: Shall be rising-stem type.
2. Ball Valves: Shall have extended operating handle of non-thermal-conductive material, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied. Valves installed in reclaimed water systems shall have locking handle feature.
3. Basis-of-Design Product: NIBCO Nib-seal handle extension or a comparable product by one of the following:
   a. Conbraco Industries, Inc.; Apollo Div.
   b. Jamesbury, Inc.
   c. Milwaukee
4. Butterfly Valves: Shall have extended necks.

I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

J. Valve Grooved Ends: AWWA C606.

K. Solder Joint: With sockets according to ASME B16.18.

1. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.

L. Threaded: With threads according to ASME B1.20.1.

M. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, General: MSS SP-110 and have bronze body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder ends, and blowout-proof stems.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel vented ball and stem, reinforced TFE seats, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, soldered or threaded ends; 150 psig SWP and 600-psig CWP ratings.

1. Basis-of-Design Product: NIBCO Model S-585-70-66 or T-585-70-66, or a comparable product by one of the following:

a. Conbraco Industries, Inc.; Apollo Div.

2.4 FERROUS-ALLOY BUTTERFLY VALVES

A. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, for bubble-tight shutoff, extended-neck for insulation, disc and lining suitable for potable water, unless otherwise indicated, and with the following features:

1. Full lug, grooved and flanged valves shall be suitable for bi-directional dead end service at full rated pressure without the use or need of a downstream flange. Valves NPS 12 and smaller shall not have exposed stem to disc fasteners and no exterior mounted fasteners to hold the liner.

2. Valve sizes NPS 2 through NPS 6 shall have lever lock operator; valve sizes NPS 8 and larger shall have weatherproof gear operator.

B. Single-Flange, 150-psig CWP Rating, Aluminum-Bronze Disc, EPDM Seat, Ferrous-Alloy Butterfly Valves: Full-lug type with ductile-iron body, one- or two-piece Type 416 stainless-steel stem, bronze bushing, aluminum-bronze disc, and phenolic-backed EPDM seat (liner) attached to the body.

1. Basis-of-Design Product: NIBCO Model LD-1000-5, or a comparable product by one of the following:

a. Demco

b. Apollo

2.5 BRONZE CHECK VALVES

A. Bronze Check Valves, General: MSS SP-80.

B. Class 125, Bronze, Lift Check Valves with TFE Disc: ASTM B-584 bronze body and integral seat with soldered or threaded end connections, and having 250-psig CWP rating.

1. Basis-of-Design Product: NIBCO Model S-480-Y or T-480-Y, or a comparable product by one of the following:

a. Conbraco

b. Apollo

C. Class 125, Bronze, Lift Check Valves with BUNA Disc: ASTM B-584 bronze body and integral seat with nonmetallic BUNA disc, soldered or threaded end connections, and having 250-psig CWP rating.

1. Basis-of-Design Product: NIBCO Model S-480 or T-480, or a comparable product by one of the following:

a. Conbraco

b. Apollo

D. Class 150, Bronze, Swing Check Valves with Bronze Disc: ASTM B-62 bronze body and seat with regrinding-type bronze disc, Y-pattern design, soldered or threaded end connections, and having 300 psig CWP rating.

1. Basis-of-Design Product: NIBCO Model S-433-B or T-433-B, or a comparable product by one of the following:

a. Conbraco

b. Apollo

2.6 BRONZE GATE VALVES

A. Bronze Gate Valves, General: MSS SP-80, with malleable-iron handwheel.

B. Class 150, Rising-Stem, Screw-In Bonnet, Bronze Gate Valves: ASTM B-62 bronze body, bonnet, and wedge, copper-silicone bronze stem, screw-in bonnet, threaded end connections; and having 300 psig CWP rating.

1. Basis-of-Design Product: NIBCO Model T-131, or a comparable product by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.

b. Powell, Wm. Co.

c. Conbraco

d. Milwaukee

2.7 CAST-IRON GATE VALVES

A. Cast-Iron Gate Valves, General: MSS SP-70, Type I with bolted bonnet, flanged end connections, and non-asbestos packing and gasket.

B. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: ASTM A-126, Class B cast-iron body and bonnet with bronze trim, and solid-wedge disc; and having 200 psig CWP rating.

1. Basis-of-Design Product: NIBCO Model F-617-O, or a comparable product by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.

b. Powell, Wm. Co.

c. Conbraco

d. Milwaukee

2.8 BRONZE GLOBE VALVES

A. Bronze Globe Valves, General: MSS SP-80, with malleable-iron handwheel.

B. Class 150, Bronze-Alloy Disc, Bronze Globe Valves: ASTM B-62 bronze body, bonnet, seat, and disc, copper-silicone bronze stem, union-ring bonnet, soldered or threaded end connections; and having 300 psig CWP rating.

1. Basis-of-Design Product: NIBCO Model S-235-B or T-235-B, or a comparable product by one of the following:
    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Powell, Wm. Co.
    c. Conbraco
    d. Milwaukee

2.9 CAST-IRON GLOBE VALVES

A. Cast-Iron Globe Valves, General: MSS SP-85 with bolted bonnet, flanged end connections, and non-asbestos packing and gasket.

B. Class 125, Metal Seat, Cast-Iron Globe Valves: ASTM A-126, Class B cast-iron body and bonnet with bronze trim and having 200 psig CWP rating.

1. Basis-of-Design Product: NIBCO Model F-718-B, or a comparable product by one of the following:
    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Powell, Wm. Co.
    c. Conbraco
    d. Milwaukee

2.10 CHAINWHEEL ACTUATORS

A. Manufacturers:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries, Inc.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc coating.
2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly valves.
2. Throttling Service: Angle, ball, butterfly, or globe valves.
3. Pump Discharge: Spring-loaded, lift-disc or dual-plate check valves; lever and weight swing check valves; or lever and spring swing check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Chilled-Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
3. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 150-psig CWP rating, ferrous alloy, with EPDM liner.
4. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
5. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
6. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 250, gray iron.
7. Wafer Check Valves, NPS 2-1/2 and Larger: Single-plate, wafer-lug double-flanged, Class 125 or 150 ferrous alloy.
8. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
9. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
10. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 250, OS&Y, bronze-mounted cast iron.
11. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
12. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 250, bronze-mounted cast iron.
13. Plug Valves, NPS 2 and Larger: Class 125 or 150, lubricated-type, cast iron.

D. Heating Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two -piece, full port, stainless-steel trim, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, full -port, ferrous alloy.
3. Butterfly Valves, NPS 2 to NPS 12: Single-flange, full lug, 200-psig CWP rating, bronze disc, EPDM liner, ferrous alloy.
4. Lift Check Valves, NPS 2 and Smaller: Class 125, bronze with TFE disc.
5. Swing Check Valves, NPS 2 and Smaller: Class 150 , bronze with TFE disc.
6. Swing Check Valves, NPS 2-1/2 and Larger: Class 125, cast iron, standard .

7. Grooved-End Swing Check Valves, NPS 2-1/2 and Larger: Grooved-end, ductile-iron, swing check valves.
8. Spring-Loaded, Center-Guided, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Class 125, flanged end, iron.
9. Gate Valves, NPS 2 and Smaller: Class 150 , rising stem, union-ring bonnet, bronze trim, solid wedge, bronze.
10. Gate Valves, NPS 2-1/2 and Larger: Class 125, OS&Y, bronze-mounted, cast iron.
11. Globe Valves, NPS 2 and Smaller: Class 150 , TFE disc, bronze.
12. Globe Valves, NPS 2-1/2 and Larger: Class 125, cast iron.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe. Butterfly valves may be installed with stem horizontal to allow support for the disc and the cleaning action of the disc.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves NPS 4 and larger and more than 84 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

H. Butterfly valves shall be installed with stems horizontal.

3.4 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Common Work Results for HVAC" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 23 05 23

HANGERS AND SUPPORTS FOR HVAC PIPING

SECTION 23 05 29

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 “Hanger and Support Applications” Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.
3. Grinnell Corp.
4. Tolco Inc.
5. Superstrut
6. Or equal

C. Painted Finish: Rust inhibiting baked acrylic with 400 hour salt spray rating per ASTM B-117.

D. Stainless steel for marine environments.

E. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

F. Nonmetallic Coatings: Plastic coating, jacket, or liner.

G. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Power-Strut Div.; Tyco International, Ltd.
4. Tolco Inc.
5. Unistrut Corp.; Tyco International, Ltd.
6. Or equal

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Pipe Shields, Inc.
2. Rilco Manufacturing Company, Inc.
3. Value Engineered Products, Inc.
4. Or equal

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Shall not be used.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated, except exterior or corrosive environments shall be stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

C. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Hilti, Inc.
3. ITW Ramset/Red Head.
4. Simpson Strong-Tie Company.
5. Or equal

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 OUTDOOR INSTALLATION

A. All supports and fasteners shall be stainless steel for outdoor installation. Use dielectric fittings or materials for installation between dissimilar metals.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

F. Install lateral bracing with pipe hangers and supports to prevent swaying.

G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

J. Insulated Piping:

1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inchthick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
3. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use thermal-hanger shield inserts for insulated piping and tubing.

F. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

G. Use instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

MECHANICAL VIBRATION AND SEISMIC CONTROLS

SECTION 23 05 48

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. Elastomeric isolation pads.
2. Restrained spring isolators.
3. Housed spring mounts.
4. Elastomeric hangers.
5. Spring hangers.
6. Spring hangers with vertical-limit stops.
7. Thrust limits.
8. Pipe riser resilient supports.
9. Resilient pipe guides.
10. Seismic snubbers.
11. Restraining cables.

1.3 DEFINITIONS

A. Av: Effective peak velocity related acceleration coefficient.

B. OSHPD: Office of Statewide Health Planning & Development for the State of California. OSHPD assigns a unique anchorage preapproval "R" number to each seismic restraint it tests. The number describes a specific device applied as tested.

1.4 PERFORMANCE REQUIREMENTS

A. Z: 0.40

B. Component Seismic Coefficient: shall be per CBC Table 16-Q and the soil profile type for the site.

C. Seismic Importance Factor: 1.5 for anchorage of machinery and equipment required for life-safe-ty systems, 1.0 for other equipment. Life-safety systems would include air-handling units and exhaust fans serving operating rooms, patient rooms, stairwell pressurization fans and laboratories.

D. Component Response Modification Factor: shall be per CBC Table 16-O for the respective non-structural components and equipment.

E. Component Amplification Factor: shall be per CBC Table 16-O for the respective nonstructural components and equipment.

F. All rotating and reciprocating equipment shall be statically and dynamically balanced to meet the following vibration limits under all design operating conditions and under specified vibration isolation:

Equipment Type	**Vibration Limit (inches/sec, RMS)**
Direct Drive Fans	0.05
Belt-Driven Fans	0.1
Reciprocating Equipment	0.4
All Other Equipment	0.1

1. These vibration limits apply either on the bearings or the equipment support structure, whichever applicable.
2. The vibration limits shall include the effects of inertia mass or inertia bases, where applicable.
3. Equipment with variable frequency drives shall meet these limits throughout the entire frequency range that the equipment will operate.

G. Vibration Isolated Equipment with Variable Frequency Drives (VFD) shall not be operated below the following rotational speeds:

Specified Isolation Minimum Static Defection	Minimum Allowed Equipment Rotational Speed (RPM)
Less than 1 inch	600
1 inch	500
2 inches	400
3 inches	350
4 inches	300
5 or more inches	250

1.5 SUBMITTALS

A. Product Data: Include load deflection curves for each vibration isolation device.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
2. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
3. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

C. Welding certificates.

D. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
   a. 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."
   b. 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."
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.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VIBRATION ISOLATORS

A. Manufacturers:
   1. M.W. Sausse & Co.
   2. Mason Industries, Inc.

B. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
   1. Material: Standard neoprene.

C. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

D. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.

E. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

F. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

G. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

H. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

I. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

J. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch- thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.3 SEISMIC-RESTRAINT DEVICES

A. Manufacturers:

1. M.W. Sausse & Co.
2. B-Line Systems, Inc.
3. Mason Industries, Inc.
4. TOLCO Incorporated.

B. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.

C. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.4 FACTORY FINISHES

A. Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.

2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.
5. All outdoor equipment shall be suitable for high humidity and coastal marine environment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 7 Section "Roof Accessories."

B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

C. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

D. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

E. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

F. Install resilient bolt isolation washers on equipment anchor bolts.

3.3 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:

B. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

C. Testing: Perform the following field quality-control testing:

1. Isolator seismic-restraint clearance.
2. Isolator deflection.
3. Snubber minimum clearances.

3.4 ADJUSTING

A. Adjust isolators after piping systems have been filled and equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

D. Adjust active height of spring isolators.

E. Adjust snubbers according to manufacturer's written recommendations.

F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

G. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.5 CLEANING

A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION 23 05 48

HVAC IDENTIFICATION

SECTION 23 05 53

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 mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Access panel and door markers.
5. Pipe markers.
6. Duct markers.
7. Damper Tags
8. Stencils.
9. Valve tags.
10. Valve schedules.
11. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Valve numbering scheme.

C. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

D. Air-Side Eq. Schedule: Provide hard copy and electronic spreadsheet of air-side equipment schedule covering damper, terminal boxes, instrumentation, etc. Coordinate numbering scheme prior to submittal.

E. System Drawings: For each piping system for each air system (exhaust included). Furnish system one-line plan drawings indicating valves, dampers, instruments, control devices, smoke detectors, and equipment addressed in this section. Furnish electronic spread sheets for each system. Coordinate numbering scheme prior to submittal.

F. Equipment Location Plans: For each system. Furnish plans showing equipment, equipment identification numbers/tags, and description.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
   a. Manufacturer, product name, model number, and serial number.
   b. Capacity, operating and power characteristics, and essential data.
   c. Labels of tested compliances.
2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.
2. Data:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.
2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.

3. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pre-tensioned Pipe Markers: Pre-coiled semi rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.3 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

B. Damper Tags: Same as valve tags.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

1. Stencil Material: Aluminum.

2. Stencil Paint: Exterior, gloss, black, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, in colors according to ASME A13.1, unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by the Agency. Provide 5/32-inch hole for fastener.

1. Material: 0.051-inch- thick brass minimum 2” in diameter.
2. Valve-Tag Fasteners: Stainless steel wire (heavy gage).

2.6 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fans, blowers, primary balancing dampers, terminal boxes and mixing boxes.
2. Packaged HVAC central-station and zone-type units.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Meters, gages, thermometers, and similar units.
   c. Fans, blowers, primary balancing dampers, and mixing boxes.
   d. Packaged HVAC central-station and zone-type units.

e. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:
   a. Green: For cooling equipment and components.
   b. Yellow: For heating equipment and components.
   c. Green and Yellow: For combination cooling and heating equipment and components.
   d. Brown: For energy-reclamation equipment and components.
2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
4. Include signs for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Fans, blowers, primary balancing dampers, and mixing boxes.
   c. Packaged HVAC central-station and zone-type units.

E. Stenciled Equipment Sign Option: Stenciled signs may be provided instead of laminated-plastic equipment signs, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

F. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
2. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:

1. Green: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

B. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow, may be provided instead of laminated-plastic duct markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

C. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (maximum intervals of 25 feet for exhaust ductwork) in each space where ducts are exposed or concealed by removable ceiling system.

D. Duct markers shall include air system type, and air system number.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule. Install tags on valves such that they will not interfere with the valve operation and maintenance.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:
   a. Chilled Water: 1-1/2 inches, round.
   b. Heating Hot Water: 1-1/2 inches, round.
2. Valve-Tag Color:
   a. Chilled Water: Natural.
   b. Heating Hot Water: Natural.
3. Letter Color:
   a. Chilled Water: Black.
   b. Heating Hot Water: Black.

3.6 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.8 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 23 05 53

TESTING, ADJUSTING, AND BALANCING FOR HVAC

SECTION 23 05 93

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:
   a. Constant-volume air systems.
2. Balancing Hydronic Piping Systems:
   a. Constant-flow hydronic systems.
3. Testing, Adjusting, and Balancing Equipment:
   a. Heat-transfer coils.
4. Duct leakage tests.
5. Control system verification.
6. Verifying that automatic control devices are functioning properly.
7. Reporting results of activities and procedures specified in this Section.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contractor Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit 6 copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB as a TAB Supervisor.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Owner.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As required by certifying TAB agency.

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.5 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner may occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner’s operations.

1.6 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days’ advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC’s “National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems” forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Contract Documents Examination Report:

1. After review of the Contract Documents and the Shop Drawings, submit a copy of the Contract Documents Examination Report, signed by the reviewer.
2. Identify any required devices, including air volume dampers and fluid balancing valves, missing or not included in the shop drawings.
3. Refer to Notes on the Drawings and Division 23 Sections “Metal Ducts” and “Hydronic Piping” for additional requirements.
4. A copy of the signed report shall accompany the shop drawing submittals.

D. Examine the approved submittals for HVAC systems and equipment.

E. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

F. Examine air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 23 31 13 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

G. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

H. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

I. Examine test reports specified in individual system and equipment Sections.

J. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

L. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

M. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

O. Examine system pumps to ensure absence of entrained air in the suction piping.

P. Examine operating safety interlocks and controls on HVAC equipment.

Q. Examine automatic temperature system components to verify the following:

1. The intended controller operates dampers, valves, and other controlled devices.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

R. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance "ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.

b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust flow-measuring devices installed at terminals for each space to design water flows.

1. Measure flow at terminals.

2. Adjust each terminal to design flow.

3. Re-measure each terminal after it is adjusted.

4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after flows have been balanced.

B. For systems with pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.
2. Perform temperature tests after flows have been verified.

C. For systems without pressure-independent valves or flow-measuring devices at terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.
2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

D. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

E. Verify that memory stops have been set.

3.7 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Nameplate and measured voltage, each phase.
5. Nameplate and measured amperage, each phase.
6. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

3.9 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.10 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.11 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature set-tings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.12 TEMPERATURE CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or non-grounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations

3.13 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.14 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.15 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.

5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.
8. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
9. Unit Data:
    a. Unit identification.
    b. Location.

c. Make and type.

d. Model number and unit size.

e. Manufacturer's serial number.

f. Unit arrangement and class.

g. Discharge arrangement.

h. Sheave make, size in inches, and bore.

i. Center-to-center dimensions of sheave, and amount of adjustments in inches.

j. Number, make, and size of belts.

k. Number, type, and size of filters.

10. Motor Data:
    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
11. Test Data (Indicated and Actual Values):
    a. Total air flow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Cooling-coil static-pressure differential in inches wg.
    g. Heating-coil static-pressure differential in inches wg.
    h. Outside airflow in cfm.
    i. Return airflow in cfm.
    j. Outside air damper position.
    k. Return-air damper position.

E. Apparatus-Coil Test Reports:

1. Coil Data:
    a. System identification.

b. Location.

c. Coil type.

d. Number of rows.

e. Fin spacing in fins per inch o.c.

f. Make and model number.

g. Face area in sq. ft.

h. Tube size in NPS.

i. Tube and fin materials.

j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.

b. Average face velocity in fpm.

c. Air pressure drop in inches wg.

d. Outdoor-air, wet- and dry-bulb temperatures in deg F.

e. Return-air, wet- and dry-bulb temperatures in deg F.

f. Entering-air, wet- and dry-bulb temperatures in deg F.

g. Leaving-air, wet- and dry-bulb temperatures in deg F.

h. Water flow rate in gpm.

i. Water pressure differential in feet of head or psig.

j. Entering-water temperature in deg F.

k. Leaving-water temperature in deg F.

l. Refrigerant expansion valve and refrigerant types.

m. Refrigerant suction pressure in psig.

n. Refrigerant suction temperature in deg F.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.

b. Location.

c. Make and type.

d. Model number and size.

e. Manufacturer’s serial number.

f. Arrangement and class.

g. Sheave make, size in inches and bore.

h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:
   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
   g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
   a. System and air-handling-unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F.
   d. Duct static pressure in inches wg.
   e. Duct size in inches.
   f. Duct area in sq. ft.
   g. Indicated air flow rate in cfm.
   h. Indicated velocity in fpm
   i. Actual air flow rate in cfm
   j. Actual average velocity in fpm
   k. Barometric pressure in psig

H. Air-Terminal-Device Reports:

1. Unit Data:
   a. System and air-handling unit identification.
   b. Location and zone.
   c. Apparatus used for test.
   d. Area served.
   e. Make.
   f. Number from system diagram.
   g. Type and model number.
   h. Size.
   i. Effective area in sq. ft.
2. Test Data (Indicated and Actual Values):
   a. Air flow rate in cfm
   b. Air velocity in fpm
   c. Preliminary air flow rate as needed in cfm
   d. Preliminary velocity as needed in fpm
   e. Final air flow rate in cfm
   f. Final velocity in fpm
   g. Space temperature in deg F

I. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:
   a. System and air-handling-unit identification.
   b. Location and zone.
   c. Room or riser served.
   d. Coil make and size.
   e. Flowmeter type.
2. Test Data (Indicated and Actual Values):
   a. Air flow rate in cfm
   b. Entering-water temperature in deg F
   c. Leaving-water temperature in deg F
   d. Water pressure drop in feet of head or psig

e. Entering-air temperature in deg F

f. Leaving-air temperature in deg F

J. Instrument Calibration Reports:

1. Report Data:
   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

3.16 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
   a. Measure airflow of at least 10 percent of air outlets.
   b. Measure water flow of at least 5 percent of terminals.
   c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
   d. Verify that balancing devices are marked with final balance position.
   e. Note deviations from the Design-Builder's in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by the Owner.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of the Owner.
3. Owner shall randomly select measurements, documented in the final report, to be re-checked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Design-Builder's Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

END OF SECTION 23 05 93

HVAC INSULATION

SECTION 23 07 00

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. Insulation Materials:
   a. Mineral fiber.
   b. Phenolic.
2. Adhesives.
3. Mastics.
4. Lagging adhesives.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied jackets.
8. Tapes.
9. Securements.
10. Corner angles.

B. Related Sections:

1. Division 2 Section "Hydronic Distribution" for loose-fill pipe insulation in underground piping outside the building.
2. Division 23 Section "Fire-Suppression Systems Insulation."
3. Division 23 Section "Plumbing Insulation."
4. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Duct Wrap.

b. Johns Manville; Microlite.

c. Knauf Insulation; Duct Wrap.

d. Manson Insulation Inc.; Alley Wrap.

e. Owens Corning; All-Service Duct Wrap.

E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Commercial Board.

b. Johns Manville; 800 Series Spin-Glas.

c. Knauf Insulation; Insulation Board.

d. Owens Corning; Fiberglas 700 Series.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Micro-Lok.

b. Knauf Insulation; 1000 Pipe Insulation.

c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Phenolic:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Kingspan Corp.; Koolphen K.

2. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.

3. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.

4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

a. Preformed Pipe Insulation: ASJ.

b. Board for Duct and Plenum Applications: ASJ.

c. Board for Equipment Applications: ASJ.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-96.

b. Foster Products Corporation, H. B. Fuller Company; 81-33.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.

b. Foster Products Corporation, H. B. Fuller Company; 85-20.

c. ITW TACC, Division of Illinois Tool Works; S-90/80.

d. Marathon Industries, Inc.; 225.

e. Mon-Eco Industries, Inc.; 22-25.

D. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-96.

b. Foster Products Corporation, H. B. Fuller Company; 97-13.

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.

b. Foster Products Corporation, H. B. Fuller Company; 85-20.

c. ITW TACC, Division of Illinois Tool Works; S-90/80.

d. Marathon Industries, Inc.; 225.

e. Mon-Eco Industries, Inc.; 22-25.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The); 739, Dow Silicone.

b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.

c. P.I.C. Plastics, Inc.; Welding Adhesive.

d. Red Devil, Inc.; Celulon Ultra Clear.

e. Speedline Corporation; Speedline Vinyl Adhesive.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-35.

b. Foster Products Corporation, H. B. Fuller Company; 30-90.

c. ITW TACC, Division of Illinois Tool Works; CB-50.

d. Marathon Industries, Inc.; 590.

e. Mon-Eco Industries, Inc.; 55-40.

f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-52.

b. Foster Products Corporation, H. B. Fuller Company; 81-42.

c. Marathon Industries, Inc.; 130.

d. Mon-Eco Industries, Inc.; 11-30.

e. Vimasco Corporation; 136.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Products, Division of ITW; CP-76.
   b. Foster Products Corporation, H. B. Fuller Company; 30-45.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.
   f. Vimasco Corporation; 750.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto PVC Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Products, Division of ITW; Metal Jacketing Systems.
   b. PABCO Metals Corporation; Surefit.
   c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
   a. Sheet and roll stock ready for shop or field sizing.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.

d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.

2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

3) Tee covers.

4) Flange and union covers.

5) End caps.

6) Beveled collars.

7) Valve covers.

8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross laminated polyethylene film covered with white stucco-embossed aluminum-foil facing.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Polyguard; Alumaguard 60.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.

b. Compac Corp.; 104 and 105.

c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.

d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.

3. Thickness: 11.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   b. Compac Corp.; 110 and 111.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
   d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   b. Compac Corp.; 120.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
   d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.
   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.
   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; RC-150.

2) GEMCO; R-150.

3) Midwest Fasteners, Inc.; WA-150.

4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Wire: 0.080-inch nickel-copper alloy or 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. C & F Wire.

b. Childers Products.

c. PABCO Metals Corporation.

d. RPR Products, Inc.

2.10 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

T. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same material and thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of phenolic-foam insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered segments of phenolic-foam insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.

1. Draw jacket material smooth and tight.
2. Apply lap or joint strips with the same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Apply jackets with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

C. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

D. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Fire-suppression piping.
4. Drainage piping located in crawl spaces, unless otherwise indicated.
5. Below-grade piping, unless otherwise indicated.
6. Chrome-plated pipes and fittings, unless potential for personnel injury.
7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, supply air, located in a conditioned space.
2. Indoor, supply air, located in a return air plenum, or indirectly conditioned space.
3. Indoor, supply and return air, located in an un-conditioned space.
4. Outdoor, supply and return air.

B. Items Not Insulated:

1. Outside air ducts.
2. General exhaust ducts (unless otherwise specified).
3. Fibrous-glass ducts.
4. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
5. Factory-insulated flexible ducts.
6. Factory-insulated plenums and casings.
7. Flexible connectors.
8. Vibration-control devices.
9. Factory-insulated access panels and doors.

3.10 INTERIOR INSULATION APPLICATION SCHEDULE

A. Refer to Title 24 for insulation R-value requirements.

B. Indoor Duct and Plenum Application Schedule:

1. Service: Indoor, supply air duct, located in an air-conditioned space.
   a. Material: Mineral-fiber blanket.

b. Thickness: 1-1/2 inch to achieve the minimum code required thermal (R) value.

c. Density: 0.75 lb/cu. ft. nominal

d. Number of Layers: One.

e. Vapor Retarder Required: Yes.

2. Service: Indoor, supply air duct, located in a return air plenum, or indirectly conditioned space.
   a. Material: Mineral-fiber blanket.
   b. Thickness: 1-1/2 inch to achieve the minimum code required thermal (R) value.
   c. Density: 0.75 lb/cu. ft. nominal
   d. Number of Layers: One.
   e. Vapor Retarder Required: Yes.
3. Service: Indoor, supply and return air duct, located in an un-conditioned space.
   a. Material: Mineral-fiber blanket.
   b. Thickness: 3 inch to achieve the minimum code required thermal (R) value.
   c. Density: 0.75 lb/cu. ft. nominal
   d. Number of Layers: One.
   e. Vapor Retarder Required: Yes.

C. Service: Chilled-water supply and return.
   1. Operating Temperature: 35 to 75 deg F.
   2. Insulation Material: Mineral fiber, Pre-formed pipe insulation
   3. Insulation Thickness: Apply the following insulation thicknesses:
      a. Copper Pipe, Up to 1-1/2": 1" thick.
      b. Steel and Copper Pipe, 2"-8": 1" thick.
   4. Field-Applied Jacket: FSK or ASJ Vapor Retarder
   5. Vapor Retarder Required: Yes.
   6. Finish: Painted.

D. Service: Heating hot-water supply and return.
   1. Operating Temperature: 100 to 200 deg F.
   2. Insulation Material: Mineral fiber, Pre-formed pipe insulation.
   3. Insulation Thickness: Apply the following insulation thicknesses:
      a. Copper Pipe, 1" & less: 1-1/2" thick.
      b. Copper Pipe, 1-1/4" – 1-1/2": 1-1/2" thick.
      c. Copper Pipe, 1-1/2" – 2": 2" thick

d. Steel Pipe, 2-1/2" – 6": 2" thick

4. Field-Applied Jacket: FSK or ASJ Vapor Retarder
5. Vapor Retarder Required: Yes.
6. Finish: Painted.

3.11 EXTERIOR INSULATION APPLICATION SCHEDULE

A. This application schedule is for aboveground insulation outside the building. Loose-fill insulation, for belowground piping, is specified in Division 2 piping distribution Sections.

B. Service Rectangular, supply-air ducts.

1. Material: Mineral-fiber insulation board.
2. Thickness: 2 inch to achieve the minimum code required thermal (R) value.
3. Density: 3 lb/cu. ft. nominal
4. Number of Layers: One.
5. Vapor Retarder Required: Yes.

C. Service: Rectangular, return air-ducts.

1. Material Mineral-fiber insulation board.
2. Thickness: 2 inch to achieve the minimum code required thermal (R) value.
3. Density: 3 lb/cu. ft. nominal
4. Number of Layers: One.
5. Vapor Retarder Required: Yes.

D. Service: Chilled-water supply and return.

1. Operating Temperature: 35 to 75 deg F.
2. Insulation Material: Mineral fiber, Pre-formed pipe insulation.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Copper Pipe, Up to 1-1/2": 1" thick.
   b. Steel and Copper Pipe, 2"-8": 1" thick.
4. Field-Applied Jacket: Aluminum.
5. Vapor Retarder Required: Yes.
6. Finish: Painted.

E. Service: Heating hot-water supply and return.

1. Operating Temperature: 100 to 200 deg F.
2. Insulation Material: Mineral fiber, Pre-formed pipe insulation.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Copper Pipe, 1" & less: 1-1/2" thick.
   b. Copper Pipe, 1-1/4" – 1-1/2": 1-1/2" thick.
   c. Copper Pipe, 1-1/2" – 2": 2" thick.
   d. Steel Pipe, 2-1/2" – 6": 2" thick.

4. Field-Applied Jacket: Aluminum.
5. Vapor Retarder Required: Yes.
6. Finish: Painted.

END OF SECTION 23 07 00

BUILDING AUTOMATION SYSTEM

SECTION 23 09 00

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish components for integration to the existing BACnet-based system compliant with ANSI/ASHRAE Standard 135-2012, BACnet. The BAS (Building Automation System) contractor shall include all building controllers, application controllers, and install all equipment cabinets, panels, conduit as required, data communication network cables needed, all associated hardware and wiring. Wiring shall include all interconnecting cables between supplied cabinets, application controllers, and input/output devices for a full, complete and functional system.

1.2 APPROVED MANUFACTURERS AND INSTALLERS

Commented [NL1]: Delete BAS vendors from the spec as required. Generally at least 3 vendors are sufficient.

A. Approved Control Manufacturers

1. Metasys by Johnson Controls

1.3 QUALITY ASSURANCE

B. The BAS shall be designed, installed, commissioned, and serviced by manufacturer authorized and trained personnel. System provider shall have an in-place support facility within 2 hours response time of the site with technical staff, spare parts inventory, and necessary test and diagnostic equipment.

1.4 REFERENCE STANDARDS

C. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
2. ANSI/ASHRAE Standard 135-2012, BACnet.
3. Uniform Building Code (UBC), including local amendments.
4. Title 24, Part 6: 2016 California Building Energy Efficiency Standards.

D. City, county, state, and federal regulations and codes in effect as of contract date.

1.5 SUBMITTALS

E. Drawings

1. The BAS contractor shall provide a fully complete submittal including point to point engineered drawings, control sequences of operations, bill of materials, and cut sheets for all control devices for approval. Incomplete submittals will be rejected. Partial submittals are not acceptable. Submittals and drawings shall be provided in PDF format.

F. System Documentation

1. Include the following in submittal package:

a. System architecture drawing.

b. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.

c. Complete bill of materials, valve schedule and damper schedule. Valve schedules shall include corrected actual valve pressure drops per selected Cv at full flow for characterize control valves.

d. Cut sheets of all control devices.

1.6 WARRANTY

G. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one (1) year from completion of system acceptance. Control devices that fail during the warranty period shall be adjusted, repaired or replaced at no additional cost to the owner.

PART 2 - PRODUCTS

2.1 OPERATOR'S WORKSTATION [SERVER AND OPERATING SOFTWARE]

A. The Operator's Workstation and Server are existing on site. The scope of work for this project is to expand the existing system.

Commented [NL2]: Leave this paragraph if the building has an existing BAS that is being expanded. If it is a new building with a new BAS, delete this paragraph.

2.2 BUILDING NETWORK CONTROLLER

A. General Requirements

1. Building controller shall be of modular construction such that various modules may be selected to fit the specific requirements of a given project. At a minimum, modules shall consist of a power supply module, a BACnet Ethernet-MS/TP (master slave token passing) module, a BACnet MS/TP-only module, and a modem module for telephone communication. Those projects that require special interfaces may use Modbus modules as needed.

2.3 PROGRAMMABLE APPLICATION SPECIFIC CONTROLLERS

A. Provide one or more native BACnet application controllers for each air handler and provide native BACnet application controllers as needed for central plant control that adequately cover all objects listed in object list.

B. Application controllers shall include universal inputs with 12-bit resolution that accept 3K and 10K thermistors, 0–10VDC, Platinum 1000 Ohm RTD, 0–5VDC, 4–20mA and dry contact signals. Controller shall include binary and analog outputs on board. Analog outputs with 12-bit resolution shall support either 0–10VDC or 0–20mA. Binary outputs shall have LED indication of status.

C. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs.

D. Alarm Generation

1. Alarms may be generated within the controller for any object change of value or state (either real or calculated). This includes things such as analog object value changes, and binary object state changes.

2. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.

3. Controller must be able to handle up to 25 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.

E. The controller processor shall be a 32-bit processor (minimum).

2.4 TERMINAL UNIT APPLICATION CONTROLLERS (AHU, Exhaust Fans)

A. Provide one (1) native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller through MS/TP LAN using BACnet protocol.

B. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5VDC, 4–20mA, and dry contact signals. Controller shall include binary outputs on board with analog outputs as needed.

C. All program sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs.

2.5 VAV BOX APPLICATION CONTROLLERS—SINGLE DUCT

A. Provide one (1) native BACnet application controller for each VAV box that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller through MS/TP LAN using BACnet protocol.

B. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5 VDC, and dry contact signals. Inputs on controller may be either analog or digital. Controller shall also include binary outputs on board. For applications using variable speed parallel fans, provide a single analog output selectable for 0–10 V or 0–20 mA control signals. Application controller shall include microprocessor driven flow sensor for use in pressure independent control logic. All boxes shall be controlled using pressure-independent control algorithms and all flow readings shall be in CFM (LPS if metric).

C. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs.

D. On-board flow sensor shall be microprocessor-driven and pre-calibrated at the factory. Pre-calibration shall be at 16 flow points as a minimum. All factory calibration data shall be stored in non-volatile memory. Calibration data shall be field adjustable to compensate for variations in VAV box type and installation. All calibration parameters shall be adjustable through intelligent room sensor.

E. Provide duct temperature sensor at discharge of each VAV box equipped with a reheat coil.

2.6 AUXILIARY CONTROL DEVICES

A. Room Temperature Sensor with LCD Readout

1. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit and allow occupant to raise and lower setpoint, and activate terminal unit for override use.

2. Override time may be set and viewed in half-hour increments. Override time countdown shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining

shall be displayed. Display shall show the word “OFF” in unoccupied mode unless a function button is pressed.

B. Temperature Sensors

1. Duct mount, indoor: Veris TF series 10K ohm, type II thermistor. Accuracy ±0.5ºC (±1ºF)
2. Duct mount, outdoor: Veris TF series 10K ohm, type II thermistor with weather-tight junction box, or equal. Accuracy ±0.5ºC (±1ºF)
3. Outside air: Veris TO series 10K ohm, type II thermistor encased in durable radiation shield with weather-tight junction box, or equal. Accuracy ±0.5ºC (±1ºF)

C. CO2 Sensors

1. Room, wall mount: Veris CWE series with non-dispersive infrared sensor, repeatable to +/- 20 ppm, or equal.

D. Differential Pressure Transmitter:

1. Duct Static Pressure Transmitter: Veris PX series differential pressure transducer with selectable range, +/- 1% accuracy, LCD display, or equal.
2. Building Static Pressure Transmitter: Veris PX series differential pressure transducer with selectable range, +/- 1% accuracy. Provide with AA05 ceiling mount static pressure pick up, LCD display, or equal.
3. Water differential pressure transmitter: Veris PW2 series differential pressure transmitter, wet/wet, switch selectable pressure ranges, jumper selectable port swap, LCD display and NEMA 4 enclosure, or equal.

E. Differential Pressure Switch:

1. Filter differential pressure switch for status: Dwyer Series ADPS adjustable differential pressure switch, dual scale adjustable knob, silicone diaphragm and NEMA 13 enclosure, or equal.
2. Duct static pressure hi-low pressure safety switch for fan shut down: Dwyer Series 1900MR with adjustable trip and manual reset, or equal.

F. Current Sensors

1. Current sensing switch for fans, pumps, etc.: Hawkeye Hx08 series current switch, or equal.
2. Current sensing switch for VFD’s: Hawkeye H614 Automatic VFD current switch split core, or equal.
3. Current sensing switch with relay for fan start: Hawkeye H 900 series current, or equal.
4. Current sensing transmitter: Hawkeye H921 current sensing transmitter, or equal.
5. Current sensing transmitter with relay for fan start: Hawkeye H931 current sensing transmitter, or equal.

G. Airflow Measuring Device Duct: Ebtron Gold Series C, thermal dispersion air flow array for duct mounting. Accuracy: Velocity +/- 2% of reading, Temperature +/- 0.15°F (0.01°C). Provide integral microprocessor-based transmitter with field selectable analog outputs for linear velocity, temperature or alarm. Transmitter shall also provide a concurrent RS-485 or Ethernet network interface and field selectable protocols, like: BACnet MS/TP, BACnet/IP, BACnet/Ethernet or Modbus.

2.7 CONTROL VALVES

A. Manufacturer:

1. Manufactured, brand labeled or distributed by Belimo, Tour and Andersson, or Oventrop.
2. The control valve assembly shall be provided and delivered from a single manufacturer as a complete assembly.

B. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional (except as noted).

C. Control Valve Actuators:

1. Size for valve close off at 150 percent of total system (head) pressure for two-way valves; and 100 percent of pressure differential across the valve or 100 percent of total system (pump) head differential pressure for three-way valves
2. Coupling: directly couple and mount to valve stem, shaft ISO-style direct-coupled mounting pad.

D. Characterized Control Valves:

Commented [NL3]: Where first cost is a priority for the Owner, use characterized control valves. Delete reference to pressure independent valves in the preceding sections

1. Sizing (Water):
   a. Three-Way Modulating: Size using a pressure differential of not more than 4 psi differential at design flow.
2. NPS ¾" and Smaller for Terminal Units: Nickel plated forged brass body rated at no less than 600 psi, chrome plated brass ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-Ring packing design, fiberglass reinforced Teflon seats, and a TEFZEL flow characterizing disc.
3. NPS 1" thru 2": Nickel-plated forged brass body rated at no less than 400 psi, stainless steel ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-ring packing design, fiberglass reinforced Teflon seats, and a TEFZEL flow characterizing disc.
4. NPS 2-1/2 through 6": GG25 cast iron body according to ANSI Class 125, standard class B, stainless steel ball, stainless steel blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring package design, PTFE seats, and a stainless steel flow characterizing disc.
5. Flow Characteristics: Equal percentage characteristics.

2.8 CONTROL ENCLOSURES

A. All controllers, power supplies and relays shall be mounted in enclosures.

B. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.

C. Enclosures shall be NEMA 4 when located in an outdoor environment with hinged, locking doors.

D. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 0.125 inches thick and appropriately sized to make label easy to read.

PART 3 - EXECUTION

3.1 Examination

A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.

B. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary. BAS Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2 Wiring

A. Low voltage (Class 2) wiring in concealed accessible spaces may be plenum rated and is not required to be enclosed in conduit.

Commented [NL4]: Plenum rated wire is acceptable in most non-essential commercial buildings like hospitals, fire stations…etc. If you project is NOT an essential facility, leave this paragraph and delete the preceding paragraph that requires ALL low voltage wiring to be enclosed in conduit. .

B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC.

C. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.

D. NEC Class 2 (low voltage current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.

Commented [NL5]: Delete this paragraph if the project requires all low voltage wiring to be in conduit.

E. Conduit: All conduit shall comply with the minimum requirements of the local authority having jurisdiction.

Commented [NL6]: For a project that is ALL conduit delete items 1, 2, and 3 below.

1. Install wiring in conduit where subject to mechanical damage and at levels below 10ft in mechanical, electrical, or service rooms.
2. Install wiring in conduit for wall sensors, and extend the conduit 6” above the ceiling. Install a bushing on the end of the conduit.
3. Install wiring in conduit above inaccessible ceilings.
4. Install Class 1 and Class 2 wiring in separate conduits. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.
5. Conceal conduit except within mechanical, electrical, or service rooms. Maintain minimum clearance of 6 in. between raceway and high-temperature equipment such as steam pipes or flues.
6. Flexible metal conduit and liquid-tight flexible metal conduit shall not exceed 3 ft. in length and shall be supported at each end. Do not use flexible metal conduit less than 1/2 inch electrical trade size.

F. BAS Contractor shall provide stepdown transformers.

3.3 AS-BUILT DOCUMENTATION

A. Project Record Documents. Submit three copies of record (as-built) documents upon completion of installation for approval prior to final completion. Submittal shall consist of:

1. Project Record Drawings of as-built versions of submittal Shop Drawings and product data shall be provided in electronic PDF format. As-built floor plans indicating the routing of mstp communication wiring shall be included.

3.4 Training

A. Provide 32 hours of training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

Commented [NL7]: 32 hours of training is adequate for most projects less than 100,000 sq. ft. Larger buildings or campuses with multiple buildings may require up to 60 hours of training. Revise the 32 hour quantity as needed

END OF SECTION 23 09 00

HYDRONIC PIPING

SECTION 23 21 13

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 piping, special-duty valves, and hydronic specialties for hot-water heating, and chilled-water cooling; makeup water for these systems; blowdown drain lines; and condensate drain piping.

B. Related Sections include the following:

1. Division 7 Section "Through-Penetration Firestop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
2. Division 7 Section "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
3. Division 23 Section "Common Work Results for HVAC" for general piping materials and installation requirements.
4. Division 23 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
5. Division 23 Section "Valves" for general-duty gate, globe, ball, butterfly, and check valves.
6. Division 23 Section "Meters and Gages" for thermometers, flow meters, and pressure gages.
7. Division 23 Section "Mechanical Identification" for labeling and identifying hydronic piping.
8. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.
9. Division 23 Section "HVAC Instrumentation and Controls" for temperature-control valves and sensors.

1.3 DEFINITIONS

A. CPVC: Chlorinated polyvinyl chloride.

B. PVC: Polyvinyl chloride.

C. AWS: American Welding Society

1.4 SUBMITTALS

A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.

B. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure.

Detail location of anchors, alignment guides, and expansion joints and loops. Detail, at 1/4" = 1'-0" scale, or larger.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

E. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1.6 COORDINATION

A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Calibrated Balancing Valves:
   a. Armstrong Pumps, Inc.

b. Flow Design, Inc.

c. Gerand Engineering Company.

d. Griswold Controls.

e. ITT Bell & Gossett; ITT Fluid Technology Corp.

f. Taco, Inc.

2. Pressure-Reducing Valves
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Conbraco Industries, Inc.
   d. ITT Bell & Gossett; ITT Fluid Technology Corp.
   e. Spence Engineering Company, Inc.
   f. Watts Industries, Inc.; Watts Regulators.
   g. Zurn
3. Safety Valves:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Conbraco Industries, Inc.
   d. ITT McDonnell & Miller Div.; ITT Fluid Technology Corp.
   e. Kunkle Valve Division.
   f. Spence Engineering Company, Inc.
4. Automatic Flow-Control Valves:
   a. Flow Design, Inc.
   b. Griswold Controls.
   c. Expansion Tanks:
   d. Amtrol, Inc.
   e. Armstrong Pumps, Inc.
   f. ITT Bell & Gossett; ITT Fluid Technology Corp.
   g. Taco, Inc.

2.2 PIPING MATERIALS

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

E. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

F. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

2.4 STEEL PIPE AND FITTINGS

A. Steel Pipe, NPS 4 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, black steel, plain ends.

B. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.

C. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

D. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

E. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

F. Welding Materials: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

G. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.5 VALVES

A. Gate, globe, check, ball, and butterfly valves are specified in Division 15 Section "Valves."

B. Refer to Part 3 "Valve Applications" Article for applications of each valve.

C. Calibrated Balancing Valves, NPS 2 and Smaller: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

D. Calibrated Balancing Valves, NPS 2-1/2 and Larger: Cast-iron or steel body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having flanged or grooved connections. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

E. Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown, and noncorrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.

F. Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.

G. Automatic Flow-Control Valves: Gray-iron body, factory set to maintain constant flow with plus or minus 5 percent over system pressure fluctuations, and equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case. Each valve shall have an identification tag attached by chain, and be factory marked with the zone identification, valve number, and flow rate. Valve shall be line size and one of the following designs:

1. Gray-iron or brass body, designed for 175 psig at 200 deg F with stainless-steel piston and spring.
2. Brass or ferrous-metal body, designed for 300 psig at 250 deg F with corrosion-resistant, tamperproof, self-cleaning, piston-spring assembly easily removable for inspection or replacement.
3. Combination assemblies, including bronze ball valve and brass alloy control valve, with stainless-steel piston and spring, fitted with pressure and temperature test valves, and designed for 300 psig at 250 deg F.

2.6 HYDRONIC SPECIALTIES

A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.

B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.

C. Diverting Fittings: 125-psig working pressure; 250 deg F maximum operating temperature; cast-iron body with threaded ends, or wrought copper with soldered ends. Indicate flow direction on fitting.

D. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.

E. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged- or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Chilled Water, NPS 2 and Smaller: Aboveground, use Type L drawn-temper copper tubing with soldered joints. Belowground, use Type K annealed-temper copper tubing with soldered joints. Use the fewest possible joints belowground and within floor slabs.

B. Chilled Water, NPS 2-1/2 and Larger: Schedule 40 steel pipe with welded and flanged joints.

C. Space Heating Hot Water, NPS 2 and Smaller: Aboveground, use Type L drawn-temper copper tubing with soldered joints. Belowground, use Type K annealed-temper copper tubing with soldered joints. Use the fewest possible joints belowground and within floor slabs.

D. Space Heating Hot Water, NPS 2-1/2 and Larger: Schedule 40 steel pipe with welded and flanged joints.

E. Condensate Drain Lines: Type L drawn-temper copper tubing with soldered joints.

3.2 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

1. Shutoff Duty: Ball and butterfly valves.
2. Throttling Duty: Globe and valves.

B. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.

C. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves on hot-water generators and elsewhere as required to regulate system pressure.

3.3 PIPING INSTALLATIONS

A. Refer to Division 23 Section "Common Work Results for HVAC" for basic piping installation requirements.

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

D. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

E. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

F. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

G. Anchor piping for proper direction of expansion and contraction. Install piping subject to expansion and contraction with expansion loops made up of bends or fittings, expansion joints,

swing joints, or other approved methods or devices. Branch lines from main subject to expansion and contraction shall have a swing joint at the point of connection with the main. Risers which pass through one or more floors shall have swing joints at their base. Anchor lines subject to expansion and contraction by approved methods to restrict movement.

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes, or per local code (local code is more stringent than the below):

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Refer to Division 23 Section "Common Work Results for HVAC" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping; and solvent-welded joints for PVC and CPVC piping.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be same as for equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If multiple, parallel control valves are installed, only one bypass is required.

D. Install ports for pressure and temperature gages at coil inlet connections.

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water or air as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air if water is used. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water if water is used.
4. Subject piping system to test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
5. After test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.9 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.

2. Check pump for proper direction of rotation.
3. Set automatic fill valves for required system pressure.
4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Check operation of automatic bypass valves.
7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
8. Lubricate motors and bearings.

3.10 CLEANING

A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION 23 21 13

METAL DUCTS

SECTION 23 31 00

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 metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round spiral-seam ducts and formed fittings.
3. Double-wall rectangular ducts and fittings.
4. Duct Liner
5. Sealant Materials
6. Hangers and Supports

B. Related Sections include the following:

1. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.4 SUBMITTALS

A. Shop Drawings: CAD-generated and drawn to 1/8 inch equals 1 foot scale. Show fabrication and installation details for metal ducts.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating sizes and pressure classes.
3. Elevations of top and bottom of ducts.
4. Dimensions of main duct runs from building grid lines.
5. Fittings.
6. Reinforcement and spacing.
7. Seam and joint construction.

8. Penetrations through fire-rated and other partitions.
9. Equipment installation based on equipment being used on Project.
10. Duct accessories, including access doors and panels.
11. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular 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."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular 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."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," 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."

2.3 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Either factory fabricated or shop fabricated ductwork is acceptable. The below manufacturers are acceptable for factory fabricated ductwork.

1. McGill AirFlow LLC.
2. MKT Metal Manufacturing
3. Sheet Metail Connectors, Inc.

B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

C. Outer Duct: Stainless Steel. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular 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."

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular 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."

F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard and State of California Title 24 Energy Conservation Standards, as a minimum.

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.

G. Inner Duct: Minimum 0.028-inch stainless steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.

H. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Traverse 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."

I. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular 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."

2.4 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: 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.

B. Either factory fabricated or shop fabricated ductwork is acceptable. The below manufacturers are acceptable for factory fabricated ductwork.

1. Ductmate Industries, Inc
2. Lindab, Inc.
3. McGill Airflow LLC
4. MKT Metal Manufacturing
5. SEMCO LLC
6. Sheet Metail Connectors, Inc.
7. Spiral Manufacturing Co., Inc.

C. Either factory fabricated or shop fabricated ductwork is acceptable. The below manufacturers are acceptable for factory fabricated ductwork Either factory fabricated or shop fabricated ductwork is acceptable. The below manufacturers are acceptable for factory fabricated ductwork Retain manufacturer list to require factory-fabricated, single-wall round and flat-oval ducts and fittings; delete to allow shop-fabricated ducts and fittings.

D. Transverse Joints: Select joint types and 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."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

E. 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."

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.

F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical 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."

2.5 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 A 653/A 653M.

1. Galvanized Coating Designation: G90.

2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, 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.

D. Antimicrobial coating in first paragraph below is an optional feature and usually applied only after fabrication to ducts fabricated with galvanized sheet steel. See Evaluations for discussion on coatings.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, 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.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches (76 mm)(102 mm)(152 mm).
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, or EPDM polymer with polyisobutylene plasticizer.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Main Supply Ducts: 4-inch wg, medium pressure.
2. Supply Ducts (before Air Terminal Units): 4-inch wg, medium pressure.
3. Supply Ducts (after Air Terminal Units): 2-inch wg, low pressure.
4. Return Ducts (Negative Pressure): 2-inch wg, low pressure
5. Exhaust Ducts (Negative Pressure): 2-inch wg, low pressure.

B. All interior ducts shall be galvanized steel. All exterior ducts shall be stainless steel.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards-Metal and Flexible," unless otherwise indicated.

B. Install round ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply low VOC based sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Air Duct Accessories" Firestopping materials and installation methods are specified in Division 7 Section "Through-Penetration Firestop Systems."

O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

P. Paint interior of metal ducts that are visible through registers and grilles, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

Q. All outdoor ductwork to be constructed of stainless steel.

3.3 EXPOSED DUCT INSTALLATION

A. Shop Drawing of ductwork, duct supports and accessories, to be installed in exposed locations other than mechanical equipment rooms, boiler rooms or fan rooms, shall be reviewed by Owner prior to fabrication and/or installation.

B. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

C. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

D. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter.

E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

3.4 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.

1. For pressure classes lower than 2-inch wg, seal transverse joints.

B. Seal ducts before external insulation is applied.

3.5 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories".

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to

2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.

4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.8 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Create other openings to comply with duct standards.
2. Disconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.

D. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION 23 31 00

AIR DUCT ACCESSORIES

SECTION 23 33 00

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. Backdraft dampers.
2. Volume dampers.
3. Volume damper remote control cable assemblies.
4. Turning vanes.
5. Duct-mounting access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

B. Related Sections include the following:

1. Division 28 Section "Fire Alarm" for duct-mounting fire and smoke detectors.
2. Division 23 Section "HVAC Instrumentation for electric and pneumatic damper actuators.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Turning vanes.
4. Duct-mounting access doors.
5. Flexible connectors.
6. Flexible ducts.
7. Duct Accessory hardware.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. Greenheck.
3. Penn Ventilation Company, Inc.
4. Pottorff
5. Ruskin Company.

B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners and mounting flange.

D. Blades: 0.025-inch- thick, roll-formed aluminum.

E. Blade Seals: Vinyl or Neoprene.

F. Blade Axles: Galvanized steel.

G. Tie Bars and Brackets: Galvanized steel.

H. Return Spring: Adjustable tension.

2.4 VOLUME DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. METALAIRE, Inc.
3. Nailor Industries Inc.
4. Penn Ventilation Company, Inc.
5. Pottorff
6. Ruskin Company.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
6. Blade Axles: Galvanized steel.
7. Bearings: Oil-impregnated bronze.

D. Tie Bars and Brackets: Galvanized steel.

E. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.

2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Oil-impregnated bronze thrust or ball.
5. Blade Seals: Vinyl or Neoprene.
6. Jamb Seals: Cambered stainless steel.
7. Tie Bars and Brackets: Galvanized steel.

F. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

G. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 VOLUME DAMPER CONTROL CABLE ASSEMBLIES

A. Manufacturer:

1. Young Regulator Company.
2. MAT (Battery Powered Damper)
3. Envirotech (Battery Powered Damper)

B. Concealed Ceiling Regulator:

1. Damper controller and cable shall be concealed above the ceiling. Cable to consist of Bowden cable .054" stainless steel control wire encapsulated in 1-16" flexible galvanized spiral wire sheath. Control kit shall consist of 2-5/8" diameter die cast aluminum housing with 3" diameter zinc plated (polished chrome is optional) cover and 14 gauge steel rack and pinion gear drive converting rotary motion to push-pull motion. Control shaft shall be D-style flatted and 1/4" diameter with 265-degree rotation providing graduations for positive locking and control, and 1-1/2" linear travel capability. Control kit is designed to be imbedded in the ceiling flush with the finished surface. Control kit shall be manually operated using Young Regulator Model 030-12 wrench. Control kit shall be Young Regulator Model 270-301.
2. Or Furnish a battery operated damper drive system to manually control dampers from a remote location. The damper drive will have universal mounting capabilities to accommodate damper shafts ranging in size from 1/4” - 3/8” square and 1/4” - 1/2” round. The system shall consist of a battery powered damper drive pre-wired with plenum rated cable and female over-molded connector, wall or ceiling connector termination fixtures, and a hand held control module (only one required per jobsite). A 9V DC motor shall be factory mounted to the damper drive and compliance tested prior to shipment. The damper drive unit shall operate at static pressure up to 2.5 in wg. Over-molded cable shall fit into surface termination plates, mechanical closet box, or recessed diffuser mount clip without requiring any tools. Plastic surface termination plates shall be UL94-V0 flammability rated. The damper drive shall be operated by a hand held remote control module powered by a 9V battery.

2.6 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:
   a. Ductmate Industries, Inc.
   b. Duro Dyne Corp.
   c. METALAIRE, Inc.
   d. Ward Industries, Inc.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.7 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Manufacturers:
   a. American Warming and Ventilating.
   b. CESCO Products.
   c. Ductmate Industries, Inc.
   d. Flexmaster U.S.A., Inc.
   e. Greenheck.
   f. McGill AirFlow Corporation.
   g. Nailor Industries Inc.
   h. Ventfabrics, Inc.
   i. Ward Industries, Inc.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:
   a. Less Than 12 Inches Square: Secure with two sash locks.
   b. Up to 18 Inches Square: Two hinges and two sash locks.
   c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.

1. Manufacturers:
    a. Ductmate Industries, Inc.
    b. Flexmaster U.S.A., Inc.
2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Pressure Relief Access Door: Double wall and duct mounting; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated, latches, and retaining chain.

1. Manufacturers:
    a. American Warming and Ventilating.
    b. CESCO Products.
    c. Ductmate Industries, Inc.
    d. Greenheck.
    e. KEES, Inc.
    f. McGill AirFlow Corporation.
    g. Nexus PDQ.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

E. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

F. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.8 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.9 FLEXIBLE DUCTS

A. Manufacturers:

1. Casco Silentflex II.

B. Insulated Flexible Duct: UL 181, Class 1 with:

1. Non-woven nylon liner.
2. Steel spring wire helix.
3. Polyethylene vapor barrier jacket.
4. Adjustable metal male/female collars.
5. Pressure rating 1-1/2 in. positive to 1/2 in. negative.
6. Maximum Air Velocity: 4,000 fpm (continuous).
7. Temperature Range: 20 deg. F to 200 deg. F.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts.

C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Coordinate requirements with TAB contractor. Install at a minimum of two duct widths from branch takeoff.

F. Where volume damper adjustment is not readily accessible through finished ceilings, provide volume damper remote control cable adjustment. Locate concealed ceiling regulators in coordination with Architect.

G. Provide test holes at fan inlets and outlets and elsewhere as indicated.

H. Install fire and smoke dampers, according to manufacturer's UL-approved written instructions.

I. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
5. On sides of ducts where adequate clearance is available.

J. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body Plus Ladder Access: 25 by 17 inches.

K. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches in diameter.
2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 12 inches in diameter.
4. Head and Shoulders Access: 18 inches in diameter.
5. Body Access: 24 inches in diameter.

L. Install the following sizes for duct-mounting, pressure relief access doors:

1. One-Hand or Inspection Access: 5 inches in diameter.
2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 13 inches in diameter.
4. Head and Shoulders Access: 19 inches in diameter.

M. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment".

N. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

O. Connect diffusers or light troffer boots to low pressure ducts directly or with minimum 60-inch lengths of flexible duct clamped or strapped in place.

P. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

Q. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 23 Section "Commissioning of HVAC".

END OF SECTION 23 33 00

EXHAUST FANS

SECTION 23 34 16

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: HVAC Power Ventilators

B. Related Sections:

1. 01 00 00 General Requirements
2. 07 00 00 Thermal and Moisture Protection
3. 09 00 00 Finishes
4. 23 00 00 Heating, Ventilating, and Air-Conditioning (HVAC)
5. 26 00 00 Electrical

1.2 REFERENCES

A. Air Movement and Control Association Inc. (AMCA):

1. 99 - Standards Handbook
2. 200 - Publication, Air Systems
3. 201-90 - Publication, Fans and Systems
4. 202-88 - Publication, Troubleshooting
5. 203-90 - Publication, Field Performance Measurement of Fan Systems
6. 211-05 - Publication, Certified Ratings Program – Product Rating Manual for Fan Air Performance
7. 300-96 - Standard Reverberant Room Method for Sound Testing of Fans
8. 311-05 - Publication Certified Ratings Program – Product Rating Manual for Fan Sound Performance
9. 99-2408-69 - Operating Limits for Centrifugal Fans

B. Air Movement and Control Association Inc. (AMCA), American National Standards Institute (ANSI):

1. 204-05 - Standard Balance Quality and Vibration Levels for Fans
2. 210-99 - Standard Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

C. American National Standards Institute (ANSI):

1. 11-r1999 - Method of Evaluating Load Ratings of Bearings

D. American Society of Civil Engineers (ASCE):

1. 7-02 - Minimum Design Loads for Building and Other Structures

E. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

1. Chapter 45 - 2003 Handbook, HVAC Applications
2. Chapter 7 - 2001 Fundamentals Handbook, Sound-Vibration
3. Chapter 32 - 2001 Fundamentals Handbook, Duct Design
4. Chapter 18 - 1992 HVAC System and Equipment Handbook, Fans

F. American Society for Testing and Materials (ASTM):

1. E330-02 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylight and Curtain Walls by Uniform Static Air Pressure Difference.

G. National Fire Protection Association (NFPA)

1. 70 - National Electrical Code
2. 90A-02 - Standard for the Installation of Air-Conditioning and Ventilating Systems

H. Occupational Safety and Health Administration (OSHA):

1. 1910.212 - General requirements for Machine Guarding
2. 1910.219 - General requirements for guarding safe use of mechanical power transmission apparatus
3. 1926.300 - General requirements for safe operation and maintenance of hand and power tools

I. Underwriters Laboratories (UL):

1. 507 - Electric Fans
2. 555 - Fire Dampers
3. 555S - Smoke Dampers
4. 705 - Standard Power Ventilators

1.3 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00 Submittal Procedures

B. Provide dimensional drawings and product data on each fan.

C. Provide fan curves for each fan at the specified operation point, with the flow, static pressure and horsepower clearly plotted.

D. Provide outlet velocity and fan's inlet sound power readings for the eight octave bands, decibels, and sones.

E. Strictly adhere to QUALITY ASSURANCE requirements as stated in section 1. 4 of this specification.

F. Provide manufacturer's certification that exhaust fans are licensed to bear Air Movement and Control Association (AMCA), Certified Rating Seal for sound and air performance.

G. Installation, Operation, and Maintenance Manual (IOM): Provide manufacturer's installation, operations, and maintenance manual, including instructions on installation, operations, maintenance, pulley adjustment, receiving, handling, storage, safety information and cleaning. A troubleshooting guide, parts list, warranty and electrical wiring diagrams.

1.4 QUALITY ASSURANCE

A. Performance ratings: Conform to AMCA standard 211 and 311. Fans must be tested in accordance with ANSI/AMCA Standard 210-99 and AMCA Standard 300-96 in an AMCA accredited laboratory. Fans shall be certified to bear the AMCA label for air and sound performance seal.

B. Each fan shall be given a balancing analysis which is applied to wheels at the outside radius. The maximum allowable static and dynamic imbalance is 0.05 ounces (Balance grade of G6.3).

C. Comply with the National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.

B. Storage: Store materials in a dry area indoor, protected from damage, and in accordance with manufacturer’s instructions. For long term storage follow manufacturer's Installation, Operations, and Maintenance Manual.

C. Handling: Handle and lift fans in accordance with the manufacturer’s instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer.

1.6 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1. The warranty of this equipment is to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at the Manufacturers option when returned to Manufacturer, transportation prepaid.
2. Motor Warranty is warranted by the motor manufacturer for a period of one year. Should motors furnished prove defective during this period, they should be returned to the nearest authorized motor service station.

1.7 MAINTENANCE

A. Refer to Manufacturer's Installation, Operation and Maintenance Manual (IOM), to find maintenance procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Greenheck is basis of design or equal by:

1. Loren Cook

2.2 BELT DRIVEN BACKWARD INCLINED CENTRIFUGAL UTILITY FANS

A. General Description:

1. Base fan performance at standard conditions (density 0.075 Lb/ft3)

2. Fan type in AMCA Arrangement 10 with a single width and single inlet housing
3. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

B. Wheel:

1. Non-overloading, backward inclined centrifugal wheel Constructed of steel
2. Statically and dynamically balanced in accordance to AMCA Standard 204-05
3. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
4. Single thickness blades are securely riveted or welded to a heavy gauge back plate and wheel cone.
5. Blades shall be airfoil.

C. Motors:

1. Motor enclosures: TEFC
2. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase
3. Motors shall be NEMA premium efficiency as defined by NEMA MG-1.

D. Shafts and Bearings:

1. Fan shaft shall be ground and polished solid steel with an anti-corrosive coating
2. Permanently sealed bearings or pillow block ball bearings
3. Bearings shall be selected for a basic rating fatigue life (L-10) of 80,000 hours at maximum operating speed for each pressure class

E. Housing:

1. Discharge position specified on equipment schedule
2. Constructed of steel and coated with Permatector Coating must exceed 1,000-hour salt spray under ASTM B117 test method.
3. Housing and bearing supports shall be constructed of bolted steel members.

F. Housing Supports and Drive Frame:

1. Housing supports are constructed of structural steel with formed flanges
2. Drive frame is bolted steel which supports the shaft and bearings and reinforcement for the housing
3. Pivoting motor plate with adjusting screws to make belt tensioning operations
4. Prepunched mounting holes for installation
5. Drive frame is coated with Permatector

G. Disconnect Switches:

1. NEMA rated: 3R
2. Positive electrical shut-off
3. Wired from fan motor to junction box

H. Drive Assembly (if applicable):

1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower

2. Belts: Static free and oil resistant
3. Pulleys: Cast type, keyed, and securely attached to wheel and motor shafts
4. Motor pulleys are adjustable for final system balancing
5. Readily accessible for maintenance

I. Options/Accessories (see schedule for requirements):

1. Access Door:
   a. Type: bolted
   b. Provides access for inspection and cleaning of wheel
2. Dampers:
   a. Types: Gravity
   b. Galvanized frames with prepunched mounting holes
   c. Backdraft dampers are not suitable for downblast or bottom angular downblast discharge positions.
   d. Balanced for minimal resistance to flow
3. Drain Connection:
   a. Threaded connection
   b. Provided to drain moisture form the bottom of the fan housing; fan supplied without drain plug, unless specified
4. Weatherhood:
   a. Completely cover motor and drive compartments
   b. Vented to provide sufficient motor cooling
   c. Required to meet UL 705 and 762 (grease) ratings

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions.

3.2 EXAMINATION

A. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected

3.3 PREPARATION

A. Ensure roof openings are square, accurately aligned, correctly located, and in tolerance

B. Ensure duct is plumb, sized correctly, and to proper elevation above roof deck. Install duct as specified in Air Distribution (Division 23)

3.4 INSTALLATION

A. Support units using restrained spring isolators having a minimum static deflection of 1 inch. Vibration and seismic-control devices are specified in Division 23 Section “Mechanical Vibration Controls and Seismic Restraints.”

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

B. Install fans system as indicated on the Installation, Operation and Maintenance Manual (IOM) and contract drawings.

C. Install fans in accordance with manufacturer's instructions

3.5 SYSTEM STARTUP

A. Refer to Installation, Operation, and Maintenance Manual (IOM)

3.6 ADJUSTING

A. Adjust exhaust fans to function properly

B. Adjust Belt Tension (if applicable)

C. Lubricate bearings

D. Adjust drive for final system balancing

E. Check wheel overlap

3.7 CLEANING

A. Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction.

3.8 PROTECTION

A. Protect installed product and finished surfaces from damage during construction.

B. Protect installed exhaust fans to ensure that, except for normal weathering, fans will be without damage or deterioration at time of substantial completion.

END OF SECTION 23 34 16

AIR TERMINAL UNITS

SECTION 23 36 00

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. Shutoff single-duct air terminal units.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. 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.

C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.5 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

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 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

A. Basis of Design Product: The design for each product is based on manufacturer named on the drawings. Subject to compliance with requirements, provide either named product or a comparable equivalent product by on of the other manufacturers specified.

B. Manufacturers:

1. Price
2. Titus.
3. Krueger.
4. Anemostat Products; A Mestek Company.

C. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.

D. Casing: 22 gauge galvanizes steel.

1. Casing Lining: Adhesive attached, 3/4-inch- thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections, size matching inlet size.
4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.

E. Regulator Assembly: Extruded-aluminum or galvanized-steel components; key damper blades onto shaft with nylon-fitted pivot points located inside unit casing.

1. Factory-calibrated and field-adjustable assembly with shaft extension for connection to externally mounted control actuator.

F. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 6-inch wg inlet static pressure.
2. Damper Position: Normally closed.

G. Attenuator Section: 22 gauge acoustically lined sheet metal.

H. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig; and factory installed.

I. DDC Controls: Single-package unitary controller and actuator specified in Division 23 Section Building Automation Systems.

2.3 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air terminal units to allow service and maintenance.

C. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

D. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

E. Ground units with electric heating coils according to Division 26 Section "Grounding and Bonding."

F. Connect wiring according to Division 26 Section "Conductors and Cables."

G. 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.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions and do the following:

a. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.

b. Verify that controls and control enclosure are accessible.

c. Verify that control connections are complete.

d. Verify that nameplate and identification tag are visible.

e. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 1.

END OF SECTION 23 36 00

DIFFUSERS, REGISTERS, AND GRILLES

SECTION 23 37 13

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Diffusers:
   a. Perforated diffusers
   b. Louver face diffusers.
2. Registers and Grilles:
   a. Perforated grilles
   b. Louver face register

B. Related Requirements:

1. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

B. Samples: For each color and texture specified. Actual size of smallest diffuser indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

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:
   a. Krueger (Basis of Design)
   b. Price
   c. Titus

2.2 PERFORATED DIFFUSERS

A. Product: Titus PMC

B. Diffusers shall have a perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers and no less than 51 percent free area. Perforated face shall be steel. The back pan shall be heavy gauge steel of the sizes and mounting types shown on the plans and outlet schedule. The diffuser neck shall have at least 1 inch depth for easy duct connection.

C. Provide 24” x 24” modular face size at accessible ceiling areas. Use 16” x 16” modular face size for hard ceiling application. Provide suitable mounting/border to ceiling system. Provide face accessible opposed blade damper for all diffusers located in hard ceiling.

D. Individually adjustable curved deflectors shall be mounted in the neck of the diffuser and must allow the discharged air to enter the room in either vertical or one-, two-, three-, four-way horizontal jets. The perforated face must be easily unlatchable from the back pan to facilitate opening of the face for pattern controller adjustment or to access an optional damper.

E. The finish shall be white powder coat.

F. Provide branch balancing damper with remote damper operator by Pottorff or Young Regulator in inaccessible locations where no access panels are indicated on the drawings.

G. The manufacturer shall provide published performance data for the perforated diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

2.3 PERFORATED GRILLES

A. Product: Titus PXP

B. Grilles shall have a perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers and no less than 51 percent free area. Perforated face shall be steel.

C. Provide 24” x 24” modular face size at accessible ceiling areas.

D. The finish shall be white powder coat.

E. The manufacturer shall provide published performance data for the perforated diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

2.4 SIDEWALL REGISTERS

A. Product: Titus 300RL

B. Steel supply grilles shall be TITUS Model 300R (double deflection) of the sizes and mounting types shown on the plans and outlet schedule. The deflection blades shall be available parallel to the long dimension of the grille. Construction shall be of steel with a 1¼-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.

C. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be spaced on ¾-inch centers. Blades shall have steel friction pivots on both ends to allow individual blade adjustment without loosening or rattling. Plastic blade pivots are not acceptable.

D. Optional opposed-blade volume damper shall be constructed of heavy gauge steel. Damper must be operable from the face of the grille.

E. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

F. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

2.5 LOUVERED FACE REGISTER

A. Product: Titus 350RL

B. The fixed deflection blades shall be available parallel to the long or short dimension of the grille. Construction shall be of steel with a 1-1/4-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.

C. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be available at 35°.

D. The grille finish shall be powder coated white.

E. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

2.6 LINEAR SLOT DIFFUSER

A. Product: Titus FL

B. Linear diffusers supported by screws in the flanges or from air plenums are unacceptable. For hard ceilings, provide clips that are integral with the linear slot diffusers allowing the diffusers to be secured directly to the ceiling framing without the requirement for hanger supports. Provide spline clips to secure joints and ceiling tees to the diffusers.

C. Provide ends and corners as required. Ends shall be butt type, field installed, or mitered picture frame type factory installed, as indicated herein or shown on the drawings. Corners shall be mitered one-piece unit.

D. Pattern controllers shall be one-piece extruded aluminum, 24 inches long maximum, positioned between spring loaded spacers. Pattern controllers shall allow the airstream to be directed flat against the ceiling in either direction or downward as well as allowing throw reduction every two feet along the entire length of the linear slot diffusers. The airstream shall be maintained at the ceiling plane and shall not dump when volume is reduced. Only extruded aluminum pattern controllers are acceptable. Where shown or noted pattern controllers shall be designed to allow the airstream to be jetted into the occupied space and be adjustable to vector the airstream as required.

E. Material shall be minimum wall thickness 0.062 inches extruded aluminum. Spring steel retainers shall be used under the spacers to hold the slot diffusers assembly tightly together and allow the slot diffusers to be disassembled easily for field trimming. Materials other than extruded aluminum and spring steel will not be accepted.

F. All slot diffusers shall be manufactured by the same manufacturer of the plenums and hoods. No exceptions will be allowed. Plenum lengths and entry collar sizes shall be as indicated on the plan schedules.

G. Plenums shall be minimum 24-gauge galvanized steel and lined inside with black matte fiberglass insulation.

H. Provide branch balancing damper with remote damper operator by Pottorff or Young Regulator in inaccessible locations where no access panels are indicated on the drawings.

I. All slot diffusers shall be performance tested with air plenums as a composite assembly in full accordance with ASHRAE, and/or ARI standards.

2.7 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

AIR HANDLING UNITS

SECTION 23 74 13

PART 1 GENERAL

1.1 WORK INCLUDED

A. Constant Volume, Air Handling Units with coils for outdoor installations.

1.2 RELATED WORK

A. Section 233113 – Metal Ducts.

1.3 REFERENCES

A. ARI 430 - Standard for Central Station Air Handling Units.

B. ARI 410 - Standard for Forced Circulation Air-Cooling and Air-Heating Coils.

C. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

D. UL 1995 - Heating and Cooling Equipment

E. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

F. SMACNA - HVAC Duct Construction Standards.

G. ANSI/UL 900 - Test Performance of Air Filter Units.

H. AMCA 300 - Reverberant Method for Sound Testing of Fans.

I. ARI 260 - Standard for Sound Rating of Ducted Air Moving and Conditioning Equipment

J. AMCA 301 - Method for Publishing Sound Ratings for Air Moving Devices.

K. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain custom outdoor air-handling units through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of custom indoor air-handling units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. 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.

D. NFPA Compliance: Custom indoor air-handling units and components shall be designed, fabricated, and installed in compliance with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

E. ETL or UL Listed: Custom air handler shall be designed and manufactured in strict accordance with UL 1995, Standard for Heating and Cooling Equipment. Air handling shall be ETL or UL listed in accordance with UL 1995, and shall carry the ETL or UL label. If manufacturer cannot provide ETL/UL sticker on air handler, it will be the sole responsibility of the contractor to arrange for local, on-site, ETL or UL approval and labeling.

F. Comply with NFPA 70.

1.5 SUBMITTALS

A. Product Data: For each type of custom air-handling unit indicated include the following:

1. Drawings including dimensions, weights and required clearances.
2. Field connection details.
3. Unit sound power levels.
4. Fan performance.
5. Fan base details.
6. Vibration isolation and seismic restraints details.
7. Coil capacities, pressure drops (water and air).
8. Drain pan details.
9. Filter section and frame details.
10. Insulation characteristics.
11. Panel and unit base/floor construction details.
12. Access door and door frame details.
13. Metal gauges and finishes of materials and paint characteristics.

1.6 COORDINATION

A. Coordinate size and location of structural steel support members.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Products shall be provided by the following manufacturers:

1. AAON
2. Substitute equipment may be considered for approval that includes at a minimum:
   a. Direct drive supply fans
   b. Double wall cabinet construction
   c. Insulation with a minimum R-value of 13
   d. Stainless steel drain pans

2.2 ROOFTOP UNIT

A. General Description

1. Outdoor air handling unit shall include filters, supply fans, dampers, chilled water coils, hot water coils, return fans, and unit controls.
2. Unit shall be factory assembled and tested including leak testing of the chilled water coils, leak testing of the hot water coils, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
4. Unit components shall be labeled, including pipe stub outs, electrical and controls components.
5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
6. Installation, Operation, and Maintenance manual shall be supplied within the unit.
7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, cooling coils, return fans, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit shall be provided with horizontal discharge and horizontal return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.

11. Unit shall include lifting lugs on the top of the unit.
12. Interior ceiling, floor, service doors, fan inlet cone, damper rack, and filter rack in the air stream are spray coated with a two-part polyurethane, heat baked coating. The coils, coil casings, condensate drain pans, damper blades and gears, fan wheel, fan motor, energy recovery wheel casing, and compressor cabinet are not coated. Option is intended for use in coastal saltwater conditions under the stress of heat, salt, sand and wind and is applicable to all corrosive environments where a polyurethane coating is acceptable. Coating withstands at least 2,500 hours when tested under ASTM B 117-95 requirements.

C. Electrical

1. Unit shall be provided with standard power block for connecting power to the unit.
2. Unit shall have an SCCR rating per applicable equipment schedule.

D. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000. hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.
5. Variable frequency drive shall include interface card for BACnet compatibility.

E. Return Fans (AH-1N and 1S only)

1. Unit shall include direct drive, axial flow return fans. Blades shall be adjustable pitch.
2. Unit shall include barometric relief dampers.
3. Fans and motors shall be dynamically balanced.
4. Motors shall be premium efficiency ODP with ball bearings rated for 200,000. hours service with external lubrication points.
5. Access to return fans shall be through double wall, hinged access doors with quarter turn lockable handles.
6. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.
7. Variable frequency drive shall include interface card for BACnet compatibility.

F. Cooling Coils

1. Chilled Water Cooling Coils
    a. Coils shall be certified in accordance with AHRI Standard 410 and be hydrogen or helium leak tested.
    b. Coil shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
    c. Coil shall have required circuiting to meet the pressure drop performance scheduled and minimum rows and fins per equipment schedule.
    d. Control valves shall be field supplied and field installed.
    e. Coils shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance

shall be up to a minimum 1,000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing, with coating capable of withstanding at least 6,000 hours of salt spray per ASTM B117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Luvata Electrofin. The Luvata Electrofin written instructions for installation, operation, coil cleaning, maintenance, and recording keeping must be followed. Refer to the Luvata Electrofin Terms and Conditions of Sale.

G. Heating Coils

1. Hot Water Heating Coils

a. Coils shall be certified in accordance with AHRI Standard 410 and be hydrogen or helium leak tested.

b. Coils shalls be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.

c. Coil shall have required circuiting to meet the pressure drop performance scheduled and minimum rows and fins per equipment schedule.

d. Coils shall be located in the reheat position downstream of the cooling coil.

e. Control valves shall be field supplied and field installed.

H. Filters

1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil.
2. Unit shall include a clogged filter switch.

I. Outside Air/Economizer

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return actuator. Unit shall include outside air opening bird screen, outside air hood, and barometric relief dampers.
2. Economizer shall be furnished with a California Energy Commission Certified Title 24 Fault Detection and Diagnostic package. Economizer assembly shall carry a 5 year parts warranty from the date of original equipment shipment from the factory.
3. Unit shall include 100% motor operated outside air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge and end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511.Damper assembly shall be controlled by spring return, 2 position actuator. Unit shall include outside air opening bird screen and outside air hood.

J. Outside Air Flow Measuring Device- EBTRON, Inc. Model GTC116-PC is basis of design. (ATMD)

1. Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, 32 bit microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor nodes contained in one or more probe assemblies per measurement location.
2. Probes shall be constructed of extruded, gold anodized, 6063 aluminum tubes. All internal wires within the tube shall be Kynar coated. PVC insulated conductors are not acceptable.
3. Each sensor node shall contain two individually wired, hermetically sealed bead-in-glass thermistors.
4. Thermistors shall be mounted in the sensor node using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment. Thermistors leads shall not be fastened to the thermistor semiconductor substrate by weld or solder connections. Manufacturer shall provide UL listed, FEP jacketed, plenum rated cable(s) between sensor probes and the remote transmitter.
5. The airflow rate at each sensor node shall be equally weighted and arithmetically averaged by the transmitter prior to output. All integrated circuitry shall be temperature rated as 'industrial-grade'. Submissions containing 'commercial-grade' integrated circuitry are not acceptable.
6. Each sensing node shall be individually wind tunnel calibrated at 16 points to NIST traceable airflow standards. Airflow accuracy shall be +/-2% of Reading over the entire operating airflow range of not less than 0 to 5,000 fpm (25.4 m/s).
7. The transmitter shall have an integral LCD display capable of simultaneously displaying airflow and temperature. Individual airflow and temperature readings of each independent sensor node shall be accessible. The transmitter shall be capable of field configuration and diagnostics using an on-board pushbutton interface and LCD display.
8. The ATMD shall be UL 973 and BTL listed
9. The transmitter shall have two isolated and fused analog output signals and one RS-485 network connection. One analog output shall be for velocity and the other for a temperature output or LEED alarm function. All transmitters shall have integral self-diagnostics
10. Other than the thermistor sensors, no other electronic components shall be located at the sensing node. Signal processing circuitry on or in the sensor probe shall not acceptable.
11. Devices using chip-in-glass, epoxy-coated or diode-case chip thermistors are not acceptable.
12. Devices with RJ-45 connections exposed to the environment or having electronic circuitry mounted in or at the sensor node are not acceptable.
13. Pitot tubes and arrays are not acceptable.
14. Vortex shedding devices are not acceptable.

K. Controls- See Controls Specification section

PART 3 EXECUTION

3.1 Examination

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Examine roughing-in of steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Connections

1. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

2. Install piping adjacent to machine to allow service and maintenance.

3. Connect piping to modular indoor air-handling units mounted on vibration isolators with flexible connectors.

4. Connect condensate drain pans using NPS 1-1/4, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

5. Hot- and Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Connect to supply and return coil tappings with shutoff or balancing valve and union or flange at each connection.

6. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connections.

7. Electrical: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.

8. Ground equipment according to Division 26 Section "Grounding and Bonding."

9. 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.

C. FIELD Quality Control

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

   a. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. STARTUP SERVICE

1. Engage a factory-authorized service representative to perform startup service.

2. Final Checks before Startup: Perform the following:

   a. Verify that shipping, blocking, and bracing are removed.

   b. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

   c. Perform cleaning and adjusting specified in this Section.

   d. Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.

e. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.

f. Set zone dampers to fully open position for each zone.

g. Set face-and-bypass dampers to full face flow.

h. Set outside- and return-air mixing dampers to minimum outside-air setting.

i. Comb coil fins for parallel orientation.

j. Install clean filters.

k. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

3. Starting procedures for custom indoor air-handling units include the following:

a. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.

b. Measure and record motor electrical values for voltage and amperage.

c. Manually operate dampers from fully closed to fully open position and record fan performance.

4. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for modular indoor air-handling system testing, adjusting, and balancing.

E. Adjusting

1. Adjust damper linkages for proper damper operation.

F. Cleaning

1. Clean custom indoor air-handling units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

2. After completing system installation and testing, adjusting, and balancing custom indoor air-handling and air-distribution systems, clean filter housings and install new filters.

G. Demonstration

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain modular indoor air-handling units. Refer to Division 1.

H. Warranty

1. Provide parts and labor warranty for twelve months from date of start-up or eighteen (18) months from date of shipment, whichever occurs first. Filter changes are not part of this warranty

END OF SECTION 23 74 13

GENERAL ELECTRICAL SPECIFICATIONS

SECTION 26 00 00

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This specification shall apply to all phases of Work hereinafter specified, shown on Drawings, or as required to provide a complete installation of electrical systems for this Project. Work required under this specification is not limited to just the Electrical Drawings - refer to Architectural, Structural, Landscape, and Mechanical/Plumbing Drawings, as well as all other drawings applicable to this project, which designate the scope of work to be accomplished. The intent of the Drawings and Specifications is to provide a complete and operable electrical system that includes all documents that are a part of the Contract.

1. Work Included: Furnish labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on Drawings, and its delivery to the Owner complete in all respects ready for use.

2. The electrical Work includes installation or connection of certain materials and equipment furnished by others. Verify installation details, installation and rough-in locations from the actual equipment or from the equipment shop drawings.

B. Electrical Drawings: Electrical Drawings are diagrammatic, and are intended to convey the scope of work, indicating intended general arrangement of equipment, conduit and outlets. Follow Drawings in laying out Work and verify spaces for installation of materials and equipment based on actual dimensions of equipment furnished.

1.2 QUALITY ASSURANCE

A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules of the following:

1. Institute of Electrical and Electronic Engineers - IEEE

2. National Electrical Manufacturers' Association - NEMA

3. Underwriters' Laboratories, Inc. - UL

4. National Fire Protection Association - NFPA

5. Federal Specifications - Fed. Spec.

6. American Society for Testing and Materials - ASTM

7. American National Standards Institute - ANSI

8. National Electrical Code - NEC

9. National Electrical Safety Code - NESC

10. Insulated Cable Engineers Association - ICEA

11. American Institute of Steel Construction - AISC

12. State and Municipal Codes In Force In The Specific Project Area

13. Occupational Safety and Health Administration (OSHA)

14. Electronics Industries Association/Telecommunications Industry Association (EIA/TIA)

15. California Electrical Code (where adopted)

16. Local Authority Having Jurisdiction (AHJ) Published Electrical Standards and Codes

B. Perform Work in accordance with the National Electrical Code, applicable building ordinances, and other applicable codes, hereinafter referred to as the "Code." The Contractor shall comply with the Code including local amendments and interpretations without added cost to the Owner. Where Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.

1. Comply with all requirements for permits, licenses, fees and codes. The Contractor, at Contractor's expense, shall obtain all permits, licenses, fees, special service costs, inspections and arrangements required for Work under this contract, unless otherwise specified.

2. Comply with requirements of the applicable utility companies serving this Project. Make all arrangements with utility companies for proper coordination of Work.

1.3 GENERAL REQUIREMENTS

A. Guarantee: Furnish a written guarantee for a period of (1) one-year from date of acceptance.

B. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to ensure complete and operable systems as required by the Owner and Engineer.

C. All Core Cutting, Drilling, and Patching:

1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.

2. No holes will be allowed in any structural members without the written approval of the Project's Structural Engineer.

3. For penetrations of concrete slabs or concrete footings, the work shall be as directed in the Concrete Section of Specifications.

4. The Contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.

5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.

D. Verifying Drawings and Job Conditions:

1. The Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.

2. The Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment(s) shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

1.4 WORK IN COOPERATION WITH OTHER TRADES

A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment.

B. Provide a conduit-only system for low voltage wiring required for control of mechanical and plumbing equipment described in this or other parts of the Contract Documents. Install all control housings, conduits, and backboxes required for installing conductors to the controls.

C. Install separate conduits between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating and air conditioning control wiring, verify the exact requirements from the control diagrams provided with the equipment manufacturer's shop drawings.

1.5 TESTING AND ADJUSTMENT

A. Upon completion of all electrical work, the Contractor shall test all circuits, switches, light fixtures, lighting control and dimming systems including distributed systems, UPSs, generators, SPDs, lighting inverters, transfer switches, motors, circuit breakers, motor starters and their auxiliary circuits and any other electrical items to ensure perfect operation of all electrical equipment.

B. Equipment and parts in need of correction and discovered during such testing, shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.

C. All circuit(s) shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.

D. All test reports, including copies of any required Energy Code Acceptance Forms (e.g. CA Title 24 Acceptance for Code Compliance Forms) should be submitted to the Engineer at completion of project.

1.6 IDENTIFICATION

A. Nameplates shall be provided for unit substations, switchgear, switchboards, distribution boards, distribution panels, panel boards, motor control centers, transformers, transfer switches, contactors, starters, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, fire alarm/central monitoring terminal cabinets/power supplies/control panels, and all low voltage system terminal and control cabinets.

1. Nameplate inscriptions shall be identical to the equipment designations indicated in plans and specifications. Nameplates shall be engraved with the device designation/identification on the top line, source identification for the device on the 2nd line per NEC, or CEC where adopted, Art 408.4 and load designation for the device on the bottom line. Where load designation consists of a branch circuit, omit bottom line. Where device designation is not indicated on plans/specifications, Contractor shall submit a written clarification request to the Engineer.

Example: Transformer 1TA
Source Disconnecting Location: Switchboard MSA located in Rm 110
Load: Panels 1LA and 1 LB

2. All circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDU sub-feed circuit breakers and motor control centers shall have individual nameplates located immediately adjacent to the respective device. Nameplate inscription shall identify the downstream equipment or device served by the circuit breaker or fuse.

B. Identification nameplates, UON, shall be laminated/extruded modified acrylic that is 3/32" thick, UV-stabilized, matte finish, suitable for use in 180 deg. F ambient, with beveled edges and engraved white letters 3/8" high, minimum, on 1-1/2" high black background (utility/normal and optional standby power systems) for single line of text. Where two lines of text are required, provide minimum 2" high nameplate. Where three lines of text are required, provide minimum 2.5" high nameplate. Provide white letters on red background for all NEC, or CEC where adopted, Article 517 essential power systems, Article 700 Emergency Systems, Article 701 Legally required standby systems and Article 708 COPS.

C. Identification nameplates for new switchgear, switchboards, distribution boards, distribution panels, panel boards and motor control centers shall be attached with switchgear manufacturer-provided screws via switchgear manufacturer factory pre-drilled holes. A factory option to rivet identification nameplates to the equipment is only acceptable if screw-fastened nameplates are not an available option from the switchgear manufacturer. Field drilling or other mechanical attachment methods that change/void the NEMA or NTRL rating of the enclosure are strictly forbidden.

D. Identification nameplates for transformers, transfer switches, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control

panels, dimming panels, door releasing system panels, terminal cabinets and all circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDUs, PDU sub-feed circuit breakers, and motor control centers shall be attached to the equipment by self-adhesive backing integral to the nameplates. When equipment is located outdoors, provide nameplates without self-adhesive backing and attach to equipment using weather-rated, UV-resistant epoxy. In all cases, clean surfaces before applying identification nameplates parallel to equipment lines.

E. Warning Placards, as required by General Single Line Diagram Notes for multiple power sources, or instruction placards, as required for all kirk-key interlock schemes, all UPS bypass procedures or as required elsewhere in the plans/specifications shall be engraved 1/2" high white lettering on a red background using the same material specified for identification nameplates with a self-adhesive backing. Warning/instruction placards shall be attached to the face of the equipment directly related to the placards. Provide a formal placard submittal for review by the Engineer prior to ordering any warning/instruction placards. In all cases, clean surfaces before applying warning/instruction placards parallel to equipment lines.

F. Receptacles that are part of a UL-listed under floor computer room whip assembly, ceiling and/or cable/ladder tray-mounted receptacles used in lab, manufacturing, commercial kitchen environments or that are serving telecom/data/AV racks and cabinets shall have identification nameplates located on the wiring device plate cover. Nameplates shall be self-adhesive, 3/32" thick Micarta with beveled edges, engraved 1/4" high white lettering on black background with serving power source, circuit identification and NEMA/IEC receptacle type. Use of two (2) separate nameplates per device plate cover is acceptable. Affix nameplates to be visible when plugs are occupying receptacles.

G. See wiring device section of this specification for wiring device plate cover labeling requirements.

H. See drawings for panel board schedule directory installation requirements.

I. See conduit installation section of this specification for conduit labeling requirements.

1.7 FINAL INSPECTION AND ACCEPTANCE

A. After all requirements of the Specifications and/or the Drawings have been fully completed; representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.

B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

1.8 RECORD DRAWINGS

A. Drawings of Record: The Contractor shall provide and keep up-to-date, a complete record set of drawings. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in

a neat, legible, understandable and professional manner. Refer to the Supplementary General Conditions for complete requirements.

1.9 APPROVALS, EQUALS, SUBSTITUTIONS, ALTERNATIVES, NO KNOW EQUAL

A. Approvals: Where the words (or similar terms) “approved”, “approval”, “acceptable”, and “acceptance” are used, it shall be understood that acceptance by the Owner, Architect and Engineer are required.

B. Equal: Where the words (or similar terms) “equal”, “approved equal”, “equal to”, “or equal by”, “or equal” and “equivalent” are used, it shall be understood that these words are followed by the expression “in the opinion of the Owner, Architect, and Engineer.” For the purposes of specifying products, the above words shall indicate the same size, made of the same construction materials, manufactured with equivalent life expectancy, having the same aesthetic appearance/style (includes craftsmanship, physical attributes, color and finish), and the same performance.

C. Substitution: For the purposes of specifying products, “substitution” shall refer to the submittal of a product not explicitly approved by the construction documents/ specifications.

1. Substitutions of specified equipment shall be submitted and received by the Engineer ten (10) days prior to the bid date for review and written approval. Regulatory Agency approval for all substitutions will be the sole responsibility of the Contractor. To receive consideration, requests for substitutions must be accompanied by documentary proof of its equality with the specified material. Documentary proof shall be in letterform and identify the specified values/materials alongside proposed equal values/materials. In addition, catalog brochures and samples, if requested, must be included in the submittal. ONLY PRE-BID APPROVED PRODUCTS, ISSUED VIA A FORMAL BID ADDENDUM TO ALL BIDDERS, WILL BE ALLOWED ON THE PROJECT. REGARDLESS OF THE APPROVAL ON ANY SUBSTITUTION, ALL BIDS SHALL BE BASED ON THE PRODUCTS EXACTLY AS SPECIFIED. PRICING FOR EACH APPROVED SUBSTITUTION SHALL BE INCLUDED IN THE BID SUBMITTAL AS A SEPARATE LINE ITEM.

2. In the event that written authorization is given for a substitution, after award of contract, the Contractor shall submit to the Engineer quotations from suppliers/distributors of both the specified and proposed equal material for price comparison, as well as a verification of delivery dates that conform to the project schedule.

3. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.

4. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.

D. Alternates/Alternatives: For the purposes of specifying products, “alternatives/alternates” may be established to enable the Owner/Architect/Engineer to compare costs where alternative materials or methods might be used. An alternate price shall be submitted in addition to the base bid for consideration. If the alternate is deemed acceptable, written authorization will be issued.

E. No Known Equal: For the purposes of specifying products, “No Known Equal” shall mean that the Owner/Architect/Engineer is not aware of an equivalent product. The Contractor will need to submit a “Substitution” item, per the requirements listed above, if a different product is proposed to be utilized.

1.10 SHOP DRAWINGS/SUBMITTALS

A. Shop Drawings/Submittals, unless required otherwise by general project specifications or instructions to bidders, shall be submitted in electronic format (PDF) to include a Letter of Transmittal (PDF), which shall give a list of the drawings submitted with dates and/or system(s) components contained within the submittal. Drawings and material cut sheets shall be complete in every respect and edited/marked to indicate specific items being provided. Printed/Hard copies are not acceptable.

B. The Shop Drawings/Submittals shall be marked with the name of the project, numbered consecutively, and bear the approval of the Contractor as evidence that the Contractor has checked the Drawings. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.

C. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in the Contractor’s letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment that may be caused by the substitution. Samples shall be submitted when requested.

D. Only products listed as “Equal” within the contract documents, along with formally approved “Substitutions” will be reviewed. Products not conforming to these items will not be reviewed and will be returned to the Contractor for re-submittal.

E. Review comments used in response to shop drawings/submittals are:

1. “No Exception Taken” - Product approved as submitted.

2. “Furnish as Corrected” - Re-submittal not required, although the Contractor shall provide the submitted product with corrections as noted.

3. “Revise and Resubmit” - Re-submittal required with corrections as noted.

4. “Rejected” - Re-submittal required based upon the originally specified product.

F. Shop drawings shall be submitted on the following but not limited to:

1. Lighting Fixtures, Lamps, and Ballasts.

2. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information.

3. Transformers.

4. Fire Alarm System/Central Monitoring System.

5. Wiring Devices.

6. Lighting Control System/Dimming System Products.

7. Pullboxes and Underground Vaults.

8. Terminal Cabinets

9. Lighting Inverters, UPSs, RDCs, PDUs, Generators, Transfer Switches, SPD Systems.

10. Cable Tray, Flexible Cable Tray and Cable Runway.

11. Power Poles and Floor Boxes.

12. Arc Flash, Short-Circuit and Coordination studies.

13. All other products called out on drawings that call for shop drawing submittal.

1.11 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS

A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating, maintenance, and servicing instructions, as well as four (4) complete wiring diagrams for the following, but not limited to, items or equipment:

1. Lighting Control System/Dimming Systems.

2. Fire Alarm System.

3. Transformers.

4. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information

5. Lighting Inverters, UPS's, PDUs, Generators, Transfer Switches, SPD Systems

B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Four (4) copies shall be presented to the Owner.

1.12 INTERRUPTION OF SERVICE/SERVICE SHUTDOWN

A. Any interruption of electrical services, electrical circuits, electrical feeders, signal systems, communication systems, fire alarm systems, etc. required to perform work, shall meet the specific prior-approval requirements of the Owner. Such work shall be scheduled with the Owner to be performed at the Owner's convenience.

B. Interruptions/outages of any of the Owner’s systems and services mentioned above shall be scheduled to occur during other than the Owner’s normal business hours. Any overtime costs shall be borne by the Contractor.

C. See drawings for any additional requirements regarding outages, interruption and any temporary services required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and Equipment: All electrical materials and equipment, including custom-made equipment, shall be new and shall be listed by Underwriter's Laboratories (UL) and bear their label or be listed and certified by a Nationally Recognized Testing Lab (NRTL) that is also recognized by the local Authority-Having-Jurisdiction (AHJ)

B. Switchgear/Switchboards/Distribution Boards/Motor Control Centers:

1. See general single line notes on single line drawing for more information.

C. Panel boards – Branch Circuit:

1. See drawings for panel board schedules and specifications.

D. Transformers:

1. See drawings for transformer schedules and specifications.

E. Lighting Fixtures:

1. See drawings for lighting fixture and lamp schedules and additional specifications. Furnish, install and connect a lighting fixture at each outlet where a lighting fixture type symbol (designated on plans) is shown as being installed. Each fixture shall be complete with all required accessories including sockets, glassware, boxes, spacers, mounting devices, fire rating enclosure and lamps.

2. Ballasts: See lighting fixture schedule notes. All noisy ballasts shall be replaced at no cost to the Owner.

3. Lamps: See lamp/fixture schedule and lamp/lighting fixture schedule notes.

F. Wiring Devices:

1. Provide wiring devices indicated per plan. Devices shall be specification grade. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell. Provide all similar devices of same manufacturer, unless indicated otherwise. All device colors shall be from the full range of manufacturer standard color options as selected by the Architect. This selection will be made during the shop drawing review process

a. Wiring Devices (Decora)

1)	Convenience Receptacle	#16252- ???
2)	Dedicated Receptacle	#16352-???
3)	Convenience I.G. Receptacle	#16262-IG-???
4)	Dedicated I.G. Receptacle	#16362-IG-???
5)	Convenience G.F.C.I. Receptacle	#GFT1-???
6)	Dedicated G.F.C.I. Receptacle	#GFNT2-???
7)	Convenience Hospital Grade Receptacle	#16252-HG?-???
8)	Dedicated Hospital Grade Receptacle	#16352-HG?-???
9)	Convenience G.F.C.I. Hospital Grade	#GFNT1-HG?
10)	Dedicated G.F.C.I. Hospital Grade	#GFNT2-HG?
11)	Tamper Resistant Convenience Receptacle	#TDR15-???
12)	Tamper Resistant Dedicated Receptacle	#TDR20-???
13)	Tamper Resistant GFCI Receptacle	#GFTR2-???

14)	Tamper Resistant. Convenience. G.F.C.I. Hospital Grade Receptacle	#GFTR1-HG?
15)	Tamper Resistant. Dedicated. G.F.C.I. Hospital Grade Receptacle	#GFTR2-HG?
16)	Weather/Tamper Resistant GFCI Receptacle	#GFWT2-???
17)	Convenience Simplex Receptacle	#16251-???
18)	Dedicated Simplex Receptacle	#16351-???
19)	Recessed Clock Receptacle	#5361-CH-???(Non-Decora)
20)	Single Pole Switch	#5621-2-???
21)	Double Pole Switch	#5622-2-???
22)	Three Way Switch	#5623-2-???
23)	Four Way Switch	#5624-2-???
24)	Pilot Light Switch “On”	#5628-2-???
25)	Pilot Light Switch “Off”	#5631-2-???
26)	Projection Screen Switch	#5657-2-???
27)	Low Voltage Momentary Switch	#5657-2-???
28)	Keyed Switch	#1221-2L-???(Non-Decora)
29)	Door Jam Switch	#1865-???

b. Use of dedicated receptacles is required where plans depict a branch circuit supplying only a single simplex or duplex receptacle. Use of controlled receptacles is required where depicted on plans - see controlled receptacle specifications for additional information.

2. I.G. (isolated ground) receptacle bodies shall be of a basic color specified above with an orange triangle to symbolize isolated ground.

3. H.G. (hospital grade) receptacle bodies shall be of a basic color specified above with a green circle to symbolize hospital grade.

4. When shown circuited with an I.G. conductor, receptacles shall be of an I.G. type. As an example, a NEMA L6-30R denoted on the plans and shown circuited with an I.G. conductor shall be an I.G. version of that receptacle.

5. Wiring devices located in wood finished areas shall generally be black unless otherwise indicated by the Architect.

6. Wiring devices located in mirrors shall generally be white with stainless steel cover plates unless otherwise indicated by the Architect.

7. In addition to other device requirements listed elsewhere in this specification, 125V (Volt), 15A (Amp) and 20A Tamper-Resistant wiring devices shall be provided as follows:

   a. In dwelling units per NEC, or CEC where adopted, Article 210.52.

   b. In pediatric care areas per NEC, or CEC where adopted, Article 517.18(C).

   c. In child care or day care facilities.

   d. In wet and/or exterior locations.

8. Wiring devices shall be listed “hospital grade”, and so identified, in the following locations:

a. Patient bed locations within general care areas per NEC, or CEC where adopted, Article 517.18(B).

b. Patient bed locations within critical care areas per NEC, or CEC where adopted, Article 517.19(B).

c. In “other-than-hazardous” anesthetizing locations per NEC, or CEC where adopted, Article 517.61(C)(2).

9. Wiring device cover plates located on recessed boxes shall be commercial grade nylon. Plate color shall match wiring device color UON on plans. Cover plates utilized on surface mounted boxes shall be metal. Plastic cover plates are unacceptable.

10. Except as otherwise noted, all wiring device plates on the project shall be labeled with panel and circuit number(s) utilizing a Brother P-Touch labeling system with 1/2" tape (yellow on black) or equal by Herman-Tellerman or Panduit. Locate label on the concealed side of the wiring device plate. Handwritten labels are unacceptable.

11. The Contractor shall provide duplex receptacle outlets in the appropriate configurations necessary to comply with applicable energy code requirements for controlled receptacles and as shown on plans. All wiring devices indicated to be controlled receptacles shall be NEMA-approved, electrical code-compliant with factory markings on the face of the receptacle(s) with the word "Controlled" or utilize further markings and symbols to indicate which receptacles on each outlet is/are controlled. Stickers, field-applied markings or other non-permanent markings are not acceptable. Where a GFCI receptacle outlet is required to be controlled, provide an adjacent controlled duplex receptacle outlet connected on the load side of the GFCI outlet. Generally, one receptacle in a duplex receptacle outlet is required to be controlled. It may be the lower receptacle or upper receptacle based on manufacturer offering. However, the controlled receptacle location within a controlled receptacle outlet shall remain consistent throughout the project. Where an existing duplex receptacle outlet is required to be controlled, provide a new wiring device with the appropriate control configuration necessary to comply with plans. All controlled receptacles shall be connected to a branch circuit controlled by an occupancy sensor-based or relay panel lighting control system. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell.

12. The following wiring device plates shall have custom engraving:

a. Key operated switches, switches with pilot lights, and switches for the control of motors, heaters and ventilators. Engraving shall be black and occur on the exposed side of the plate indicating the motor, heater, or ventilator controlled.

b. Receptacles on optional standby generator and/or UPS power shall have custom engraved plates with the words "Generator" or "UPS" in black letters. In addition, where located in telecommunications closets, IDFs, server rooms, data centers, labs (wet, dry or electronic) indicate panel board and circuit number.

c. For Health Care Facilities, provide custom engraved device cover plates, for all devices, indicating panel board and circuit number. Devices served

by normal/utility power circuits shall have black lettering. Devices served by essential electrical system power circuits shall have red lettering.

d. All stainless steel and nylon device plates shall be engraved using a rotary engraving process except for black lettering on stainless steel device plates which may be accomplished via laser etching process. All lettering shall be 3/16" high. Provide a dimensioned submittal drawing detailing a typical device faceplate with engraving.

G. Weatherproof Outlet Covers/Assemblies: All Receptacles identified as weatherproof on the drawings shall be weather-resistant, tamper-resistant, GFCI type and equipped as follows:

1. Type WP-A: Recessed wall box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed rain tight while "in use". Unit shall comply with NEC, or CEC where adopted, Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation of power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:

a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.

b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.

c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box. Where shown mounted in a building wall, any blank/unused compartment shall be equipped min. 3/4" C.O. with pull string routed to the nearest accessible ceiling space.

d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.

e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.

f. Custom color powder coat finish as selected by Architect - Include all costs in base bid for same.

g. In locations with sufficient wall depth, provide 6" wide x 6" tall x 5-1/2" deep recessed wall box (C.W. Cole #TL310-WCS-K1-CUSTOM COLOR).

h. In locations utilizing shallow stud walls construction or other walls of insufficient depth, provide 10-3/4" wide x 7-3/8" tall x 3-7/8" deep recessed wall box (C.W. Cole #TL310-WCS-SH-K1 -CUSTOM COLOR).

i. See drawings for additional details.

2. Type/Subscript WP-B: Wet location-listed raintight while "in use" cast copper-free aluminum lockable cover with baked aluminum lacquer finish and one gang, weather-resistant, tamper-resistant GFCI receptacle. Hubbell WP26E series. Polycarbonate covers are unacceptable. Unit shall comply with NEC, or CEC

where adopted, Article 406.9(A) and (B). Contractor shall powder coat cover assembly to a custom color where receptacle locations are deemed by the Architect to be in aesthetically sensitive or public spaces. Custom color as selected by Architect.

3. Type WP-C: (C.W. Cole #TL310-WCS-PED-ADA-K1-CUSTOM COLOR or #TL310-WCS-PED-K1-CUSTOM COLOR) pedestal device box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed raintight while "in use". Unit shall comply with NEC, or CEC where adopted, Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:

   a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.

   b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.

   c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box.

   d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.

   e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.

   f. Include all costs in base bid for ADA version (22.5" tall) of pedestal box. Prior to ordering material, contractor shall coordinate with Architect and/or AHJ to determine which pedestal box locations do not require ADA compliance and may be changed to the standard (11.5" tall) version of the pedestal box.

   g. Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.

   h. See drawings for additional details.

4. Type/Subscript WP-D: Damp location-listed (not-Raintite-in-use) cast copper-free, pad lockable, die-cast aluminum cover with baked aluminum lacquer finish and one gang GFCI receptacle. Hubbell/Rayco 502?/503? Series. Polycarbonate covers are unacceptable. Unit shall comply with NEC, or CEC where adopted, article 406.9(A) and (B). Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.

H. Motor Controllers/Starters: See drawings for motorized equipment schedules and specifications.

I. Circuit Breakers:

1. Service entrance circuit breakers smaller than 400A (Amp) frame shall be thermal-magnetic trip with inverse time current characteristics unless otherwise indicated below. Service entrance main circuit breakers and main circuit breakers, 400A

frame and larger, shall be 100% rated, solid-state type as outlined in this specification. All other service entrance circuit breakers, 400A frame and larger, shall be 100% rated, solid-state type as outlined in this specification.

2. All non-service entrance circuit breakers 225A and larger shall be thermal magnetic type and have continuously adjustable instantaneous pick-ups of approximately 5 to 10 times trip rating. Breakers shall have either tamper-resistant rating dials or easily changed trip rating plugs with trip ratings as indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Additionally, all non-service entrance circuit breakers, 600A frame and larger, located in 480V, 3-phase, 3-wire or 277/480V, 3-phase, 4-wire switchgear, distribution boards, panel boards or busway plugs shall be solid state, 100% rated. Breaker shall have built-in test points for testing long delay, short delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above - at the Engineer's request.

3. All non-service entrance circuit breakers less than 225A shall be molded plastic case, air circuit breakers conforming to UL 489. Provide breakers with thermal magnetic trip units, and a common trip bar for two- or three-pole breakers, connected internally to each pole so tripping of one pole will automatically trip all poles of each breaker. Provide breakers of trip-free and trip-indicating bolt-on type, with quick-make, quick-break contacts. Provide single two- or three-pole breaker interchangeability. Provide padlocking device for circuit breakers as shown on the Drawings.

4. Where a Current Limiting Circuit Breaker (CLCB) is indicated on drawings or as required elsewhere in this specification, provide a UL listed current limiting thermal magnetic circuit breaker(s) UON. An independently operating limiter section within a molded case is not allowed. Coordinate CLCB ratings as required to protect electrical system components on the load side of the CLCB to include, but not limited to, protecting automatic transfer switches, panel boards and lighting control panels.

5. Where a solid-state circuit breaker is indicated on drawings or as required elsewhere in this specification, provide a solid-state circuit breaker with minimum five function complete with built-in current transformers. The five functions shall be independently adjustable and consist of Overload/Long Time Amp Rating, Long Time Delay, Short Time Delay, Short Circuit/Instantaneous Pickup, but may also include Shunt Trip and/or Ground Fault if so indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Breaker shall have built-in test points for testing long delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above, at the Engineer's request.

6. Circuit breakers, 1200A Frame or larger, or circuit breakers with sensors or adjustable trip settings, 1200A or larger, shall be equipped with an Energy Reducing Maintenance Switch that complies with NEC, or CEC where adopted, 240.87 (B) (3) unless specified elsewhere with an alternate arc energy reduction method allowed by this same code section.

7. Ground Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with ground fault circuit interrupt capability, conforming to UL Class A, Group 1.

8. Arc Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with arc fault circuit interrupt capability, conforming to UL 1699. Provide on all dwelling-unit circuits supplying bedrooms, sleeping quarters etc. as required to comply with NEC, or CEC where adopted, Article 210.12.

9. Tandem or half-sized circuit breakers are not permitted.

10. Series-Rated Breakers: UL listed series-rated combinations of breakers can be used to obtain panelboard-interrupting ratings shown on Drawings. If series-rated breakers are used, switchboards, distribution boards, and panel boards shall be appropriately labeled to indicate the use of series-rated breakers. Shop drawing submittal shall include chart of UL listed devices, which coordinate to provide series rating.

11. Circuit breakers shall be standard interrupting construction. Panelboard shall accept standard circuit breakers up to 100A.

12. Circuit breaker handle accessories shall provide provisions for locking handle in the on or off position.

13. Shunt-trip equipped circuit breakers shall be provided on all elevator feeders.

14. Temperature compensating circuit breaker(s) shall be provided when located in outdoor enclosure(s) or when located in an enclosure subject to high ambient heat due to due nearby industrial processes, etc.

15. Provide 75 degree Celsius-rated conductor lugs/lug kits as required on all circuit breakers to accept conductor quantities and sizes shown on drawings.

16. All circuit breaker terminations shall be suitable for use with 75-degree Celsius ampacity conductors. Listed, dual-rated pin terminals, straight or offset, are acceptable for use to in accommodating oversized or parallel conductor installations.

17. Circuit breakers serving Fire Alarm or Central Monitoring panels and power supplies shall be red in color and lockable in the “ON” position.

J. Disconnect Switches:

1. Non-fusible or fusible, heavy-duty, externally-operated horsepower-rated, 600V A.C: Provide NEMA 3R, lockable enclosures for all switches located on rooftops, in wet or damp areas and in any area exposed to the elements.

2. Fusible switches shall be Class “R” when 600A or less or Class “L” when greater than 600A.

3. Amperage, Horsepower, Voltage and number of poles per drawings: All shall be clearly marked on the switch nameplate.

4. Provide the Owner’s project manager with one (1) spare set of fuses and two (2) sets of fuse clips/fuses for every set of fuses on the project.

K. Fuses:

1. Provide fuses at all locations shown on the Drawings and as required for supplemental protection:

    a. Fuses shall be manufactured by Bussman, Shawmut, or equal.

    b. All fuses shall be the product of a single manufacturer.

2. Main and Feeder Protection:

    a. Protective devices rated greater than 600A: Provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.

    b. Protective devices rated 600A or less: Provide Bussman Class R fuses, Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.

3. Motor Protection:

    a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.

    b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.

    c. Where fuses feeding motors are indicated, but not sized, it shall be the responsibility of the Contractor to coordinate the fuse size with the motor to provide proper motor running protection.

    d. When rejection type fuses are specified (Class RK series) the fuse holder of all switches (specified in other Sections) shall be suitable for the fuses provided.

L. Cable Tray, Flexible Cable Tray and/or Cable Runway:

1. See drawings for Cable Tray, Flexible Cable Tray and/or Cable Runway specifications.

M. Uninterruptible Power Systems (UPS):

1. See drawings for UPS schedules and specifications.

N. Power Distribution Units (PDU):

1. See drawings for PDU schedules and specifications.

O. Generator Systems:

1. See drawings for Generator schedules and specifications.

P. Transfer Switches:

1. See drawings for Transfer Switch schedules and specifications.

Q. Lighting Control/Dimming Systems:

1. See drawings for Lighting Control and/or Dimming Systems schedules and specifications.

2. Wall box dimmers shall be rocker-type as manufactured by Lutron (no known equal except as noted below). Dimmers and dimmer faceplates shall match the color of adjacent switches and faceplates. Dimmers and dimmer faceplates in wood finished areas shall generally be black unless otherwise indicated by the Architect. The Contractor shall obtain written approval of the Architect regarding final dimmer and dimmer faceplate color selection prior to ordering material. Multiple dimmers/switches shall be ganged together with a common cover plate. Provide dimmers as follows:

   a. Incandescent: Lutron DIVA DV-10P or DV-103P (3-way) (1000-Watt max.).

   b. Electronic Low Voltage: Lutron DIVA DVELV-300P or DVELV-303P-(3-way) (300 Watt).

   c. Magnetic Low Voltage: Lutron DIVA DVLV-10P or DVLV103p (3-way) (800-Watt max.).

   d. Fluorescent (3-Wire): Lutron DIVA DVF-103P (single/3way, 8A @ 120V) or DVF-103P-277 (single/3way, 6A @ 277V).

   e. Fluorescent (0-10V): Lutron DIVA DVTV with PP-???H Power Pack.

   f. Fluorescent (Lutron Tu-Wire): Lutron DIVA DVFTU-5A3P with Lutron H.P. module where required.

   g. LED (0 - 10V): Lutron DIVA DVTV with PP-???H Power Pack.

   h. Screw Base CFL/LED: Lutron DIVA DVCL-153P.

   i. Fan Control: Lutron DIVA DVFSQ-F (1.5A @ 120V max, 3 speed, single pole, 3-way).

3. Contractor shall verify if dimmer(s) requires derating when ganged. Contractor shall provide, and provide connections to, additional Lutron Power Modules, Lutron Power Packs, and / or Lutron Interface Modules where required to accommodate loads higher than dimmers standard or derated load-carrying capacity. Note - contractor may to provide a Lutron recommended dimmer type (typically a #DVF-103P unit) to control the necessary power modules or interface devices.

R. Fire Alarm System/Central Monitoring System:

1. See drawings for Fire Alarm System or Central Monitoring System specifications.

S. Surge Protective Device (SPD):

1. See drawings for SPD specifications.

T. Conduit:

1. Galvanized Rigid Conduit (GRC) shall be full weight threaded type steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metalizing, or sherardizing process.

2. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242, and meet Federal Specification WWC-581 (latest revision).

3. Electrical Metallic Tubing (EMT) shall be zinc-coated steel with baked enamel or plastic finish on inside surfaces. EMT shall be dipped in a chromic acid bath to chemically form a corrosion-resistant protective coating of zinc chromate over galvanized surface.

4. Flexible metal conduit shall be constructed of aluminum or hot-dipped galvanized steel strips wound spirally with interlocking edges to provide greatest flexibility with maximum strength. Interior surfaces shall be smooth and offer minimum drag to pulling in conductors. Use only as directed in writing by the Engineer with the exception of 400 Hz feeders and 400 Hz branch circuits which shall be run in flexible aluminum conduit.

5. Liquid-tight conduit (Seal-Tite) shall be galvanized steel flexible conduit as above except with moisture and oil-proof jacket, pre-cut lengths and factory-installed fittings. For outdoor installations and motor connections only unless otherwise noted on drawings.

6. Factory assembled, or off-site assembled wiring systems (such as Metal Clad (MC) Cable, Type AC Cable, Type NM Cable, Type BX Cable, etc.) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing.

7. When approved for use in the Allowed Specification Deviations Section, generally located on the symbols list drawing, MC cables shall be allowed for lighting branch circuits (homeruns shall be EMT), receptacle branch circuits (homeruns shall be EMT) and poke-thru fed systems furniture homeruns. MC shall not be used where exposed, except for a maximum 6’ length for final connections to light fixtures, or terminate in electrical panelboards or distribution boards. Equipment ground conductor shall be green. Isolated ground conductor shall be green with yellow stripe. Provide 600V rated aluminum or lightweight steel interlocking armor Metal Clad (MC) cable with copper conductors, THHN (90-degree C) insulation, and integral equipment grounding conductor and isolated grounding conductor as required. Type AC cable listed for use in patient care areas for non-essential electrical system branch circuits per NEC or CEC where adopted, Article 517.13 shall be required in such areas in lieu of MC cable. Type AC and MC cable shall not be used for essential electrical system branch circuits. MC cable shall be manufactured to Underwriter Laboratory Standard 1569. See PART 3 - EXECUTION section of this specification for additional installation requirements.

8. Nonmetallic Flexible Tubing (ENT) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing. Use of ENT, if allowed, is strictly limited to use in CMU walls and parking structures decks or as directed in writing by the Engineer. See PART 3 - EXECUTION section in this specification for additional installation requirements.

9. Non-Metallic Conduit:

a. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only with solvent welded joints, conforming to Underwriters Laboratories, Inc. (UL) requirements, listed for exposed and direct burial application.

b. Conduit and fittings shall be produced by the same manufacturer.

10. Fire-rated MC Cable:

a. 2-hour fire-rated, polymer insulated 600V MC cable listed and conforming to Underwriters Laboratories, Inc. (UL) 2196 and UL 1569 requirements for installation as an Electrical Circuit Protective System for use in complying with NEC, or CEC where adopted, Articles 695 and 700. Where adopted, cable sheath shall be suitable for use as a NEC or CEC equipment grounding conductor, and shall be listed for use in wet locations to 90 degrees C (Raychem or equal).

b. Cable connectors shall be brass MC connectors.

U. Fittings:

1. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system. These fittings shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.

2. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductors do not pass through the cover.

3. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.

4. UON all EMT fittings, connectors and couplings installed in concealed locations, areas not considered to be wet or damp locations by the AHJ, or areas not subject to physical damage, shall be steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. Where suitable for use, steel set screw fittings are allowed for trades sizes of 2” and smaller. Insulated throat is not required for fittings, connectors and couplings 1” and smaller.

5. All interior and exterior EMT fittings, connectors and couplings, 2” and smaller, installed in exposed or concealed locations that are considered by the AHJ to be wet or damp locations, shall be Raintite-listed, steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If Raintite-listed, EMT fittings, connectors and couplings are unavailable for a given trade size or if conduit is installed in an area subject to damage – provide rigid metallic or intermediate metallic conduits, fittings, connectors and couplings as required.

6. Flexible steel conduit connectors shall be a malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.

7. Conduit unions shall be "Erickson" couplings, or approved equal. The use of running threads will not be permitted.

V. 600 Volt Conductors - Wire and Cable:

1. All conductors shall be copper. Provide stranded conductor for #10 AWG and larger or when making flexible connections to vibrating machinery. Use compression "fork" type connectors or transition to solid conductors when connecting to switches, receptacles, etc.

2. Type THHN/THWN-2 thermoplastic, 600 volt, UL approved, dry and wet locations rated at 90 degrees Celsius, for conductors of all sizes from #12 AWG up to and including 1000 kcmil. RHH/RHW insulation is allowed only to provide an Electrical Circuit Protective System to comply with NEC, or CEC where adopted, Articles 695 and 700.

3. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.

4. Wire and cable shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color-coded and it shall be maintained throughout.

5. Systems Conductor Color Coding:

   a. Power 208/120V, 3PH, 4W:

      1) Phase A = Black
      2) Phase B = Red
      3) Phase C = Blue
      4) Neutral = White or White with Phase Color Tracer
      5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
      6) Travelers = Purple with Black stripe or Pink.

   b. Power 480/277V, 3PH, 4W:

      1) Phase A = Brown
      2) Phase B = Orange
      3) Phase C = Yellow
      4) Neutral = Grey or Grey with Phase Color Tracer
      5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
      6) Travelers = Purple with black stripe or Pink..

   c. Ground Conductors: Green

   d. Isolated Ground Conductors: Green with continuous yellow stripe.

   e. Fire Alarm System: As recommended by the manufacturer.

6. All color-coding for #12 through #6 AWG conductor shall be as identified above. Conductors #4 AWG and larger shall be identified with utilizing phase tape at each termination.

7. No conductors carrying 120V or more shall be smaller than #12 AWG.

8. Aluminum conductors shall not be used.

9. Wire-pulling compounds used as lubricants in installing conductors in raceways shall only be "Polywater J". No oil, grease, graphite, or similar substances may be used. Pulling of #1/0 or larger conductors shall be done with an approved cable pull machine. Other methods; e.g. using vehicles and block and tackle to install conductors are not acceptable.

W. Medium Voltage Conductors (greater than 600V):

1. See drawings for Medium Voltage Cable Schedule and Specifications.

X. Junction and Pullboxes:

1. For interior dry locations, boxes shall be NEMA 1 galvanized one-piece drawn steel, knockout type, with removable, machine screw secured covers.

2. For outside, damp or surface locations, boxes shall be NEMA 3R heavy cast aluminum or cast iron with removable, gasketed, non-ferrous machine screw secured covers.

3. For in-grade applications, junction and pull boxes shall be pre-cast concrete or molded fiberglass manufactured by Christy, Brooks-Jensen, or Utility Vault Co. Fiberglass boxes shall:

   a. Be used only in landscape planter areas that are not subject to damage from lawnmowers, tractors and other machinery.

   b. Not be used in lawn or turf areas.

   c. Not exceed 11” W x 17” L in size unless required to be larger to meet code requirements.

4. All boxes shall be sized for the number and sizes of conductors and conduits entering the box and equipped with plaster rings where required.

5. All boxes located in traffic areas shall be traffic rated.

Y. Outlet Boxes:

1. For fixtures, boxes shall be galvanized, one-piece drawn steel, knockout type equipped with 3/8" fixture studs and plaster rings where required.

2. For convenience outlets, wall switches, or other devices, outlet boxes shall be galvanized one-piece drawn steel, knockout type 4" x 4"x 2-1/8" minimum size with plaster rings as required.

3. For locations where standard boxes are not suitable due to number and size of conduit to be terminated, special boxes shall be designed to fit space or meet other requirements, and submitted for approval.

4. For exposure to weather, damp locations, or surface mounting, outlet boxes shall be heavy cast aluminum or cast iron with threaded hubs; covers shall be watertight with gaskets and non-ferrous screws.

5. Outlet boxes used for support of ceiling fans shall be galvanized, one-piece drawn steel, knockout type equipped with bracing bars and plaster rings where required and listed for ceiling fan support use. Such boxes shall be labeled and capable of supporting ceiling fan weights up to 70 pounds.

6. See drawings for floor box installation notes and specifications.

Z. Plywood Backboards: Where indicated for telephone or communications system terminals or other equipment assemblies, provide backboards of size indicated. Use 3/4" thick x 8' all (length per plans), Douglas Fir, void-free, kiln-dried, fire-rated plywood finished on one side and prime coat painted on all surfaces with finish coat of enamel paint, color by Architect. Leave one (1) fire-rating stamp/sheet exposed for inspection.

AA. Terminal Cabinets:

1. Terminal cabinets shall be fabricated of hot dipped galvanized code gauge sheet metal for flush or surface mounting, complete with barriered sections, a door for each vertically barriered section and sizes as indicated on plan. Doors shall be hinged and lockable. Locks shall be keyed to match the branch circuit panelboards. Terminal cabinet trims shall match the branch circuit panels.

2. Provide each terminal cabinet with a full size mounting backplate.

3. Terminal cabinets shall be installed complete with full-length skirts of the same construction and finish as the terminal cabinet.

4. Where mounted outdoors, terminal cabinets shall be NEMA 3R, weatherproof complete with gaskets and required sealant to prevent moisture from entering the terminal cabinet.

5. All terminal cabinets and terminal cabinet barriered sections shall be labeled by the cabinet or cabinet section use (i.e. CATV, Security, etc.). Labels shall be Micarta type as specified elsewhere in these specifications. Unless otherwise noted, all termination blocks and cables shall be labeled per ANSI/EIA 606 standard.

BB. Painting: Terminal cabinets, panels, junction boxes, pull boxes, etc., and conduit installed in public view shall be painted with colors selected by the Architect to match the subject surfaces. Refer to painting section of the specifications for additional requirements.

CC. Seismic Design, Certification and Anchoring of Electrical Equipment:

1. Contractor shall include all costs in the base bid for labor, materials, all special inspections and structural engineering design necessary to meet the Seismic Design Requirements for Non-structural Components (Chapter 13, ACE SEI 7-05 Minimum Design loads for Buildings and Other Structures) as required by IBC, or CBC where adopted, Section 1708 and as related to the installation all electrical equipment furnished under this contract. See Specific Project Site Seismic Criteria on architectural and/or structural plans which include Building Occupancy Category, Seismic Design Category, Design Spectral Response Acceleration (S_{DS}), Height factor ratio (z/h) and Site Class. Non-structural Component Importance Factor (I_P) for a particular component shall be determined based on the following criteria:

a. I_P = 1.0: Non-life safety, Non-structural Components in an Occupancy Category IV Facility not required for continued operations of the facility or in any other Occupancy Category Facility where component failure will not impair continued operation of the facility.

b. I_P=1.5: Designated Seismic Systems are those non-structural components in any Occupancy Category IV facility (except as noted above) or that are a part of any code-defined Critical, Life Safety, Emergency and Legally Required Standby Electrical System. Additionally, those non-structural components containing hazardous materials shall be classified as Designated Seismic Systems. While Designated Seismic Systems are generally identified on the plans, they may include items such as generators, automatic transfer switches, UPS units and all associated electrical distribution equipment and components necessary for the designated seismic system to form a complete and operable system. The Contractor shall ultimately be responsible for identifying Designated Seismic Systems. For any electrical component either identified on the plans or determined by the contractor to be a Designated Seismic System, all line and load side electrical distribution systems supporting that Designated Seismic System (including, but not limited to, feeders, panel boards switchboards, transformers, all related component supports and attachments etc.) shall be considered a part of the designated seismic system for the purposes of code-compliance and seismic certification.

c. z/h - Height factor ratio: See plans for respective equipment locations.

2. Provide a delegated-design submittal for each of the following seismic-restraint systems to be used as required:

a. Restraint Channel Bracings consisting of MFMA-4, shop-or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

b. Restraint Cables consisting of ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service, with a minimum of two clamping bolts for cable engagement.

c. Seismic-Restraint Accessories consisting of hanger rod/hanger rod stiffener assemblies, multifunctional steel connectors for attaching hangers to rigid channel bracings and/or restraint cables, bushings for floor and wall-mounted equipment anchor bolts and resilient isolation washers and bushings.

d. Mechanical Anchor Bolts consisting of drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

e. Adhesive Anchor Bolts consisting of drilled-in and capsule anchor system containing resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide specific LEED-compatible environmentally-friendly resins and adhesives on all LEED projects. Provide anchor bolts and

hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

3. Submittal shall include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the contractor's structural engineer responsible for their preparation. Calculations shall include, but not be limited to, static and dynamic loading caused by equipment weight, operation, and seismic and, if applicable, wind forces required to select seismic and, if applicable, wind restraints and for designing vibration isolation bases. Provide seismic and wind-restraint detailing to support system selection, arrangement of restraints, attachment locations, methods, and spacings with all components identified to include their strengths, directions and values of forces transmitted to the structure during seismic events and association with vibration isolation devices. Sizes of components shall be selected so strength will be adequate to carry present static and seismic loads to accommodate 25% spare future capacity within specified loading limits.

4. Any pre-approval and evaluation documentation shall have a California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproval (OSP) demonstrating horizontal and vertical load testing and analysis showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

5. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified elsewhere in the project specifications.

6. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment. Flexible connection limitations of the NEC, or CEC where adopted, shall apply.

7. Install seismic-restraint devices using methods approved by OSHPD or an agency acceptable to authorities having jurisdiction providing required submittals for component.

8. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by OSHPD or an agency acceptable to authorities having jurisdiction.

9. The contractor shall engage a qualified testing agency to perform tests and inspections as listed in other Project Specifications, but as a minimum shall include at least four of each type and size of installed anchors and fasteners selected by Architect. Schedule tests with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members as required. Test to 90 percent of rated proof load of device. Prepare and submit test and inspections reports.

DD. Trenching and Backfilling: Contractor shall be responsible for trenching and backfilling. Refer to Trenching and Backfilling section of the specifications for complete requirements.

PART 3 - EXECUTION

3.1 PREPARATION AND INSTALLATION

A. Installation of Conduit and Outlet Boxes:

1. All conduit installed in the dry walls or ceilings of a building shall be steel tube (EMT), aluminum tube (EMT), or Intermediate Metal Conduit (IMC). Flexible conduit shall not be used in lieu of EMT, IMC or rigid conduit except as noted herein.

2. Galvanized rigid conduit (GRC) or intermediate metal conduit (IMC) shall be used as follows:

   a. When noted on the drawings.

   b. When considered exposed to damage by the local AHJ.

   c. When installed in wet or damp locations and of a trade size where listed-Raintite fittings, connectors, couplings etc. are unavailable.

   d. When required by NEC or CEC Article 517.13.

   e. When installed in concrete and masonry. The use of ENT in CMU walls and parking structures may be allowed only as directed in writing by the Engineer. Request for ENT substitution must be made prior to bid and in accordance with pre-bid substitution requests requirements of these specifications.

3. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or steel-tube EMT and in accordance with NEC, or CEC where adopted, Article 342.

4. Flexible steel conduit shall only be permitted to be used at light fixture outlets and connections to vibrating electrical equipment. Except when concealed in walls or other structural elements, all flexible steel conduit runs shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of flexible conduit shall be allowed only as approved in writing by the Engineer.

5. Flexible liquidtight conduit shall be installed in lieu of the flexible steel; where required by the NEC, or CEC where adopted, in damp and wet location, where exposed to weather, in refrigerated area (65°F or less), and/or between seismic joints. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of liquidtight flexible conduit shall be allowed as approved in writing by the Engineer on a case by case basis.

6. Rigid metallic conduit installed underground or embedded in concrete shall be 1” trade size minimum and shall be wrapped with 20 mil. Polyvinylchloride plastic tape, PVC conduit installed underground or embedded in concrete shall be 3/4" minimum trade size.

7. Where required for providing an electrical circuit protective system to comply with NEC, or CEC where adopted, Articles 695 and 700 utilize UL Listed 2-hour fire-rated, MC cable or UL Listed 2-hour fire-rated RHH/RHW conductors in conduit.

8. Conduit shall be run so as not to interfere with other piping fixtures or equipment.

9. The ends of all conduit shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.

10. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.

11. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight.

12. All metal conduit in masonry and concrete and where concealed under floor slabs shall have joints painted with thread compound prior to makeup.

13. PVC conduit shall not be run in walls except where approved by the Engineer prior to bid in limited instances that may include concrete or CMU walls used in site retaining, parking structures, or exterior equipment yard or enclosure walls, etc.

14. Where conductors enter a raceway or a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.

15. Where conduit extends through roof to equipment on roof area, the Contractor shall provide flashing material compatible with the roofing system as required by the roofing specifications or as required by the Owner’s roof warranty. This flashing shall be delivered to the roofing Contractor for installation. The actual location of all such roof penetrations and outlets shall be verified by the Architect/Owner. Contractor to verify type of flashing prior to bid and include all costs.

16. All conduit shall be supported at intervals not less than 6'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two-hole conduit clamp properly secured.

17. Where conduit racks are used the rack shall consist of two-piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.

18. Nail-in conduit supports, one-piece set screw type conduit clamps or perforated iron for supporting conduit shall not be used.

19. Seismic Conduit Support:

    a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting

the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:

CONDUIT SIZE	MAXIMUM SPACING
1/2" to 3"	6'-0"
3-1/2" to 4"	8'-0"

20. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.

21. Open knockouts in outlet boxes only where required for inserting conduit.

22. Locate wall outlet of the same type at same level in all rooms, except where otherwise noted.

23. Outlet boxes on metal studs shall be attached to metal hangers, tack welded or screwed to studs; on wood studs attachment shall be with wood screws, nails are not acceptable.

24. Recessed boxes shall not be mounted back-to-back in any wall; minimum offset shall be 24 inches.

25. Junction Boxes that do not contain any device(s) shall be located in storage rooms, electrical closets, or above accessible ceilings, not in hard lid ceilings or other forms of inaccessible ceilings. Place boxes which must be exposed to public view in a location approved by the Owner's Project Manager. Provide covers or plates to match adjacent surfaces as approved by the Owner's Project manager.

26. Surface mounted pull boxes, terminal cabinets, junction boxes, panel boards etc., shall be attached to walls using appropriate screws, fasteners, backing plates, stud blocking etc., as detailed on architectural and/or structural drawings. If architectural and/or structural drawings are not provided on the project, Contractor shall provide all necessary mounting hardware and backing support to comply with local building code requirements and any additional requirements imposed by the local Authority-Having-Jurisdiction.

27. Sleeves shall be installed where conduit passes through masonry or concrete walls and shall be 24-gauge galvanized steel no more than 1/2" greater in diameter than the outside diameter of the conduit. When located in non-rated structures, caulk conduit sleeve with stone wool and waterproof below grade. When located in fire rated structures, provide UL listed fire stopping system. See fire stopping section of this specification for additional requirements.

28. All boxes shall be covered with outlet box protector, Appleton SB-CK, or similar device/method to keep dirt/debris from entering box, conduit or panels. If dirt/debris does get in, it shall be removed prior to pulling wires.

29. All boxes installed outdoors shall be suitable for outdoor installations, gasketed, screw cover, and painted as directed by the Architect with weatherproof paint to match building.

30. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.

31. Provide nylon or a 1/8-inch O.D. polyethylene rope, rated at 250 pounds tensile strength, in all conduits more than 5 feet in length left empty for future use. Not less than 5 feet of rope shall be left at each end of the conduit. Tag all lines with a plastic tag at each end indicating the termination/stub location of the opposite end of the conduit.

32. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/racks, Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system. Support conduit to structure above suspended ceilings 8" minimum above ceiling to allow removal of ceiling tile. Maintain two-inch clearance above recessed light fixtures

33. All exposed conduits and support hardware shall be painted to match the finish of the wall or ceiling to which it is supported.

34. Where conduits or wireways cross seismic joints, provide approved flexible conduit connection or approved expansion/deflection fitting to allow for displacement of conduit in all three axes. Connection shall allow for movement in accordance with design of seismic joint. Non-flexible raceways crossing expansion joints or other areas of possible structural movement shall make provision for 3-way movement at such points by means of expansion/deflection fittings. Fittings shall be installed in the center of their axes of movement and shall not be deflected to make part of a conduit bend, or compressed or extended to compensate for incorrect conduit expansion/deflection fittings(s) complete with ground jumpers. Where necessary, provide approved expansion joints to allow for thermal expansion and contraction of conduit(s). Install expansion joints complete with ground jumpers.

35. Seal all conduits where termination is subject to moisture or where conduit penetrates exterior wall, floor or roof, in refrigerated areas, classified (hazardous areas) and as indicated on the drawings.

36. Except as otherwise indicated on the Drawings or elsewhere in these specifications, bends in feeder and branch circuit conduit 2 inches or larger shall have a radius or curvature of the inner edge, equal to not less than ten (10) times the internal diameter of the conduit. Except where sweeping vertically into a building, and where sweep radius equals ten (10) times conduit diameter, underground communications and building interconnect conduits 3 inches or larger shall have a minimum 12’-6” radius or curvature of the inner edge. For the serving utilities, radius bends shall be made per their respective specifications.

37. Tag all empty conduits at each accessible end with a permanent tag identifying the purpose of the conduit, footage end-to-end, and the location of the other end. In wet, corrosive outdoor or underground locations, use brass, bronze, or copper 16-gauge tags secured to conduit ends with #16 or larger galvanized wire. Inscribe on the tags, with steel punch dies, clear and complete identifying information.

38. The following additional requirements shall apply to underground conduits:

    a. Underground conduit shall be Schedule 40 PVC (polyvinyl chloride) unless otherwise indicated elsewhere in these specifications or as required per NEC, or CEC where adopted Article 517.13.

    b. For all communications conduits 2" and larger and feeders 100A or greater, provide with a minimum 3" inch, (2,000 LB) concrete envelope, 2-

inch minimum separation between conduits, installed at depth of not less than 24" below grade. (Provide concrete encasement and/or greater minimum conduit depth as required by the Utility Companies.) Conduit separation within a duct bank shall be maintained using plastic spacers located at 5'-0" intervals. Where power and communication conduits are run in a common trench, a 12-inch minimum separation shall be maintained between power and communication conduits or as required by Utility Companies. Where concrete encasement is not required by serving utilities for a utility-only duct bank, provide free draining sand bedding suitable to achieve 95% relative compaction based on ASTM D1557 using 6” lifts or directed by Utility Company Standards.

c. In all cases, where any conduit(s) pass under a building slab or footing, the electrical Contractor will provide a Bentonite clay or concrete barrier that conforms to the height and width of the trench excavation extending a minimum of 24” on either side of the foundation. In all cases, where conduit(s) pass through a sleeve in a footing or other foundation element, the electrical Contractor will provide a Bentonite clay or concrete barrier between the sleeve and the conduit(s) surrounding the conduit(s) for the entire depth of the sleeve. The barrier is required to prevent passage of moisture under or through the slab or footing via the trench or sleeve.

d. Where underground conduit passes under a building slab, concrete encasement may not be required, except as required above, contact the Engineer for written direction prior to omitting any encasement.

e. Underground conduits, which terminate inside building(s) below grade, such as in a basement level, or which slope so that water might flow into interior building spaces, shall be sealed at the point of penetration with a modular conduit seal (Link-Seal or equal by Rox Systems). Conduit/conduit sealing system penetrations of waterproofing membranes/systems on existing structures shall be completely restored as required to maintain membrane/system manufacturer and installer warranty for the installation. All conduits shall be provided with a 4% slope away from buildings. All conduits shall be installed such that the water cannot accumulate in the conduit and such that water drains into the nearest manhole, pull box or vault – not into the facility. In instances where grade changes or elevation differences prevent sloping of conduit away from a building into the nearest manhole, pull box or vault or where accumulation of water in a manhole, pull box or vault may result in water traveling into the facility, conduits shall be sealed internally at each end of each conduit using conduit sealing bushing, sized as required for the conductors contained within the conduit (O-Z Gedney #CSBG 100psig withstand or equal). In all cases, install plugs or caps in spare (empty) conduits at both ends of each conduit (Jackmoon or equal) preventing both water and gas from entering the facility via the conduits.

f. Include a separate insulated green ground conductor sized per NEC, or CEC where adopted, in each underground electrical feeder/branch circuit.

g. All underground conduits with circuits rated at 40As or greater and all underground communications conduits shall be provided with a metallic marker tape located 12 inches below the finished grade.

h. Where underground conduits sweep into/through slabs, utilize PVC 90 degree sweeps that transition, via female PVC adapter to GRC coupling

mounted flush in slab. GRC couplings shall be 1/2 lap taped with 20-mil tape. If the distance of the conduit run between a sweep and the next connecting sweep, pullbox, vault or manhole exceeds 150 ft then the sweep shall be concrete encased. Exceptions:

1) Communications conduits shown terminating at a finished floor shall have an additional 4" high GRC nipple equipped with a bushing, removable conduit plug, labeling tag and pull rope. Tie off pull rope to conduit plug.
2) Utility conduit sweeps shall be installed per the requirements of the respective utility company.

i. All PVC conduit shall be glued for a water and gas tight installation. The Contractor shall use appropriate solvent on all joints prior to gluing conduit and fittings together.

j. All underground conduit work shall conform to the Federal, State and Local Safety Orders or Rules regarding excavations, trenches and related earthwork. For projects in California, refer to the California Code of Regulations, Title 8, Construction Code Sections 1540 and 1541 for additional requirements.

39. Installation of Metal Clad (MC) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing).

a. Provide J-box above accessible ceiling prior to running MC cable within partitions or walls. J-box shall be permanently labeled with panel identification and circuit numbers contained within.

b. Overhead MC cable runs shall generally follow building lines to provide a neat and workmanlike installation.

c. Provide code-sized J-boxes to accommodate MC cable splicing in general. For systems furniture poke-through feeds utilizing MC cable, transition from MC cables to conduit and wire near the panelboard in the TI accessible ceiling space on the floor below the panel board via code-sized gutter(s). Utilize UL listed, insulated barrier strips with recessed screw heads (Ideal #89-6?? Series or equal) fastened within the gutter(s), terminate MC conductors on one side of the strips(s) and individual conductors in conduit from the panelboard(s) on the other side of the strip(s). Label each terminal strip(s) with panel designation. Label each phase conductor with circuit number using wire markers (Ideal or equal). Wire nuts are not an acceptable alternative to the terminal strips in these underfloor transition locations. Provide (1) spare 3/4" conduit from each gutter to its respective panelboard.

d. MC cable shall not run directly into panelboards, distribution boards or electrical rooms.

e. MC cabling shall be provided with its own code-approved ceiling support wires, cable hangers, individual spring steel support clips, steel trapeze hangers, threaded roads or dedicated #10 AWG drop wire. Cable supports shall be fastened to concrete slabs, beams, joists or other structural members of the building. In no case shall MC cable rest on

ceilings, suspended ceilings or structures. Do not support MC cable using ceiling support wires. The use of nylon cable ties to support MC cable is not allowed.

f. Use lock or spring nut MC cable fittings.

g. Cable runs shall be continuous from wiring device to wiring device – no intermediate splicing J-boxes allowed.

h. When terminating or splicing at a junction, outlet, or switch box, cut the cable with an armored cable rotary cutter such that 6-inches of free conductors remain for connections or splices. Use screw-in or spring lock connector and ensure a proper bonding by firmly tightening the connector to both the box and cable. Insert an anti-short bushing at cable ends to protect conductors from abrasion and use insulated connectors.

i. MC cable bend radius shall not e less than seven (7) times the external diameter of the cable.

j. MC cables passing through fire-rated walls or floors shall be firestopped as required with a UL listed system. See firestopping requirements outlined elsewhere in this specification for additional requirements.

k. Installation shall not exceed code requirements for total current carrying conductors in multiple MC Cable runs bundled together into a single MC cable hanger or strap, unless support device is specifically listed for such purpose. Neutrals shall be counted as current carrying conductors.

l. Maintain MC Cable clearance of at least 6 inches from hot water and any other high temperature pipes. Maintain at least 12-inches clearance between MC cable(s) and telecommunication conduits and cables. MC cable shall cross telecommunication cables and conduits at right angles.

m. MC cabling shall not be run through exposed ceilings, where open grid conditions exist, exposed on walls, or exposed to view. See Power Plan and Lighting Plan General Notes for additional requirements.

40. Installation of Electrical Nonmetallic Tubing (ENT) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing).

a. When approved for use in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing, 1/2" and 3/4” trade size ENT shall be allowed for concealed lighting branch circuits, receptacle branch circuits and miscellaneous signal system circuits within concrete floors, walls and columns within parking structures.

b. ENT conduit shall meet the requirements of Underwriters Laboratories Standards 1479 and 1655, NEMA TC-13, and be UL-listed.

c. All ENT conduit, ENT fittings, ENT boxes and ENT accessories shall be UL listed and manufactured by the same manufacturer so as to form a complete ENT system. ENT systems shall only be used if they are listed for use in fire resistance rated concrete floors and ceilings with resistance

ratings as indicated elsewhere in the project plans. ENT system shall comply with NEC, or CEC where adopted, Article 362.

d. All ENT fittings and ENT boxes shall be concrete-tight listed without the use of tape. Additionally, ENT fittings shall be constructed of high impact PVC and able to resist ENT conduit pull out forces of a minimum of 175 lbs. ENT fittings with fewer than 6 locking tabs for ENT connection shall utilize manufacturer approved glue as additional protection from fitting/conduit separation. ENT conduit to rigid conduit transition fittings shall be equipped with set screw fittings on the rigid conduit side of the fitting. ENT to metal box fittings shall be equipped with a threaded end and lock washer.

e. Where tubing enters a box, fitting, or other enclosure provide a bushing or adapter to protect conductors from abrasion unless the box, fitting, or enclosure design provides equivalent protection.

f. ENT junction boxes shall have brass screw inserts and shall be rated to support lighting fixtures weighing less than 50 lbs.

g. Concrete tight metal boxes shall be used to support pendant hung fixtures or fixtures over 50 lbs.

h. ENT shall be provided in continuous lengths between junction boxes without use of in-line splices or connectors and shall be clearly marked/labeled at least every 10 feet.

i. All ENT conduit containing electrical branch circuits shall contain a code-sized equipment ground conductor.

j. ENT shall transition to EMT, IMC, RMC, or rigid PVC, as appropriate or as called out elsewhere in this specification, for all exposed conduits within/on/under a parking structure.

k. ENT shall transition to appropriately sized PVC expansion joint(s) at all structure expansion or seismic joints.

l. ENT shall be securely fastened and supported every 2 – 3 ft. and within 1 ft. of every junction box and fitting to prevent movement and sag.

m. ENT shall be routed straight without sags, or excessive bending. Where bends are required, comply with Table 362.24 of the NEC for minimum radius of bends. Number of bends shall not exceed quantity allowed by code where used for power and lighting branch circuit and/or feeder conductors. Where utilized for communications system conductors (phones, data cabling, etc.) number of bends shall not exceed the equivalent of (2) 90-degree bends with conduit length no more than 100 feet without installation of a TIA 569-compliant pull box.

n. Separation of ENT from fittings, excessive sags, or deflections in ENT runs that prevent pulling of wire and other ENT system product or system installation failures/errors shall be corrected by saw cutting and patching as necessary at no additional cost to the Owner. Use of surface mounted conduits and junction boxes as a repair method is unacceptable.

o. Empty ENT runs shall be provided with a nylon pull string.

p. Coordinate installation of raceway with structural steel and other structural members. Do not cut, notch or otherwise alter structural members without obtaining approval in writing from the Structural Engineer of record.

q. No more than (2) 3/4" ENT conduits may cross each other within a horizontal concrete slab without obtaining approval in writing from the Structural Engineer of record.

B. Installation of 600-Volt Conductors:

1. All electrical wire, including signal circuits, shall be installed in conduit.

2. All circuits and feeder wires for all systems shall be continuous from over current protective device or switch to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.

a. Utilize preinsulated "winged" spring type connectors, 3M Company "Performance Plus" #O/B or #R/Y or equal as required for splices and taps in conductors #6 AWG and smaller. When a spring connector is used in an underground environment or when subject to moisture, utilize a 3M Company Scotchcast 3507G epoxy resin connector sealing pack to seal the spring connector. THE USE OF PUSH-WIRE CONNECTORS (e.g. "WAGO" OR EQUIVALENT) IS STRICTLY PROHIBITED.

b. Wires #4 AWG and larger AWG shall be joined together as follows:

1) When located in an underground environment or when subject to moisture, the splice shall be made with compression connector and sealed by a 3M, or equal, PST cold shrink connector insulator.
2) When located in an interior environment, the splice shall be made with an Ilsco or equal dual rated, insulated splice-reducer connector or multi-tap connector-listed for use with 75/90-degree Celsius rated conductors.

c. Connections to busbar shall be made with dual-rated copper/aluminum one-piece compression lugs. Paralleled conductor connections shall be by mechanical lugs.

3. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires.

4. Install UL approved fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.

5. For 20A branch circuit wiring, increase #12 conductors to #10 for 120-volt circuits longer than 100 feet and for 277V circuits longer than 150 feet.

6. Conductor Support: Provide conductor supports as required by codes and recommended by cable manufacturer. Where required, provide cable supports in vertical conduits and provide lower end of conduit with a ventilator.

C. Grounding/Bonding:

1. Provide grounding and bonding for entire electric installation as shown on plans, as listed herein, and as required by applicable codes. Included, but not limited to, are items that require grounding/bonding:

    a. Conduit, Raceways and Cable Trays.

    b. Neutral or identified conductors of interior wiring system.

    c. Panel boards, Distribution Boards, Switchgear and Switchboards.

    d. Non-current carrying metal parts of fixed equipment.

    e. Telephone distribution equipment.

    f. Transformers, Inverters, UPS, PDU, RDC, Transfer Switch and Generator Systems.

    g. Raised Flooring.

    h. Exposed metal in maintenance holes, hand holes.

    i. Lightning Protection Systems and Antennas.

    j. Metal piping installed in or attached to a building/structure.

    k. Metallically isolated structural steel.

    l. Metallically isolated underground metal water piping.

    m. Elevator hydraulic piston/lift case.

2. In multi-occupancy buildings, Contractor shall bond metal water piping systems instated in, under or attached to a building and/or structure serving individual occupancies where the piping system(s) are metallically isolated from each other. Per NEC, or CEC where adopted ART. 250.104(A)(2) and (4), the bonding conductor shall be sized per Table 250.122 and connected to the switchboard/panel board serving that suite/occupancy.

3. Use of Ground Rods: Furnish and install required number of 3/4" x 10' copper clad ground rods to meet specified resistance, all required grounding wires, conduit and clamps. The size of the grounding conductors shall be not less than that set forth in the latest edition of the California Code of Regulations, Title 24, State of California and NEC (CEC, where adopted), unless otherwise indicated. Rods shall be installed such that at least 10 feet of length is in contact with the soil. Where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from vertical or shall be buried in a trench that is at least 30 inches deep. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding electrode conductor attachments are protected against physical damage. Unless otherwise noted, connection to the grounding electrode conductor may be by compression type or exothermic process connector. Mechanical connectors shall not be used.

4. Grounding System Connection:

a. Compression connectors shall be unplated copper, manufactured by Burndy, or approved equal, designed specifically for the intended connection.

b. Exothermic weld-type connectors shall be 'Cadweld' manufactured by Erico Products, or approved equal, designed specifically for the intended connection.

c. Mechanical connectors shall not be used.

5. Isolated Ground Receptacles shall have an insulated ground wire connected between the receptacle and the panelboard isolated ground bus. Unless otherwise noted, this ground wire shall not be grounded at any other point, and shall be distinguished from other ground wires by a continuous yellow stripe.

6. Provide separate green equipment ground conductor in all electrical raceways to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through #10 AWG. Use NEC (or CEC where adopted) Table 250.122 for conductor size with phase conductors #8 and larger, if not shown on the Drawings.

7. Clean the contact surfaces of all ground connections prior to making connections.

8. Ductwork: Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.

9. Motors: Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium plated steel.

10. Building grounding system resistance to ground shall not exceed 25 ohms unless otherwise noted and should be confirmed by testing.

D. Line Voltage and Low Voltage Power Supplies to all Mechanical Equipment Including Plumbing, Heating and Air Conditioning Units:

1. An electric power supply, including conduit, any necessary junction and/or outlet boxes and conductors and connection shall be furnished and installed by the Contractor for each item or mechanical equipment.

2. Power supplies to individual items of equipment shall be terminated in a suitable outlet or junction box adjacent to the respective item of equipment, or a junction box provided by the manufacturer or the equipment and directed by the Mechanical Contractor. Allow sufficient lengths of conductor at each location to permit connection to the individual equipment without breaking the wire run.

3. The location of all conduit terminations to the equipment is approximate. The exact location of these conduit terminations shall be located and installed as directed by the Mechanical and Plumbing Contractor.

4. Provide power supplies to all plumbing and mechanical equipment, including but not limited to, equipment furnished and installed by Owner or Contractor such as heating and air conditioning equipment, pumps, boilers, auto valves, water coolers, trap primers etc. The installation shall produce a complete and operable system.

5. Unless otherwise noted, the Contractor shall furnish and install all conduit, boxes, wires, etc., for line voltage wiring and low voltage wiring.

6. It is the Contractor's responsibility to verify with the drawings of other trades regarding the extent of his responsibility for mechanical equipment. The bid must include a sum sufficient to cover the cost of the installation.

7. The location of all power supply connection and/or terminations to the mechanical equipment is approximate. The exact locations of these terminations shall be verified with other trades during construction.

E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.

F. Firestopping:

1. The Contractor shall be responsible for furnishing all material, labor, equipment, and services in conjunction with the selection and installation of a complete, fully functioning, code compliant, UL-listed, fire stop assembly/system(s) as required by project conditions.

2. Each fire stop assembly/system shall have an "F" and/or "T" rating as required by each condition requiring fire stopping. Each fire stop assembly/system shall have a current UL listing, as indicated in the latest edition of the UL Fire Resistance Directory. Contractor shall verify acceptability of all fire stopping methods and system selections with the authority having jurisdiction prior to installation. The Contractor shall install each fire stop assembly/system in accordance with the manufacturer's printed instructions.

3. Each fire stop assembly/system shall be labeled with fire stop manufacturer-furnished label on each side of the fire stopping systems depicting UL # etc.

G. Housekeeping Pads

1. Provide a minimum 3" high housekeeping pad above finished floor/finished grade for all floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, etc., flush with the face of the equipment. Located in mechanical central plant(s), other mechanical spaces, and located outdoors, pads shall be flush with the face of the equipment. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.

2. Unless otherwise noted above, provide a minimum 1-1/2" high housekeeping pad above finished floor/finished grade for all interior floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, transfer switches etc., flush with the face of the equipment. All housekeeping pad heights are as measured from finished floor or grade. Confirm pad dimensions with local

inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.

3. Provide a 1-1/2" high housekeeping pad above finished floor/finished for service equipment. Prior to pad rough-in, Contractor shall verify serving utility company's maximum meter height requirements and, if necessary, adjust height of housekeeping pad to comply with those requirements. In indoor applications, the pad shall be flush with the face of the switchgear. In outdoor applications, the housekeeping pad shall extend a minimum of 4 feet from the front of switchgear/switchboard's weatherproof enclosure. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.

4. All housekeeping pads located in, on or attached to a building shall be seismically braced/connected to the building structure.

END OF SECTION