



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

STANDARD LOW BID PROJECT

November 14, 2007

BOILER REPLACEMENT ROOSEVELT CAMPUS

**UTAH STATE UNIVERSITY
ROOSEVELT, UTAH**

DFCM Project Number 07189770

Cunning and Associates
591 North Main
Clearfield, Utah 84015

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at <http://dfcm.utah.gov> or are available upon request from DFCM.

DFCM General Conditions dated May 25, 2005.

DFCM Application and Certification for Payment dated May 25, 2005.

Technical Specifications :

Drawings:

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at <http://dfcm.utah.gov>

NOTICE TO CONTRACTORS

Sealed bids will be received by the Division of Facilities Construction and Management (DFCM) for:

BOILER REPLACEMENT - ROOSEVELT CAMPUS
UTAH STATE UNIVERSITY – ROOSEVELT, UTAH
DFCM PROJECT NO: 07189770

Bids will be in accordance with the Contract Documents that will be available at 3:00 PM on Wednesday, November 14, 2007, and distributed in electronic format only on CDs from DFCM, 4110 State Office Building, Salt Lake City, Utah and on the DFCM web page at <http://dfcm.utah.gov>. For questions regarding this project, please contact Vic Middleton, DFCM, at 801-971-0504. No others are to be contacted regarding this bidding process. The construction budget for this project is \$120,000.00

A **mandatory** pre-bid meeting will be held at 10:00 AM on Wednesday, November 28, 2007 at the Utah State University Roosevelt Campus, 987 East Lagoon Street, Roosevelt, Utah. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 3:00 PM on Wednesday, December 12, 2007 at DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. NOTE: Bids must be received at 4110 State Office Building by the specified time.

A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

The Division of Facilities Construction and Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of DFCM.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
Marla Workman, Contract Coordinator
4110 State Office Building, Salt Lake City, Utah 84114

PROJECT DESCRIPTION

The facility has two small boilers and some additional piping to be changed out. Some controls work associated with the boilers is also included.



PROJECT SCHEDULE

PROJECT NAME:	BOILER REPLACEMENT - ROOSEVELT CAMPUS			
	UTAH STATE UNIVERSITY – ROOSEVELT, UTAH			
DFCM PROJECT NO.	07189770			
Event	Day	Date	Time	Place
Bidding Documents Available	Wednesday	November 14, 2007	3:00 PM	DFCM 4110 State Office Bldg SLC, UT and the DFCM web site *
Mandatory Pre-bid Site Meeting	Wednesday	November 28, 2007	10:00 AM	USU Roosevelt Campus 987 East Lagoon Street Roosevelt, UT
Last Day to Submit Questions	Friday	November 30, 2007	3:00 PM	Vic Middleton – DFCM E-mail vmiddlet@utah.gov Fax 801-538-3267
Addendum Deadline (exception for bid delays)	Tuesday	December 4, 2007	2:00 PM	DFCM web site *
Prime Contractors Turn In Bid and Bid Bond	Wednesday	December 12, 2007	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Sub-contractor List Due	Thursday	December 13, 2007	3:00 PM	DFCM 4110 State Office Bldg SLC, UT Fax 801-538-3677
Substantial Completion Date	Monday	April 14, 2008		

* **NOTE:** DFCM's web site address is <http://dfcm.utah.gov>



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

BID FORM

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **BOILER REPLACEMENT – ROOSEVELT CAMPUS UTAH STATE UNIVERSITY - ROOSEVELT, UTAH – PROJECT NO. 07189770** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

_____ DOLLARS (\$_____)

(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **April 14, 2008**, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **\$300.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____.

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract.

The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable 100% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization:

(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

Respectfully submitted,

Name of Bidder

ADDRESS:

Authorized Signature

INSTRUCTIONS TO BIDDERS

1. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Invitation to Bid.

2. Bids

Before submitting a bid, each contractor shall carefully examine the Contract Documents, shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Invitation to Bid prior to the deadline for submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. **THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.**

If the bid bond security is submitted on a bid bond form other than DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. **NOTE: A cashier's check cannot be used as a substitute for a bid bond.**

3. Contract and Bond

The Contractor's Agreement will be in the form found in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the contract sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for subcontractors will be specified in the Supplementary General Conditions.

4. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the “Instructions and Subcontractor’s List Form”, which are included as part of these Contract Documents. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

5. Interpretation of Drawings and Specifications

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Project Manager a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by addenda posted on DFCM’s web site at <http://dfcm.utah.gov>. Neither the DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

6. Addenda

Addenda will be posted on DFCM’s web site at <http://dfcm.utah.gov>. Contractors are responsible for obtaining information contained in each addendum from the web site. Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda may result in disqualification from bidding.

7. Award of Contract

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

8. DFCM Contractor Performance Rating

As a contractor completes each DFCM project, DFCM, the architect/engineer and the using agency will evaluate project performance based on the enclosed “DFCM Contractor Performance Rating” form. The ratings issued on this project will not affect this project but may affect the award on future projects.

9. Licensure

The Contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

10. Permits

In concurrence with the requirements for permitting in the General Conditions, it is the responsibility of the Contractor to obtain the fugitive dust plan requirements from the Utah Division of Air Quality and the SWPPP requirements from the Utah Department of Environmental Quality and submit the completed forms and pay any permit fee that may be required for this specific project. Failure to obtain the required permit may result in work stoppage and/or fines from the regulating authority that will be the sole responsibility of the Contractor. Any delay to the project as a result of any such failure to obtain the permit or noncompliance with the permit shall not be eligible for any extension in the Contract Time.

11. Right to Reject Bids

DFCM reserves the right to reject any or all Bids.

12. Time is of the Essence

Time is of the essence in regard to all the requirements of the Contract Documents.

13. Withdrawal of Bids

Bids may be withdrawn on written request received from bidder prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

14. Product Approvals

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of

the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

15. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the contractor, subcontractor or sub-subcontractor.

16. Debarment

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by DFCM as part of the requirements for award of the Project.

**Division of Facilities Construction and****INSTRUCTIONS AND SUBCONTRACTORS LIST FORM**

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, based on the following:

DOLLAR AMOUNTS FOR LISTING

PROJECTS UNDER \$500,000: ALL FIRST-TIER SUBS \$20,000 OR OVER MUST BE LISTED
PROJECTS \$500,000 OR MORE: ALL FIRST-TIER SUBS \$35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- If there are no subcontractors for the job that are required to be reported by State law (either because there are no subcontractors that will be used on the project or because there are no first-tier subcontractors over the dollar amounts referred to above), then you do not need to submit a sublist. If you do not submit a sublist, it will be deemed to be a representation by you that there are no subcontractors on the job that are required to be reported under State law. At any time, DFCM reserves the right to inquire, for security purposes, as to the identification of the subcontractors at any tier that will be on the worksite.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A. Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

GROUNDS FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM
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such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

- (1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
- (2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
- (3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
- (4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
- (5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
- (6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONTRACTOR LICENSE #
ELECTRICAL	ABCD Electric Inc.	\$350,000.00	123456789000
LANDSCAPING	"Self" *	\$300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	\$298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: \$350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

* Bidders may list "self", but it is not required.

PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.



SUBCONTRACTORS LIST
FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

Table with 4 columns: TYPE OF WORK, SUBCONTRACTOR, 'SELF' OR 'SPECIAL EXCEPTION', SUBCONTRACTOR BID AMOUNT, CONT. LICENSE #

We certify that:

- 1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed 'Self' or 'Special Exception' in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____

SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR OWNER'S REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY OWNER. ATTACH A SECOND PAGE IF NECESSARY.

CONTRACTOR'S AGREEMENT

FOR:

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ DOLLARS AND NO CENTS (\$_____.00), which is the base bid, and which sum also includes the cost of a 100% Performance Bond and a 100%

CONTRACTOR'S AGREEMENT
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Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete by _____. Contractor agrees to pay liquidated damages in the amount of \$_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Invitation to Bid, Instructions to Bidders/ Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the Contractor requests payment and agrees to

safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

PERFORMANCE BOND
(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee," in the amount of _____ DOLLARS (\$) _____ for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ Dollars (\$ _____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

PRINCIPAL:

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

SURETY:

By: _____ (Seal)

Attorney-in-Fact

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.

My commission expires: _____

Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____ authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars (\$ _____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ Dollars (\$ _____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, 1953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

PRINCIPAL:

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

SURETY:

By: _____ Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.

My commission expires: _____
Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General



CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

The Owner acknowledges receipt of the following closeout and transition materials:

- As-built Drawings
- O & M Manuals
- Warranty Documents
- Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of _____(Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within _____ calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: \$_____. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

_____ by: _____
CONTRACTOR (include name of firm) (Signature) DATE

_____ by: _____
A/E (include name of firm) (Signature) DATE

_____ by: _____
USING INSTITUTION OR AGENCY (Signature) DATE

_____ by: _____
DFCM (Owner) (Signature) DATE

**General Contractor Performance Rating Form**

Project Name:		DFCM Project#	
Contractor: <small>(ABC Construction, John Doe, 111-111-1111)</small>	A/E: <small>(ABC Architects, Jane Doe, 222-222-2222)</small>	Original Contract Amount:	Final Contract Amount:
DFCM Project Manager:		Contract Date:	
Completion Date:		Date of Rating:	

Rating Guideline	QUALITY OF PRODUCT OR SERVICES	COST CONTROL	TIMELINESS OF PERFORMANCE	BUSINESS RELATIONS
5-Exceptional	Contractor has demonstrated an exceptional performance level in any of the above four categories that justifies adding a point to the score. Contractor performance clearly exceeds the performance levels described as "Very Good"			
4-Very Good	Contractor is in compliance with contract requirements and/or delivers quality product/service.	Contractor is effective in managing costs and submits current, accurate, and complete billings	Contractor is effective in meeting milestones and delivery schedule	Response to inquiries, technical/service/administrative issues is effective
3-Satisfactory	Minor inefficiencies/errors have been identified	Contractor is usually effective in managing cost	Contractor is usually effective in meeting milestones and delivery schedules	Response to inquires technical/service/administrative issues is somewhat effective
2-Marginal	Major problems have been encountered	Contractor is having major difficulty managing cost effectively	Contractor is having major difficulty meeting milestones and delivery schedule	Response to inquiries, technical/service/administrative issues is marginally effective
1-Unsatisfactory	Contractor is not in compliance and is jeopardizing achievement of contract objectives	Contractor is unable to manage costs effectively	Contractor delays are jeopardizing performance of contract objectives	Response to inquiries, technical/service/administrative issues is not effective

1. Rate Contractors quality of workmanship, management of sub contractor performance, project cleanliness, organization and safety requirement.	Score
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

2. Rate Contractor administration of project costs, change orders and financial management of the project budget.	Score
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

3. Rate Contractor's performance and adherence to Project Schedule, delay procedures and requirements of substantial completion, inspection and punch-list performance.	Score
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

4. Evaluate performance of contractor management team including project manager, engineer and superintendent also include in the rating team's ability to work well with owner, user agency and consultants.	Score
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

5. Rate success of Contractor's management plan, completion of the plans mitigation of project risks and performance of value engineering concepts.	Score
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

Signed by:	Date:	Mean Score
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Additional Comments:

ROOSEVELT EDUCATION CENTER BOILER REPLACEMENT

DFCM Project #07189770



State of Utah—Department of Administrative Services

DIVISION OF FACILITIES CONSTRUCTION
AND MANAGEMENT

4110 State Office Building/Salt Lake City, Utah 84114/538-3018

Prepared by



Mechanical
Consulting
Engineers

Cunning and Associates



Mechanical
Consulting
Engineers

Cuning and Associates

**ROOSEVELT EDUCATION CENTER
BOILER REPLACEMENT**

PROJECT DIRECTORY

OWNER

State of Utah
Division of Facilities and
Construction Management
4110 State Office Building
SLC, Utah 84114
Telephone: 801-537-9116
Project Manager: Vic Middleton

MECHANICAL

Cuning & Associates
Consulting Engineers
591 No. Main
Clearfield, Utah 84015
Telephone: 801-776-5047
Cell: 801-726-5047
Contact: Norm Cuning



Mechanical
Consulting
Engineers

Cunning and Associates

ROOSEVELT EDUCATION CENTER BOILER REPLACEMENT

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SECTION 01027 - APPLICATION FOR PAYMENT

1.1 GENERAL

- A. Coordinate the Schedule of Values and Application for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.
- B. Schedule of Values: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's Construction Schedule.
 - b. Application for Payment forms, including Continuation Sheets.
 - c. List of subcontractors.
 - d. List of products.
 - e. List of principal suppliers and fabricators.
 - f. Schedule of submittals.
 - 2. Submit the Schedule of Values at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Application for Payment.
- C. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Include the following Project identification:
 - a. DFCM Project name and location
 - b. Name of Engineer.
 - c. DFCM Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of Work.
 - d. Dollar value.
 - e. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate evaluation of Application for Payment. Break subcontract amounts down into several line items. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
 - 4. Provide a separate line item for each part of the Work where Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
 - 5. Provide separate line items for initial cost of the materials, for each subsequent stage of completion, and for total installed value.
 - 6. Show line items for indirect costs and margins on costs only when such items are listed individually in Application for Payment. Each item in the Schedule of Values and

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Application for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

- a. Temporary facilities and items that are not direct cost of work-in-place may be shown as separate line items or distributed as general overhead expense.
7. Update and resubmit the Schedule of Values when Construction Change Directives change the Contract Sum.
- D. Application for Payment shall be consistent with previous application and payments as certified by the Engineer and paid for by the Owner.
- E. Payment-Application Times: Payment dates are indicated in the Agreement. The period covered by each application is the period indicated in the Agreement.
- F. Payment-Application Forms: All payment applications shall be made using the Application for Payment form found in Division 0 of these specifications.
- G. Application Preparation: Complete every entry, including notarization and execution by a person authorized to sign on behalf of the Contractor. The Engineer will return incomplete application without action.
1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Construction Change Directives issued prior to the last day of the construction period covered by the application.
- H. Transmittal: Submit 3 executed original copies of each Application for Payment to the Engineer within 24 hours. One copy shall be complete, including waivers of lien and similar attachments.
1. Transmit each copy with a transmittal listing attachments and recording appropriate information related to the application.
- I. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of lien from every entity who may file a lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. Submit each Application for Payment with Contractor's waiver of lien for the period of construction covered by the application.
 - a. Submit final Application for Payment with final waivers from every entity involved with performance of the Work covered by the application who may file a lien.
 4. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.
- J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
1. List of subcontractors.
 2. List of principal suppliers and fabricators.
 3. Schedule of Values.
 4. Contractor's Construction Schedule (preliminary if not final).

5. Submittal Schedule (preliminary if not final).
6. Certificates of insurance and insurance policies.
7. Performance and payment bonds.

K. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

1. Administrative actions and submittals that shall precede or coincide with this application include the following:
 - a. Occupancy permits.
 - b. Warranties and maintenance agreements.
 - c. Test/adjust/balance records.
 - d. Maintenance instructions.
 - e. Changeover information related to Owner's occupancy.
 - f. Final cleaning.
 - g. Application for reduction of retainage and consent of surety.

L. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:

1. Completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Transmittal of Project construction records to the Owner.
5. Proof that taxes, fees, and similar obligations were paid.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01035 - MODIFICATION PROCEDURES

1.1 GENERAL

- A. Minor Changes in the Work: The Engineer will issue instructions authorizing minor (no cost) changes in the Work on office letterhead. Minor changes will be issued in response contractor RFI's submitted utilizing approved forms in Division 0 of the specifications.
- B. Owner-Initiated Change Order Proposal Requests: The Engineer will issue a description of proposed changes in the Work that require adjustment to the Contract Sum or Time. The description may include supplemental or revised Drawings and Specifications.
 - 1. Proposal requests are for information only. Do not consider them an instruction to stop work or to execute the proposed change.
 - 2. Within 20 days of receipt, submit an estimate of cost necessary to execute the change for the Owner's review.
 - a. Include an itemized list of products required and unit costs, with the total amount of purchases.
 - b. Indicate taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Indicate the effect the change will have on the Contract Time.
- C. Contractor-Initiated Proposals: When unforeseen conditions require modifications, the Contractor may submit a request for a change to the Engineer.
 - 1. Describe the proposed change. Indicate reasons for the change and the effect of the change on the Contract Sum and Time. Include an itemized list of products required and unit costs, with the total amount of purchases. Indicate taxes, delivery charges, equipment rental, and amounts of trade discounts.
- D. Proposal Request Form: Submit utilizing standard form found in Division 0 of the specifications.
- F. Construction Change Directive: When Owner and Contractor disagree on the terms of a Proposal Request, the Engineer may issue a Construction Change Directive on the form found in Division 0 of the specifications.
 - 1. The Construction Change Directive contains a description of the change and designates the method to be followed to determine change in the Contract Sum or Time.
- G. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completing the change, submit an itemized account and supporting data to substantiate Contract adjustments.
- H. Change Order Procedures: Upon the Owner's approval of a Proposal Request, the Engineer will issue a Change Order on the form found in Division 0 of the specifications.

END OF SECTION 01035

SECTION 01040 - COORDINATION

1.1 GENERAL

- A. This Section includes requirements for coordinating construction operations including, but not necessarily limited to, the following:
 - 1. Coordination drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Cleaning and protection.

1.2 COORDINATION

- A. Coordinate construction to assure efficient and orderly installation of each part of the Work. Coordinate operations that depend on each other for proper installation, connection, and operation.
 - 1. Schedule operations in the sequence required to obtain the best results where installation of one part depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to assure maximum accessibility for maintenance, service, and repair.
 - 3. Make provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required procedures with other activities to avoid conflicts and assure orderly progress. Such activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Delivery and processing of submittals.
 - 3. Progress meetings.
 - 4. Project closeout activities.
- D. Conservation: Coordinate construction to assure that operations are carried out with consideration for conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not incorporated in, the Work.
- E. Coordination Drawings: Prepare coordination drawings if needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the relationship of components shown on separate shop drawings.
 - 2. Indicate required installation sequences.

3. Comply with requirements contained in Section "Submittals."

1.3 PRODUCTS (Not Applicable)

1.4 EXECUTION

- A. Inspection of Conditions: Require Installers of major components to inspect substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected.
- B. Coordinate temporary enclosures with inspections and tests to minimize the need to uncover completed construction.
- C. Clean and protect construction in progress and adjoining materials, during handling and installation. Apply protective covering to assure protection from damage.
- D. Clean and maintain completed construction as necessary through the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- E. Limiting Exposures: Supervise construction to assure that no part is subject to harmful, dangerous, or damaging exposure. Such exposures include, but are not limited to, the following:
 1. Excessive static or dynamic loading.
 2. Excessive internal or external pressures.
 3. Excessively high or low temperatures.
 4. Water or ice.
 5. Solvents and chemicals.
 6. Abrasion.
 7. Soiling, staining, and corrosion.
 8. Combustion.

END OF SECTION 01040

SECTION 01045 - CUTTING AND PATCHING

1.1 GENERAL

- A. Cutting and Patching Proposal: Submit a proposal describing procedures in advance of the time cutting and patching will be performed. Request approval to proceed. Include the following:
 - 1. Describe extent of cutting and patching. Show how it will be performed and indicate why it cannot be avoided.
 - 2. Describe changes to existing construction. Include changes to structural elements and operating components and changes in the building's appearance and other significant visual elements.
 - 3. List products to be used and firms that will perform Work.
 - 4. Indicate dates when cutting and patching will be performed.
 - 5. Utilities: List utilities that will be disturbed or relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
 - 6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
 - 7. Approval to proceed does not waive the Engineer's right to later require complete removal and replacement of unsatisfactory work.

- B. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
 - 1. Obtain approval before cutting and patching the following structural elements:
 - a. Foundation construction.
 - b. Bearing walls.

- C. Operational Limitations: Do not cut and patch operating elements in a manner that would reduce their capacity to perform as intended. Do not cut and patch operating elements in a manner that would increase maintenance or decrease operational life or safety.
 - 1. Obtain approval before cutting and patching the following operating elements or safety related systems:
 - a. Primary operational systems and equipment.
 - b. Fire protection systems.
 - c. Electrical wiring systems.

- D. Visual Requirements: Do not cut and patch exposed construction in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities. Do not cut and patch in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

- E. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged in such a manner as not to void warranties.

1.2 PRODUCTS

- A. Use materials identical to existing materials. Use materials that visually match adjacent surfaces to the fullest extent possible if identical materials are unavailable. Use materials whose performance will equal that of existing materials.

1.3 EXECUTION

- A. Examine surfaces to be cut and patched and conditions under which work is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action.
 - 1. Before proceeding, meet with parties involved. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- B. Temporary Support: Provide temporary support of work to be cut.
- C. Protection: Protect existing construction to prevent damage. Provide protection from adverse weather conditions for portions that might be exposed during cutting and patching operations.
- D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- E. Avoid cutting pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.
- F. Performance: Employ skilled workmen. Proceed at the earliest feasible time and complete without delay.
 - 1. Cut construction to install other components or perform other construction and subsequent fitting and patching required to restore surfaces to their original condition.
- G. Cutting: Cut using methods that will not damage elements retained or adjoining construction. Comply with the original Installer's recommendations.
 - 1. Use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring 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 a diamond-core drill.
 - 4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
 - 5. Where services are required to be removed, relocated, or abandoned, by-pass utility services before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- H. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. 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.

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3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove floor and wall coverings and replace with new materials to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire surface containing the patch after the area has received primer and second coat.
 4. Patch, repair, or rehang ceilings as necessary to provide an even-plane surface of uniform appearance.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar items. Clean piping, conduit, and similar features before applying paint or finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION 01045

SECTION 01200 - PROJECT MEETINGS

1.1 GENERAL

- A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
 - 1. Preconstruction conferences.
 - 2. Preinstallation conferences.
 - 3. Progress meetings.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction. Review responsibilities and personnel assignments.
- C. Attendees: Authorized representatives of the Owner, Engineer, the Contractor and its superintendent; major subcontractors; and other concerned parties shall attend.
 - 1. Participants shall be familiar with the Project and authorized to conclude matters relating to the Work.
- D. Agenda: Discuss items that could affect progress, including the following:
 - 1. Tentative construction schedule.
 - 2. Critical work sequencing.
 - 3. Submittal of Shop Drawings, Product Data, and Samples.
 - 4. Use of the premises.
- E. Preinstallation Conferences: Conduct a conference before each activity that requires coordination with other operations.
- F. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation shall attend. Advise the Engineer of scheduled meeting dates.
 - 1. Review the progress of other operations and preparations for the activity under consideration at each preinstallation conference, including requirements for the following:
 - a. Compatibility problems and acceptability of substrates.
 - b. Time schedules and deliveries.
 - c. Manufacturer's recommendations.
 - d. Warranty requirements.
 - e. Inspecting and testing requirements.
 - 2. Record significant discussions and agreements and disagreements, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Engineer.
 - 3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate actions necessary to resolve problems and reconvene the conference.
- G. Progress Meetings: Conduct progress meetings at the Project Site at regular intervals. Notify the Owner and the Engineer of scheduled dates. Coordinate meeting dates with preparation of the payment request.

- H. Attendees: The Owner, Engineer, and other entities concerned with current progress or involved in planning, coordination, or future activities shall be represented. Participants shall be authorized to conclude matters relating to the Work.

- I. Agenda: Review and correct or approve minutes of the previous meeting. Review items of significance that could affect progress. Include topics for discussion appropriate to Project status.
 - 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule. Determine how to expedite construction behind schedule; secure commitments from parties involved to do so. Discuss revisions required to insure subsequent activities will be completed within the Contract Time.
 - 2. Review the present and future needs of each entity present, including the following:
 - a. Time.
 - b. Sequences.
 - c. Status of submittals.
 - d. Deliveries and off-site fabrication problems.
 - e. Temporary facilities and services.
 - f. Quality and work standards.
 - g. Change Orders.
 - 3. Reporting: Distribute meeting minutes to each party present and to parties who should have been present. Include a summary of progress since the previous meeting and report.
 - 4. Schedule Updating: Revise the Contractor's Construction Schedule after each meeting where revisions have been made. Issue the revised schedule concurrently with the report of each meeting.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION (Not Applicable)

END OF SECTION 01200

SECTION 01300 - SUBMITTALS

1.1 GENERAL

- A. Submittal Procedures: Coordinate submittal preparation with construction, fabrication, other submittals, and activities that require sequential operations. Transmit in advance of construction operations to avoid delay.
1. Coordinate submittals for related operations to avoid delay because of the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination until related submittals are received.
 2. Processing: Allow 2 weeks for initial review. Allow more time if the Engineer must delay processing to permit coordination. Allow 2 weeks for reprocessing.
 - a. No extension of Contract Time will be authorized because of failure to transmit submittals sufficiently in advance of the Work to permit processing.
 3. Submittal Preparation: Place a permanent label on each submittal for identification. Provide a 4- by 5-inch (100- by 125-mm) space on the label or beside title block to record review and approval markings and action taken. Include the following information on the label for processing and recording action taken.
 - a. DFCM Project name, project number and date.
 - b. Name and address of the Engineer.
 - c. Name and address of the Contractor.
 - d. Name and address of the subcontractor.
 - e. Name and address of the supplier.
 - f. Name of the manufacturer.
 - g. Number and title of appropriate Specification Section.
 - h. Drawing number and detail references, as appropriate.
 4. Submittal Transmittal: Package each submittal appropriately. Transmit with a transmittal form. The Engineer will not accept submittals from sources other than the Contractor.
- B. Contractor's Construction Schedule: Prepare a horizontal bar-chart-type, contractor's construction schedule. Provide a separate time bar for each activity and a vertical line to identify the first working day of each week. Use the same breakdown of Work indicated in the "Schedule of Values." Indicate estimated completion in 10 percent increments. As Work progresses, mark each bar to indicate actual completion.
1. Submit within 30 days of the date established for "Commencement of the Work."
 2. Prepare the schedule on stable transparency, or other reproducible media, of width to show data for the entire construction period.
 3. Secure performance commitments from parties involved. Coordinate each element with other activities; include minor elements involved in the Work. Show each activity in proper sequence. Indicate sequences necessary for completion of related Work.
 4. Coordinate with the Schedule of Values, list of subcontracts, Submittal Schedule, payment requests, and other schedules.
 5. Indicate completion in advance of Substantial Completion. Indicate Substantial Completion to allow time for the Engineer's procedures necessary for certification of Substantial Completion.
 6. Work Stages: Indicate important stages for each portion of the Work.

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7. Area Separations: Provide a separate time bar to identify each construction area for each portion of the Work. Indicate where each element must be sequenced with other activities.
- C. Submittal Schedule: After developing the Contractor's Construction Schedule, prepare a schedule of submittals. Submit within 10 days of submittal of the Construction Schedule.
1. Coordinate with list of subcontracts, Schedule of Values, list of products, and the Contractor's Construction Schedule.
 2. Prepare the schedule in chronological order. Provide the following information:
 - a. Date for first submittal.
 - b. Related Section number.
 - c. Submittal category (Shop Drawings, Product Data, or Samples).
 - d. Name of the subcontractor.
 - e. Description of the Work covered.
 - f. Date for the Engineer's final approval.
 3. Schedule Distribution: Distribute copies of the Contractor's Construction Schedule and the Submittal Schedule to the Engineer, Owner, subcontractors, and parties required to comply with submittal dates. Post copies in the field office.
 - a. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their Work and are no longer involved in construction activities.
 - b. Updating: Revise the schedule after each meeting or activity where revisions have been made. Issue the updated schedule concurrently with the report of each meeting.
- D. Daily Construction Reports: Prepare a daily report recording events at the site. Submit duplicate copies to the Engineer at weekly intervals. Include the following information:
1. List of subcontractors at the site.
 2. High and low temperatures, general weather conditions.
 3. Accidents and unusual events.
 4. Stoppages, delays, shortages, and losses.
 5. Meter readings and similar recordings.
 6. Emergency procedures.
 7. Orders and requests of governing authorities.
 8. Services connected, disconnected.
 9. Equipment or system tests and startups.
 10. Substantial Completions authorized.
- E. Shop Drawings: Submit newly prepared information drawn to scale. Indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information. Include the following information:
1. Dimensions.
 2. Identification of products and materials included by sheet and detail number.
 3. Compliance with standards.
 4. Notation of coordination requirements.
 5. Notation of dimensions established by field measurement.
 6. Sheet Size: Except for templates and full-size Drawings, submit one correctable, reproducible print and one blue- or black-line print on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 36 by 48 inches (890 by 1220 mm). The Engineer will return the reproducible print.

- a. Do not use Shop Drawings without an appropriate final stamp indicating action taken.
- F. Product Data: Collect Product Data into a single submittal for each element of construction. Mark each copy to show applicable choices and options. Where Product Data includes information on several products, mark copies to indicate applicable information.
- 1. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with 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.
 - 2. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
 - 3. Submittals: Submit 2 copies; submit 4 copies where required for maintenance manuals. The Engineer will retain one and return the other marked with action taken.
 - a. Unless noncompliance with Contract Documents is observed, the submittal serves as the final submittal.
 - 4. Distribution: Furnish copies to installers, subcontractors, suppliers, and others required for performance of construction activities. Show distribution on transmittal forms. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
 - a. Do not use unmarked Product Data for construction.
- G. Samples: Submit full-size Samples cured and finished as specified and identical with the material proposed. Mount Samples to facilitate review of qualities.
- 1. Include the following:
 - a. Specification Section number and reference.
 - b. Sample source.
 - c. Product name or name of the manufacturer.
 - d. Compliance with recognized standards.
 - e. Availability and delivery time.
 - 2. Submit Samples for review of size, kind, color, pattern, and texture, for a check of these characteristics, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed. Where variations are inherent in the material, submit at least 3 units that show limits of the variations.
 - a. Refer to other Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar characteristics.
 - 3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from standard choices. The Engineer will review and return submittals indicating selection and other action.
 - 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. One set

will be returned marked with the action taken. Maintain sets of Samples, at the Project Site, for quality comparison.

- a. Unless noncompliance with Contract Documents is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
5. Distribution of Samples: Distribute additional sets to subcontractors, manufacturers, and others as required for performance of the Work. Show distribution on transmittal forms.
- H. Quality Assurance Submittals: Submit quality-control submittals, including design data, certifications, manufacturer's instructions, and manufacturer's field reports required under other Sections of the Specifications.
- 1. Certifications: Where certification that a product or installation complies with specified requirements is required, submit a notarized certification from the manufacturer certifying compliance.
 - a. Signature: Certification shall be signed by an officer authorized to sign documents on behalf of the company.
 - I. Engineer's Action: Except for submittals for the record or information, where action and return are required, the Engineer will review each submittal, mark to indicate action taken, and return. Compliance with specified characteristics is the Contractor's responsibility.
 - 1. Action Stamp: The Engineer will stamp each submittal with an action stamp. The Engineer will mark the stamp appropriately to indicate the action taken.
- 1.2 PRODUCTS (Not Applicable)
- 1.3 EXECUTION (Not Applicable)
- END OF SECTION 01300

SECTION 01421 - REFERENCE STANDARDS AND DEFINITIONS

1.1 GENERAL

- A. Definitions: Basic contract definitions are included in the Conditions of the Contract.
- B. "Indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.
- C. "Directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Engineer, requested by the Engineer, and similar phrases.
- D. "Approved," when used in conjunction with the Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- E. "Regulations" includes laws, ordinances, statutes, 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.
- F. "Furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide" means to furnish and install, complete and ready for the intended use.
- I. "Installer" is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
 - 2. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter."
- J. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

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- L. Specification Format: These Specifications are organized into Divisions and Sections based on the 16-division format and CSI/CSC's "MasterFormat" numbering system.
 - M. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Streamlined language is generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - N. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
 - O. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.
 - P. Copies of Standards: Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
 - Q. Abbreviations and Names: Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.
 - R. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- 1.2 PRODUCTS (Not Applicable)
- 1.3 EXECUTION (Not Applicable)

END OF SECTION 01421

SECTION 01600 - MATERIALS AND EQUIPMENT

1.1 GENERAL

- A. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock.
 - 1. "Named Products" are items identified by the manufacturer's product name, including make or model number or designation, shown or listed in the manufacturer's published product literature.
- B. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
- C. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.
- D. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
 - 1. When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected.
- E. Nameplates: Except for required labels and operating data, do not attach manufacturer's nameplates or trademarks on surfaces exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
- F. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
 - 1. Schedule delivery to minimize long-term storage and to prevent overcrowding construction spaces. Coordinate with installation to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 2. Deliver products in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 3. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

4. Store products to facilitate inspection and measurement of quantity or counting of units. Store heavy materials away from the structure in a manner that will not endanger the supporting construction.
5. Store products subject to damage by the elements aboveground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

1.2 PRODUCTS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
 1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: Procedures governing product selection include the following:
 1. Proprietary Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.
 2. Semiproprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.
 - a. Where products are specified by name, accompanied by the term "or equal," comply with provisions concerning "substitutions" to obtain approval for use of an unnamed product.
 3. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
 4. Descriptive Specification Requirements: Where Specifications describe a product, listing characteristics required, with or without use of a brand name, provide a product that provides the characteristics and otherwise complies with requirements.
 5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply and are recommended for the application. Manufacturer's recommendations may be contained in product literature or by the manufacturer's certification of performance.
 6. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
 7. Visual Matching: Where Specifications require matching a Sample, the Engineer's decision on whether a product matches will be final. Where no product in the specified category matches and complies with other requirements, comply with provisions concerning "substitutions" for selection of a matching product in another category.
 8. Visual Selection: Where requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product that complies with other requirements. The Engineer will select the color, pattern, and texture from the product line selected.

1.3 EXECUTION

- A. Comply with manufacturer's instructions for installation of products. Anchor each product securely in place, accurately located and aligned with other Work. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600

SECTION 01631 - SUBSTITUTIONS

1.1 GENERAL

- A. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed after award of the Contract are considered requests for substitutions. The following are not requests for substitutions:
 - 1. Substitutions requested during the bidding period and accepted by Addendum prior to award of the Contract.
 - 2. Revisions to the Contract Documents requested by the Owner.
 - 3. Specified options included in the Contract Documents.
 - 4. Contractor's compliance with regulations issued by governing authorities.

- B. Substitution Request Submittal: The Engineer will consider requests for substitution received within 15 days after commencement of the Work.
 - 1. Submit 3 copies of each request for substitution. Submit requests according to procedures required for change-order proposals.
 - 2. Provide documentation showing compliance with the requirements for substitutions and the following information:
 - a. Coordination information, including a list of changes needed to other Work that will be necessary to accommodate the substitution.
 - b. A comparison of the substitution with the Work specified, including performance, weight, size, durability, and visual effect.
 - c. Product Data, including Drawings and descriptions of products and installation procedures.
 - d. Samples, where applicable or requested.
 - e. A statement indicating the effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the substitution on Contract Time.
 - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - g. The Contractor's waiver of rights to additional payment or time that may become necessary because of the failure of the substitution to perform adequately.
 - 3. Engineer's Action: If necessary, the Engineer will request additional information within one week of receipt of a request for substitution. The Engineer will notify the Contractor of acceptance or rejection within 2 weeks of receipt of the request. Acceptance will be in the form of a change order.

1.2 PRODUCTS

- A. Conditions: The Engineer will receive and consider a request for substitution when one or more of the following conditions are satisfied. Otherwise, the Engineer will return the requests without action except to record noncompliance with these requirements.
 - 1. Extensive revisions to the Contract Documents are not required.
 - 2. Changes are in keeping with the intent of the Contract Documents.
 - 3. The specified product cannot be provided within the Contract Time. The Engineer will not consider the request if the specified product cannot be provided as a result of failure to pursue the Work promptly.

4. The request is related to an "or-equal" clause.
 5. The substitution offers the Owner a substantial advantage, in cost, time, or other considerations, after deducting compensation to the Engineer for redesign and increased cost of other construction.
 6. The specified product cannot receive approval by a governing authority, and the substitution can be approved.
- B. The Contractor's submittal and the Engineer's acceptance of Shop Drawings, Product Data, or Samples for construction not complying with the Contract Documents do not constitute an acceptable request for substitution, nor do they constitute approval.

END OF SECTION 01631

SECTION 01700 - CONTRACT CLOSEOUT

1.1 GENERAL

- A. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.
- B. Substantial Completion: Before requesting inspection for certification of Substantial Completion, complete the following:
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the Work claimed as substantially complete.
 - a. Include supporting documentation for completion and an accounting of changes to the Contract Sum.
 - 2. Advise the Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 - 4. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 5. Deliver tools, spare parts, extra stock, and similar items.
 - 6. Changeover locks and transmit keys to the Owner.
 - 7. Complete startup testing of systems and instruction of operation and maintenance personnel. Remove temporary facilities, mockups, construction tools, and similar elements.
 - 8. Complete final cleanup requirements, including touchup painting.
 - 9. Touch up and repair and restore marred, exposed finishes.
- C. Inspection Procedures: On receipt of a request for inspection, the Engineer will proceed or advise the Contractor of unfilled requirements. The Engineer 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.
 - 1. The Engineer will repeat inspection when requested and assured that the Work is substantially complete.
 - 2. Results of the completed inspection will form the basis of requirements for final acceptance.
- D. Final Acceptance: Before requesting inspection for certification of final acceptance and final payment, complete the following:
 - 1. Final payment request with releases and supporting documentation. Include insurance certificates where required.
 - 2. Submit a statement, accounting for changes to the Contract Sum.
 - 3. Submit a copy of the final inspection list stating that each item has been completed or otherwise resolved for acceptance.
 - 4. Submit final meter readings for utilities, a record of stored fuel, and similar data as of the date of Substantial Completion.
 - 5. Submit consent of surety to final payment.
 - 6. Submit a final settlement statement.
 - 7. Submit evidence of continuing insurance coverage complying with insurance requirements.

- E. Reinspection Procedure: The Engineer will reinspect the Work upon receipt of notice that the Work has been completed, except for items whose completion is delayed under circumstances acceptable to the Engineer.
 - 1. Upon completion of reinspection, the Engineer will prepare a certificate of final acceptance. If the Work is incomplete, the Engineer will advise the Contractor of Work that is incomplete or obligations that have not been fulfilled but are required.
 - 2. If necessary, reinspection will be repeated.

- F. Record Drawings: Maintain a set of prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark the drawing most capable of showing conditions fully and accurately. Give attention to concealed elements.
 - 1. Mark sets with red pencil. Use other colors to distinguish between variations in separate categories of the Work.
 - 2. Organize record drawing sheets into manageable sets. Bind with durable-paper cover sheets; print titles, dates, and other identification on the cover of each set.

- G. Record Specifications: Maintain one copy of the Project Manual, including addenda. Mark to show variations in Work performed in comparison with the text of the Specifications and modifications. Give attention to substitutions and selection of options and information on concealed construction. Note related record drawing information and Product Data.
 - 1. Upon completion of the Work, submit record Specifications to the Engineer for the Owner's records.

- H. Maintenance Manuals: Organize operation and maintenance data into sets of manageable size. Bind in individual, heavy-duty, 2-inch (51-mm), 3-ring, binders, with pocket folders for folded sheet information. Mark identification on front and spine of each binder. Include the following information:
 - 1. Emergency instructions.
 - 2. Spare parts list.
 - 3. Copies of warranties.
 - 4. Wiring diagrams.
 - 5. Shop Drawings and Product Data.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION

- A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires maintenance to provide instruction in proper operation and maintenance. Include a detailed review of the following items:
 - 1. Maintenance manuals.
 - 2. Spare parts, tools, and materials.
 - 3. Identification systems.
 - 4. Control sequences.
 - 5. Warranties and bonds.
 - 6. Maintenance agreements and similar continuing commitments.

- B. As part of instruction for operating equipment, demonstrate the following:

1. Startup and shutdown.
 2. Emergency operations and safety procedures.
 3. Noise and vibration adjustments.
- C. Final Cleaning: Employ experienced cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Complete the following 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. Remove glazing compounds. Replace chipped or broken glass.
 3. Clean exposed finishes to a dust-free condition, free of stains, films, and foreign substances. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 4. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication. Clean plumbing fixtures. Clean light fixtures and lamps.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Remove waste materials and dispose of lawfully.

END OF SECTION 01700

SECTION 01740 - WARRANTIES

1.1 GENERAL

- A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.
 - 1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
- C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- D. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- F. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- G. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 2. Where the Contract Documents require a special warranty, or similar commitment, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.
- H. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion, submit written warranties upon request of the Engineer.
 - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit

properly executed warranties to the Engineer within 15 days of completion of that designated portion of the Work.

- I. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Engineer, for approval prior to final execution.
 - 1. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

- J. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
 - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
 - 2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.
 - 3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION

- A. List of Warranties: As follows:
 - 1. Boilers
 - 2. Control Devices
 - 3. Piping Systems

- B. Schedule: Provide warranties on products and installations as specified in Division 15.

END OF SECTION 01740



Mechanical
Consulting
Engineers

Cunning and Associates

15000 – General Mechanical Requirements
15005 – Demolition
15060 – General Pipes and Fittings
15100 – Valves
15130 – Thermometers and Pressure Gauges
15140 – Mechanical Supporting Devices
15170 – Motors, Drives and Electrical Requirements
15190 – Mechanical Identification
15240 – Mechanical Sound, Vibration and Seismic Control
15250 – Mechanical Insulation
15515 – Hydronic Piping and Specialties
15555 – Boilers
15576 – Appliance Flues and Vents
15955 – Mechanical Control Systems
15965 – Electrical Control Systems
15970 – DDC Control Systems
15995 – System Commissioning, Testing and Balancing

Project manual for the
MECHANICAL

Division **15**

SECTION 15000 - GENERAL MECHANICAL REQUIREMENTS

PART I - 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 work of this section.
- B. Related Sections: Refer to "Electrical Requirements for Mechanical Equipment" Section in Division 15 for basic electrical requirements for all mechanical equipment. Special and specific electrical requirements are specified within each respective equipment specification section.

1.2 SUMMARY: This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 15000. It expands and supplements the requirements of Division 1.

This Division does not define, nor is it limited by, trade jurisdictions. All work described herein is a part of the General Contract and is required of the Contractor regardless.

1.3 DESCRIPTION OF PROJECT: The mechanical work described in these mechanical specifications is for a project located in Roosevelt, Utah. Design weather conditions are: 95° db, 62° wb, and winter -20°F. Altitude readings, unless otherwise noted, are for an elevation of 5,200 feet above sea level. Make adjustment to manufacturer's performance data as needed.

1.4 CODES AND PERMITS, AUTHORITIES HAVING JURISDICTION:

- A. Perform the mechanical work in strict accordance with the applicable provisions of the various codes ordinances and adoptions pertaining to the project location in effect on the date of invitation for bids. Provide all materials and labor necessary to comply with rules, regulations and ordinances. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications govern.
- B. Hold and save the Owner and Engineer free and harmless from liability of any nature or kind arising from failure to comply with codes and ordinances.
- C. Secure and pay for permits necessary for the prosecution of the work under this contract. Contractor to pay all fees and include connection fees related to utility hookups.
- D. Reference Standards:

- American Welding Society
- International Mechanical Code/State Code
- International Building Code/State Code
- SMACNA Duct Design Standards
- Local/State Plumbing Code
- Locally enforced NFPA Codes
- Local Fuel Utility Regulations
- Local Power Utility Regulations
- American Gas Association

- ASME Codes for Pressure Vessels and Piping
- ANSI B31.1 Piping

- E. Final inspection by the Engineer will not be made nor Certificate of Substantial

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Completion issued until certificates of acceptability from the Authorities having jurisdiction are delivered.

- 1.5 **DEFINITION OF PLANS AND SPECIFICATIONS:** The mechanical drawings at reduced scale show the general arrangement of piping, ductwork, equipment, etc., and shall be followed as closely as the actual building construction and the work of other trades will permit. The Architectural and structural drawings shall be considered as part of the work insofar as these drawings furnish the Contractor with information relating to design and construction of the building. Architectural drawings shall take precedence over mechanical drawings. Request clarification and participate in resolution in the event of conflict.

Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate the structural and finish conditions affecting the work and arrange the work accordingly, providing such extensions, fittings, valves and accessories to meet the conditions as may be required. Some small scale work is not shown such as control conduit and piping, incidental piping, specialties. Provide as directed by note or specification.

Examine the actual construction site prior to bidding and obtain an understanding of the conditions under which the work will be performed. No allowances will be made for failure to make such examination.

During construction, verify the dimensions governing the mechanical work at the building. No extra compensation shall be claimed or allowed because of differences between actual dimensions and those indicated on the drawings. Examine adjoining work on which mechanical work is dependent for perfect efficiency, and report any work of other trades which must be corrected. No waiver of responsibility for defective work shall be claimed nor allowed due to failure to report unfavorable conditions affecting the mechanical work.

1.6 **ROUGH-IN:**

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

1.7 **MECHANICAL INSTALLATIONS:**

- A. Coordinate mechanical equipment and materials installation with other building components.
- B. Verify all dimensions by field measurements.
- C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
- D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- F. Coordinate the cutting and patching of building components to accommodate installation of mechanical equipment and materials.
- G. Where mounting heights are not detailed or dimensioned, install mechanical services and

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overhead equipment to provide the maximum headroom possible.

- H. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- I. Coordinate the installation of mechanical materials and equipment above ceilings with suspension systems, light fixtures, existing structures and other installations.
- J. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- K. Where mechanical work penetrates other trade work such as gypboard walls, etc., penetration shall be neatly cut and walls shall be filled and patched.

1.8 ACCESSIBILITY:

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- B. Extend all grease fittings to an accessible location.
- C. Establish required clearance to all installation features involving operation and maintenance. Respect manufacturers recommendations for access and clearance.
- D. Access Doors - General: All items of mechanical equipment which may require adjustment, maintenance, replacement or which control a system function shall be made readily accessible to personnel operating the building.
 - 1. Provide access doors in all ductwork or plenums as required to maintain fire dampers, fire smoke dampers, equipment, controls or other elements of the system. Doors shall conform to SMACNA standards unless otherwise detailed or specified.
 - 2. Provide access doors in floors, walls, ceiling and partitions to valves, cleanouts, chases, dampers, etc., and to access doors in ductwork requiring the same. Access doors shall be all-steel construction equivalent to "Milcor" by Inland Ryerson in a style approved by the Owner's Representative. Doors shall be 24" x 24", or as needed, with screwdriver latches.

1.9 CHANGE ORDERS: See General Conditions.

1.10 ALTERNATIVE CONSTRUCTION/SUBSTITUTION: These documents outline a way in which the Owner may be delivered a functional and reliable facility. Drawings and specifications describe reasonable engineering practice for the Contractor to follow.

Coordination between trades may result in periodic needs to adjust the installation from that indicated, but in no case shall the intended function be compromised.

The Contractor may perceive some work methods which differ from those specified which could save time and effort. These may be presented to the Engineer with a breakdown of possible cost savings for review. Implement only with authorization.

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Materials substitutions will generally be covered in a review process prior to bidding. After bidding, substitutions shall be proposed only on the basis of definitive cost accounting and implemented only with authorization.

1.11 CUTTING AND PATCHING:

- A. Lay out the project where new work is involved ahead of time, providing sleeves and blockouts, and have work specifically formed, poured and framed to accommodate mechanical installations. Cut and patch only as needed.
- B. Refer to the Division 1 Section: CUTTING AND PATCHING for general requirements for cutting and patching.
- C. Refer to Division 16 Section: BASIC ELECTRICAL REQUIREMENTS for requirements for cutting and patching electrical equipment, components, and materials.
- D. Do not endanger or damage installed Work through procedures and processes of cutting and patching.
- E. Arrange for repairs required to restore other and any work damaged as a result of mechanical installations.
- F. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.
- G. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work;
 - 2. Remove and replace defective Work;
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents;
 - 4. Remove samples of installed Work as specified for testing;
 - 5. Install equipment and materials in existing structures.
- H. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer observation of concealed Work.
- I. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping and other mechanical items made obsolete by the new Work.
- J. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- K. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

- 1.12 SUBMITTALS: Submittal of shop drawings, product data, and samples will be accepted only from the Contractor to the Engineer. Data submitted from subcontractors and material suppliers directly to the Engineer will not be processed. Document each transmittal and sign and stamp the submittal indicating that it has been reviewed and is in compliance with the criteria of the project, any exceptions being clearly noted.

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- A. Shop Drawings: As soon as possible after the contract is awarded, submit to the Engineer, seven (7) copies of the descriptive literature covering all equipment and materials to be used in the installation of mechanical systems for this project. Written confirmation of acceptable review by the Owner's Representative shall be obtained before ordering, purchasing, acquiring or installing any such equipment or materials for the project.

Prepare the submittals in an orderly manner after the order of this specification, contained in a three-ring loose-leaf binder(s) with identification tabs for each item or group of related items. Submitted literature shall clearly indicate performance, quality, utility requirements, dimensions of size, connection points and other information pertinent to effective review.

Equipment must fit into the available space with allowance for operation, maintenance, etc. The Contractor shall take full responsibility for space and utility requirements for equipment installed.

Factory-wired equipment shall include shop drawings of all internal wiring to be furnished with unit.

Review of the Engineer is for general conformance of the submitted equipment of the project specification; in no way does such approval relieve Contractor of his obligation to furnish equipment and materials that comply in detail to the specification, nor does it relieve the Contractor of his obligation to determine actual field dimensions and conditions which may affect his work.

- B. Record Drawings: During the course of construction, maintain a set of drawings, specifications, change orders, shop drawings, addenda, etc., for reference and upon which all deviations from the original layout are recorded. Turn these marked-up documents over to the Engineer at the conclusion of the work so that the original tracings can be revised. If the Contractor fails to mark up the prints, reimburse the Engineer for time required to do so.

1.13 OPERATION AND MAINTENANCE TRAINING:

- A. Instruction Of Owner's Personnel: At a time prior to Owner making use of a device or system, and in general after testing and balance work for a building or major system is complete, prepare, schedule and conduct a series of training sessions for Owner's operating and supervisory personnel. Instructions shall cover each device and system with emphasis on understanding of the purpose and function, the maintenance requirements and the proper adjustment and operating technique.
- B. Instruct building operating staff in operation and maintenance of mechanical systems utilizing Operation and Maintenance Manual when so doing.
- C. Contractor to video tape instruction sessions, and give video tape to owner.
- D. Minimum instruction periods shall be as follows:
1. Mechanical - six hours, total.
 2. Temperature Control - eight hours, total. Programming help as needed.
- E. Initial instruction periods shall occur after pre-final inspection when systems are properly working and before final payment is made. Schedule subsequent visits with the DFCM Building Operation Personnel throughout the first year.

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- F. None of these instructional periods shall overlap another.
- G. Vendors for each piece of equipment controls, etc., shall participate along with the Contractor(s).

1.14 **GUARANTEE/WARRANTY:** The following guarantee is a part of this specification and is binding on the part of the Contractor and his assigns:

"Contractor guarantees that this installation is in accordance with the terms of the Contract and is free from mechanical defects. He agrees to replace or repair, to the satisfaction of the Owner's Representative, any part of this installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance. See also the General Conditions of these specifications. Failed equipment in the repair or replacement shall be guaranteed for one full year from the date of recommission."

Compile and assemble the warranties required by Division 15 into a separated set of vinyl covered, insert sheets, tabulated and indexed for each reference, included in the O & M Manual.

Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

Mechanical systems and equipment shall not be considered for substantial completion and initiation of warranty until they have performed in service continuously without malfunction for at least thirty (30) working days.

1.15 **TESTS AND CERTIFICATIONS:** Make all tests required by code or specification in the presence of a representative of the Owner, with tests recorded and certified by the Contractor and Representative. Involve local authorities where required.

1.16 **PERMITS, FEES, LICENSES:** Refer to General Conditions. See Paragraph 1.04.

1.17 **CEILING SPACE COORDINATION:** Carefully coordinate ceiling cavity space with all trades; however, installation of mechanical equipment within the ceiling cavity space allocation, in the event of conflict, shall be in the following order: plumbing waste lines; supply, return and exhaust ductwork; domestic hot and cold water; fire protection; control conduit. Respect clearances required for lights, electrical conduits, protected structure, etc. All spaces above any and all ceilings shall be defined and considered as return air plenum space.

1.18 **MECHANICAL COORDINATION DRAWINGS:** For the entire building including all floor spaces, mechanical rooms, congested areas, or areas of great detail, prepare and submit a set of coordination drawings showing major elements, components and systems of mechanical equipment and materials in relationship with other building components (structure, fire sprinkler, electrical, etc.). Prepare drawings to an accurate scale of 1/4" - 1-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining equipment, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction.

Prepare floor plans, reflected ceiling plans, elevations, sections and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the work, including (but not necessarily limited to) the following:

- A. Existing mechanical equipment rooms and boiler room layouts:

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1. New boilers, existing pumps, expansion tanks, etc.
 2. Control systems.
 3. Electrical installations.
 4. Related structure.
- B. Work in pipe spaces, chases, trenches, and tunnels.
- C. Exterior wall penetrations.
- D. Ceiling plenums which contain piping, ductwork, or equipment in congested arrangement. To include structure, ductwork, piping, fire protection, large electrical conduit, recessed lights, etc.
- E. Installations in mechanical riser shafts, at typical sections and crucial offsets and junctures.
- F. Numbered valve location diagrams.
- G. Manifold piping for multiple equipment units.
- H. General floor plan layouts with ductwork, piping, lighting, structure, etc.
- I. Use drawings to coordinate all affected trades.
- 1.19 SCHEDULING/METHODS OF PROCEDURE: Where interruptions of service are needed to effect work of this contract, outline the work, coordinate with other trades, determine the Owners acceptable downtime and prepare a time based schedule to accomplish the work. Give notice of a necessary utility interruption (or shutdown) to any existing system to the owner's construction coordinator not less than 72 hours prior to the proposed shutdown.

PART II - GENERAL MECHANICAL MATERIALS AND METHODS

2.1 QUALITY OF MATERIALS AND EQUIPMENT:

- A. All equipment and materials shall be new, and shall be the standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment, and shall be the manufacturer's latest design. Specific equipment shown in schedules on drawings and specified herein is to be the basis for the Contractor's bid. Provisions for substitute equipment are outlined in the General Conditions. All materials shall be produced by manufacturing plants located in the United States of America.
- B. Furnish and install all major items of equipment specified in the equipment schedules on the drawings complete with all accessories normally supplied with catalog items listed, and all other accessories necessary for a complete and satisfactory installation.

2.2 PROTECTION OF MATERIALS AND EQUIPMENT:

- A. Close pipe and duct openings with caps or plugs to prevent lodgment of dirt or trash during the course of installation. Cover equipment tightly and protect against dirt, water and chemical or mechanical injury. Make damage and defects developing before acceptance of the work good at Contractor's expense.

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- B. Do not make temporary use of project equipment, new or existing, during construction without the consent of the owner. **DO NOT USE SYSTEM FOR TEMPORARY HEAT!!**

2.3 QUALIFICATIONS OF WORKMEN:

- A. All mechanics shall be capable journeymen, skilled in the work assigned to them. Apprentices may be used with appropriate direction.
- B. Employ no unskilled persons in the work which he is given to do; execute all work in a skillful and workmanlike manner. All persons employed upon this work shall be competent, faithful, orderly and satisfactory to the Owner. Should the Owner's Representative deem anyone employed on the work incompetent or unfit for his duties, and so certify, Contractor shall dismiss him and he shall not be again employed upon the work without permission of the Owner's Representative.
- C. All welders involved in welding of pressure piping systems shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Written verification of successful test completion shall be submitted to Engineer prior to initiating work.

- 2.4 FOREMAN: Dedicate and designate a full-time general mechanical foreman to the Owner's Representative to be consistently available on site during the life of the project for consultation. Do not replace this individual without prior approval from the Owner's Representative.

- 2.5 USE OF COMMON VENDORS: Regardless of subcontract delegations, coordinate purchasing between trades so that equipment and materials of similar nature come from a single vendor, i.e., all package HVAC terminal units shall be common source. Valves, variable volume boxes, speed drives, etc., the same. Do not burden the Owner with multiple brands of similar equipment unless so directed.

2.6 ROOF/WALL/FLOOR PENETRATIONS - FLASHINGS:

- A. Install sleeves through the floor into "dry rooms" flush with the floor, caulked and sealed. Into wet rooms, extend piping to create 1" dam. Use Schedule 40 galvanized steel pipe for all pipe sleeves.
- B. Let pipe sleeves allow for movement of the pipe due to expansion and contraction, yet to include seismic restraint.
- C. Refer to Section "FIRE STOPPING" for requirements.
- D. Flashings:
 - 1. Flash all pipes penetrating the roof. Provide required flashing components.
 - 2. Clamp roof drains to roof membrane, follow manufacturer's directions.
 - 3. Flash and counter flash other piping penetrating the roof. See drawings or Engineer for additional detail.
 - 4. Make all ductwork penetrating the roof watertight with flashings, counter flashing and sealant. Provide curbs for all such openings.

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- 2.7 HANGERS AND SUPPORTS (GENERAL):
- A. Provide hangers and/or supports for all equipment, piping and ductwork. Primary information is contained in these specifications and on the drawings.
 - B. Provide hangers and supports to correlate with seismic restraint and vibration isolation.
- 2.8 MANUFACTURER'S DIRECTIONS: Install all equipment in strict accordance with directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the plans and specifications, report such conflicts to the Engineer who shall direct adjustments as deemed necessary and desirable.
- 2.9 LUBRICATION: Lubricate equipment at startup. Then, provide all lubricants for the operation of all equipment until acceptance by the Owner. The Contractor is held responsible for all damage to equipment and bearings while the equipment is being operated by him consequent to preacceptance operation.
- 2.10 ELECTRICAL WIRING AND CONTROL:
- A. In general, motor starters, related motor starter equipment and power wiring indicated on the electrical drawings and control diagrams are to be furnished and installed under Division 16000 of this Specification. Items of electrical control equipment specifically mentioned to be furnished by the Division 15000 either in these specifications or on the electrical or mechanical drawings, shall be furnished and mounted by this Contractor and shall be connected under and as required by this Division 15000 and Division 16000 of these specifications.
 - B. Refer to the control equipment and wiring shown on the diagrams. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the contractor.
 - C. Division must be fully coordinated with Division 16000 to insure that all required components of the work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of coordination.
 - D. Where the detailed electrical work is not shown on the electrical drawings, the Mechanical Contractor shall furnish, install and wire or have prewired all specified and necessary controls for air handling equipment specified for this project. The objective of this paragraph is to make sure a complete operating system is obtained at no additional cost to the Owner for field wiring required related to the equipment.
- 2.11 FLUSHING AND DRAINING OF SYSTEMS/CLEANING OF PIPING: Fill, clean and flush and sterilize where appropriate, all water piping systems with water and drain these systems before they are placed in operation. Blow out all other piping systems with compressed air or nitrogen to remove foreign materials that may have been left or deposited in the piping system during its erection.
- 2.12 JOBSITE CLEANUP:
- A. Keep site clean during progress of work.
 - B. At the conclusion of work, clean all installation thoroughly.

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1. Leave equipment in a factory dock condition. Correct any damage and touch up or repaint if necessary.
2. Remove all debris from site.

END OF SECTION 15000

SECTION 15005 - DEMOLITION

PART I – GENERAL

1.1 SECTION INCLUDES:

- A. Remove existing general, mechanical and plumbing installations in the remodel area which is no longer useful to the functions of the building.
- B. Maintain existing installations which continue in service or are adapted to new service.
- C. Adapt existing installation to new conditions, ie. remove and reinstall piping which must be offset or revised to accommodate new installation, layouts, etc.

1.2 REFERENCES:

- A. Respond to General Conditions, Supplemental General Conditions, Division 1, etc.

1.3 PROJECT/SITE CONDITIONS:

- A. Work areas are in the existing general building areas, mechanical rooms and chase spaces. Ductwork and piping exists throughout the building. The building's utilities are to be restored to service. Be familiar with site conditions and be careful in the work.

1.4 SCHEDULING AND SEQUENCING:

- A. Program and schedule any required interruptions of primary utility service with the General Contractor.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 MECHANICAL PIPING AND EQUIPMENT:

- A. Remove all mechanical piping, related insulation, and mechanical equipment and accessories in the remodeled areas rendered obsolete by this work. The contractor shall field coordinate existing work versus new and remove all piping, equipment, and accessories not required by new work to remain. Dispose of removed material offsite in an approved manner.

3.2 CONTROLS:

- A. The existing low voltage controls systems serving the existing boilers shall be removed from the existing boilers and reinstalled on the new boilers. Removal shall include all low voltage electrical wiring, control devices, and control accessories. In addition remove portions of existing control systems made obsolete by the new work.

END OF SECTION 15005

SECTION 15060 - GENERAL PIPES AND FITTINGS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is Division-15 General Pipes and Fittings section, and is part of each Division-15 section making reference to pipes and pipe fittings specified herein.
- C. Division-15 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

- A. This section is generic in that it describes material and installation required by several other sections of this specification.
- B. Types of pipes and pipe fittings specified in this section include the following:
 - 1. Steel Piping
 - 2. Copper Piping
 - 3. Grooved Joint Piping
 - 4. Miscellaneous Piping Materials/Products.
- C. Pipes and pipe fittings furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:**
 - 1. Firm with at least three years history of successful experience on projects of similar nature.
 - 2. Licensed as a firm in the contractor state of origin and in the State of Utah.
 - 3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the contractor.
 - 4. All workmen employed on the project to carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.
- C. **Welding Certification:**
 - 1. Each welder shall have passed a qualification test within the past six months prior to working on the project.
 - 2. The test shall be in accordance with the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications", ASME Section VIII, and ANSI 313.

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3. The test report shall certify that the welder is qualified to weld the material to be used at the job site in the positions required (flat, vertical, overhead etc.).
4. Submit three copies of each welder's qualification test report to the Project Manager for approval prior to commencing the work. No welder shall be used on the project until so certified.

1.4 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.
- B. **Welding Certifications:** Submit reports as required for piping work.
- C. **Brazing Certifications:** Submit reports as required for piping work.
- D. **Maintenance Data:** Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division 1.

1.5 REFERENCES:

- A. **Codes And Standards:**
 1. **Welding:** Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.
 2. **Brazing:** Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.
 3. **NSF Labels:** Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundation (NSF).

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

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PART II - PRODUCTS

2.1 GENERAL:

- A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards. Use United States (domestic) manufactured pipe only. Do not use foreign made pipe.
- B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable. Use domestic manufactured fittings only. Do not use foreign manufactured fittings.

2.2 STEEL PIPES AND PIPE FITTINGS:

- A. Black Steel Pipe: Seamless or ERW, ASTM A 53.
- B. Electric-Resistance-Welded Steel Pipe: ASTM A 135.
- C. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.
- D. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.
- E. Unions: ANSI B16.39; 300 lb. ground joint malleable iron, hexagonal, selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
- F. Dielectric Unions: 175 psig WSP at 250°F. Equal to Walter Vallet Company V-line insulating coupling.
- G. Threaded Pipe Plugs: ANSI B16.14.
- H. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
 - 1. Material Group: Group 1.1.
 - 2. End Connections: Buttwelding.
 - 3. Facings: Raised-face.
 - 4. Steel Pipe Flanges For Waterworks Service: AWWA C207.
- I. Forged-Steel and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.
- J. Forged Branch-Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.
- K. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not

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use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (no close-nipples).

2.3 COPPER TUBE AND FITTINGS:

- A. Copper Tube: ASTM B 88; Type K, L (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated. Do not use Type M for pressure piping.
- B. DWV Copper Tube: ASTM B 306.
- C. Cast-Copper Solder-Joint Fittings: ANSI B16.18.
- D. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
- E. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.
- F. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.
- G. Cast-Copper Flared Tube Fittings: ANSI B16.26.
- H. Bronze Pipe Flanges/Fittings: ANSI B16.24.
- I. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.4 GROOVED PIPING PRODUCTS: (Only where acceptable.)

- A. General: At Installer's option, mechanical grooved pipe couplings and fittings may be used for piping systems having operating conditions not exceeding 230°F (110°C), excluding steam piping condensing water return to pump, and any other service not recommended by manufacturer, in lieu of welded, flanged, or threaded methods, and may also be used as unions, seismic joints, flexible connections, expansion joints, expansion compensators, or vibration reducers.
- B. Coupling Housings Description: Grooved mechanical type, which engages grooved or shouldered pipe ends, encasing an elastomeric gasket which bridges pipe ends to create seal. Cast in two or more parts, secure together during assembly with nuts and bolts. Permit degree of contraction and expansion as specified in manufacturer's latest published literature. (Victaulic style 77) For rigid joints (Victaulic "Zero Flex" style 07).
 - 1. Coupling Housings: Malleable iron conforming to ASTM A 47.
 - 2. Coupling Housings: Ductile iron conforming to ASTM A 536.
 - 3. Standard: Enamel coated, options hot dip galvanized.
- C. Gaskets: Mechanical grooved coupling design, pressure responsive so that internal pressure serves to increase seal's tightness, constructed of elastomers having properties as designated by ASTM D 2000.
 - 1. Water Services: EDPM Grade E, with green color code identification.
 - 2. Other Services: As recommended by Manufacturer.
- D. Bolts and Nuts: Heat-treated carbon steel, ASTM A 183, minimum tensile 110,000 psi.

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1. Exposed Locations: Tamper resistant nuts.
- E. Branch Stub-Ins: Upper housing with full locating collar for rigid positioning engaging machine-cut hole in pipe, encasing elastomeric gasket conforming to pipe outside diameter around hole, and lower housing with positioning lugs, secured together during assembly with nuts and bolts.
- F. Fittings: Grooved or shouldered end design to accept grooved mechanical couplings.
 1. Malleable Iron: ASTM A 47.
 2. Ductile Iron: ASTM A 536.
 3. Fabricated Steel: ASTM A 53, Type F for 3/4" to 1-1/2"; Type E or S, Grade B for 2" to 20".
 4. Steel: ASTM A 234.
- G. Flanges: Conform to Class 125 cast iron and Class 150 steel bolt hole alignment.
 1. Malleable Iron: ASTM A 47.
 2. Ductile Iron: ASTM A 536.
- H. Specialties:
 1. Inline strainers. Victaulic Style 730.
 2. Suction diffusers. Victaulic Style 731.
 3. Dielectric couplings. Victaulic Style 47.
- I. Grooves: Conform to the following:
 1. Standard Steel: Square cut.
 2. Standard Steel: Roll grooved.
 3. Ductile Iron: Radius cut grooved, AWWA C606.
- J. Manufacturer: Subject to compliance with requirements, provide grooved piping products of one of the following:
 1. ITT Grinnell Corp.
 2. Stockham Valves & Fittings, Inc.
 3. Victaulic Co. of America.
 4. Gustin-Bacon

2.5 MISCELLANEOUS PIPING MATERIALS/PRODUCTS:

- A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.

Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

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- B. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements. Use **no lead** bearing solders in domestic water applications.
- Tin-Antimony Solder: ASTM B 32, Grade 95TA.
- Silver-Lead Solder: ASTM B 32, Grade 96TS.
- C. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.
- Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.
- D. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.
- E. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.
1. Manufacturer: Subject to compliance with requirements, provide piping connectors of the following
- a. Fernco, Inc.
- F. Strainers:
1. Y pattern, self-cleaning, line size. Armstrong, Bailey, Crane, Fisher, Metraflex, Mueller, Sarco, Strong, or Yarway.
- Iron Body, Screwed Ends 2" and Smaller: 250 psig at 425°F, screen mesh to suit service.
- Flanged Iron Body 2-1/2" and Larger: 125 psig steam pressure rating, screen mesh to suit service.
2. Basket pattern, quick release lid. Mueller #155 to 30 psi, Mueller #165 to 125 psi.

PART III - EXECUTION

3.1 INSTALLATION:

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently- leak proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible union, flanges, etc., for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Do not cold spring. Store filler weld materials in accordance with codes.

Comply with ANSI B31 Code for Pressure Piping.

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- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated. Provide high point vents, low point drains with valves and extension to drain for all piping.
- C. All piping in mechanical rooms, fan rooms, etc., shall be exposed. Do not conceal or imbed piping in walls, floors or other structures.
- D. Make changes in direction or size with manufactured fittings. Anchor and support piping for free expansion and movement without damage to piping, equipment or to building.
- E. Arrange piping to maintain head room and keep passageways clear.
- F. Provide unions at connections to equipment and elsewhere as required to facilitate maintenance.
- G. Run full pipe size through shutoff valves, gas cocks, balancing valves, etc. Change pipe size within three pipe size diameters of final connection to equipment, coils, etc.
- H. Erect all piping to insure proper draining. Domestic water, chilled water, and heating water shall slope down a minimum of 1" per 40 feet towards the drains. Pitch standpipes down to fire department connections a minimum of 1" per 40 feet. Slope soil, waste, vent, and roof drain lines in accordance with requirements of Uniform Plumbing Code.
- I. On horizontal straight runs of pipe, use eccentric reducers with straight side on top for water piping.
- J. Electrical Equipment Spaces: Do not run piping in or through transformer vaults and other electrical or electronic equipment spaces and enclosures or above electrical gear unless authorized and directed. Install drip pan under piping that must be run through electrical spaces.
- K. Anytime lines are broken or disconnected they shall be capped immediately after flushing. If rocks or other foreign materials are found in the system after it has been closed, the Contractor shall stand the expense of their removal.

3.2 PIPING SYSTEM JOINTS:

- A. General: Provide joints of type indicated in each piping system.
- B. Threaded: Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

- C. Brazed: Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.
- D. Soldered: Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- E. Welded:
1. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.
 2. Weld pipe joints in accordance with recognized industry practice and as follows:

Weld pipe joints only when ambient temperature is above 0°F (-18°C) where possible, with minimum pipe preheat to 50°F.
Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.

Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".

Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.

Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

At Installer's option, install forged branch-connection fittings wherever branch pipe is indicated; or install regular "T" fitting.

At Installer's option, install forged branch-connection fittings wherever branch pipe of size smaller than main pipe is indicated; or install regular "T" fitting.
- F. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
- G. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions.

3.3 CLEANING, FLUSHING, INSPECTING:

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

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1. Inspect pressure piping in accordance with procedures of ASME B31.
- B. Disinfect water mains and water service piping in accordance with AWWA C601.
- C. Flush, treat and clean heating and cooling systems in accordance with Sections chemical treatment. Certify by signature of Contractor and Owner's Representative.

3.4 PIPING TESTS:

- A. General: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
 1. Required test period is 2 hours.
 2. Test long runs of Schedule 40 pipe at 150 psi, except where fittings are lower Class or pressure rating.
 3. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.
 4. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- B. Notifications: At least 10 days prior to commencement of required testing, notice shall be submitted for review. Tests shall be made prior to painting insulating or covering of any joints and shall be in accordance with ANSI Code for Pressure Piping.
- C. Inspections: Contractor to visually inspect piping while under hydrostatic pressure. Copies of inspection shall be submitted for review. At option of contract, welds not hydrostatically tested may be x-ray tested.
- D. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- E. Drain test water from piping systems after testing and repair work has been completed.
- F. Test pressure piping in accordance with ANSI B31.
- G. Test waste, drain and vent systems in accordance with local plumbing code and these specifications. Repair failed sections by disassembly and reinstallation.
- H. If test procedures in other sections differ from the above, comply with more stringent requirements.

END OF SECTION 15060

SECTION 15100 - VALVES

PART I - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is Division-15 Valves section, and is part of each Division-15 section making reference to valves specified herein.
- C. Division-15 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

- A. Extent of valves required by this section is indicated on drawings and/or specified in other Division-15 sections.
- B. Types of valves specified in section include the following:
 - 1. Drain Valves.
 - 2. Ball Valves.
 - 3. Plug Valves.
 - 4. Butterfly Valves.
 - 5. Check Valves.
 - 6. Swing Check.
 - 7. Miscellaneous Valves.
- C. Valves furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Valve Types: Provide valves of same type by same manufacturer.
- C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing Manufacturer's figure number, size, location, and valve features for each required valve.
- B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in Maintenance Manual; in

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accordance with requirements of Division 1.

1.5 REFERENCES:

A. Codes and Standards:

1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged- or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".
3. UL and FM Compliance: Provide valves used in fire protection piping, which are UL-listed and FM approved.

PART II - PRODUCTS

2.1 VALVES:

- A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.
- B. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
- C. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves, 5" and smaller, other than plug valves. Provide one wrench for every 10 plug valves. Provide gear operators for quarter-turn valves 6" and larger.
- D. Connections: Unless otherwise noted for a particular reason, any valve 2" and larger shall have flanges.

2.2 MANUFACTURERS: For all valves subject to compliance with requirements, provide valves of one of the following: Comply with specific manufacture requirements listed for specific valves.

- A. Crane
- B. Keystone
- C. Powell
- D. Nibco/Scott
- E. Lunkenheimer
- F. Stockham
- G. Milwaukee
- H. Bray
- I. Apollo
- J. Grinnell
- K. Watts
- L. Norris
- M. Wallworth

All valves of a given type shall be of the same manufacturer.

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2.3 HOT WATER HEATING:

A. Ball Valves:

1. Steel piping 3" and Smaller: 400 psig WOG @ 350°F, bronze construction, threaded ends, bubble tight mineral filled PTFE seat at 250 psig under water, hard, chrome plated brass or stainless steel full ported ball. Operate with flow in either direction. Lever or tee hand as required. Suitable for throttling and tight shut-off. Watts B-6000, B-6001 for domestic water, Apollo 70-100. Crane Hydro Gem 2190H Milwaukee, Jamesbury, Stockham. No other manufacturers approved.

For grooved joint steel pipe in 6" and larger sizes, convert to flanged pipe, use indicated ball or butterfly valves.

B. Butterfly Valves:

1. For piping 4" and larger. Install with weld neck flanges, Norris Series R-3011-23SS-2B, Norris Series r-3011-22SS-2M, double tapped lug, single-flange ductile iron or cast iron body, 316 SS disc, stainless steel shaft with extended neck for insulated pipe, EPDM seat and O-rings, 4-5" provide lever action valve with locking quadrant. Above 5" provide, indicating worm gear operator, 175 psig bubble tight pressure rating (250 where required). Centerline, Demco, Keystone, Rockwell, Grinnell, or Milwaukee.

C. Swing Check Valves:

1. 2" and Smaller: Crane No. 37 bronze, threaded, Y-pattern, 200# WOG at swing check valve.

D. Balancing Cocks:

1. 2" and Smaller: 175 psig WOG, cast iron body, square head, screwed ends, wrench operated, lubricated. Crane, Stockham.
2. 2-1/2" and Larger: 200 psig WOG, cast iron body, square head, flanged ends, wrench operated, lubricated. Crane, Stockham

- E. Balancing Valves: Bell and Gossett "Circuit Setter Plus", Armstrong "CB" or Flowset Accusetter CB circuit balancing valve with venturi and pressure taps. Unless specifically indicated, gate valves and butterfly valves may not be used as balancing valves.

2.4 MISCELLANEOUS VALVES AND SPECIALTIES:

- A. Air Vent Valves: Stockham B-64, 300 psi working pressure, 3/8" bronze, Crane No. 88 or ball valve.
- B. Gauge Valves; Ball valve with tee handle.
- C. Install valves with bonnets at least 45 degrees above the horizontal to ensure debris does not collect in bonnet.

PART III - INSTALLATION

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3.1 VALVE INSTALLATION:

- A. Locate all valves in locations which will allow easy operation and facilitate maintenance.
- B. Install valves with stems horizontal or above.
- C. All branch lines which supply a specific area of the building (such as a toilet room) shall be valved near the main so that each area may be isolated from the system for repairs without having to shut down both men and women's restrooms, other areas, or the whole building.
- D. Make all valves located above a non-lay-in type ceiling or behind a wall accessible by means of an access door.

END OF SECTION 15100

SECTION 15130 - THERMOMETERS AND PRESSURE GAUGES

PART I - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is Division-15 Thermometers and Pressure Gauges section, and is part of each Division-15 section making reference to thermometers and pressure gauges specified herein.
- C. Division-15 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY

- A. Meters and gauges specified in this section include the following:
 - 1. Temperature Gauges and Fittings.
 - a. Glass Thermometers.
 - b. Thermometer Wells.
 - c. Temperature Gauge Connector Plugs.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of thermometers and/or pressure gauges, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Temperature and Pressure Gauge Types:** Provide temperature and pressure gauges of same type by same manufacturer.

1.4 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's technical product data, including installation instructions for each type of thermometer and pressure gauge.
- B. **Shop Drawings:** Submit manufacturer's assembly-type shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.
- C. **Maintenance Data:** Submit maintenance data and spare parts lists for each type of thermometer and pressure gauge. Include this data, product data, and shop drawings in Maintenance Manual; in accordance with requirements of Division 1.

PART II - PRODUCTS

2.1 GLASS THERMOMETERS:

- A. **General:** Provide glass thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

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- B. Case: Die cast aluminum finished in baked epoxy enamel or extruded brass, glass front, spring secured, 9" long. Separable socket (union type).
- C. Adjustable Joint: Die cast aluminum, finished to match case, 180 degrees adjustment in vertical plane, 360 degrees adjustment in horizontal plane, with locking device. Stainless steel bulb chamber.
- D. Tube And Capillary: Stainless steel bulb chamber. Mercury filled, magnifying lens, 1% scale range accuracy, shock mounted.
- E. Scale: Satin faced, non-reflective aluminum, permanently etched markings.
- F. Stem: Copper-plated steel, or brass, for separable socket, length to suit installation.
- G. Range: Conform to the following:
 - 1. Hot water(s): 30° - 240°F with 2°F scale divisions.
- H. Manufacturer: Subject to compliance with requirements, provide glass thermometers of one of the following:
 - 1. Marshalltown Instruments, Inc.
 - 2. Marsh
 - 3. Terice (H.O.) Co.
 - 4. Weksler
 - 5. Weiss Instruments, Inc.
 - 6. U.S. Gauge

2.2 THERMOMETER WELLS:

- A. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.
- B. Manufacturer: Same as thermometers.

2.3 TEMPERATURE/PRESSURE GAUGE CONNECTOR PLUGS:

- A. General: Provide temperature gauge connector plugs pressure rated for 500 psi and 200 degrees F (93 degrees C). Construct of brass and finish in nickel-plate, equip with ½" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.
- B. Manufacturer: Subject to compliance with requirements, provide temperature gauge connector plugs of one of the following:
 - 1. Peterson Equipment Co.
 - 2. SISCO
 - 3. Universal
 - 4. Flow Design

END OF SECTION 15130

SECTION 15140 - MECHANICAL SUPPORTING DEVICES

PART I - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is Division-15 Mechanical Supporting Devices section, and is part of each Division-15 section making reference to supports and anchors specified herein.
- C. Division-15 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

- A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division-15 sections.
- B. Types of supports and anchors specified in this section include the following:
 - 1. Horizontal-Piping Hangers and Supports.
 - 2. Vertical-Piping Clamps.
 - 3. Hanger-Rod Attachments.
 - 4. Building Attachments and In-Beds.
 - 5. Saddles and Shields.
 - 6. Miscellaneous Materials.
 - 7. Anchors.
 - 8. Equipment Supports.
- C. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.
- D. Relate this section to Section 15240 regarding seismic and vibration control.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.4 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.
- B. **Shop Drawings:**
 - 1. Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.
- C. **Maintenance Data:** Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

1.5 REFERENCES:

A. Codes and Standards:

1. Code Compliance: Comply with applicable building, mechanical and plumbing codes pertaining to product materials and installation of supports and anchors.
2. UL and FM Compliance: Provide products which are UL-listed and FM approved.
3. MSS Standard Compliance:
 - a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
 - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - d. Terminology used in this section is defined in MSS SP-90.

PART II - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

- A. General: Except as otherwise indicated, provide factory- fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
- B. Adjustable Steel Clevises Hangers: MSS Type 1. (For suspension of non-insulated or insulated stationary pipe lines; 1/2" to 30".)
- C. Steel Double Bolt Pipe Clamps: MSS Type 3. (For suspension of pipe requiring up to 4" of insulation and where flexibility of clamp is desirable; 3/4" to 24".)
- D. Steel Pipe Clamps: MSS Type 4. (For suspension of cold pipe lines or hot lines where little or no insulation is required; 1/2" to 24".)
- E. Pipe Hangers: MSS Type 5. (For suspension of piping when off-center closure allowing installation of hanger before erection of piping is desired; 1/2" to 4".)
- F. Adjustable Swivel Pipe Rings: MSS Type 6. (For suspension of non-insulated stationary pipe lines; 3/4" to 8".)
- G. Adjustable Steel Band Hangers: MSS Type 7. (For suspension of non-insulated stationary pipe lines; 3/4" to 8".)
- H. Adjustable Band Hangers: MSS Type 9. (For suspension of non-insulated stationary pipe lines; 1/2" to 8".)

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- I. Adjustable Swivel Rings, Band Type: MSS Type 10. (For suspension of non-insulated stationary pipe lines; 3/8" to 8".)
- J. Split Pipe Rings: MSS Type 11. (For suspension of non-insulated stationary pipe lines; 3/8" to 3".)
- K. Extension Split Pipe Clamps: MSS Type 12. (For suspension of non-insulated stationary pipe lines; 3/8" to 3".)
- L. U-Bolts: MSS Type 24. (For support of heavy loads; 1/2" to 30".)
- M. Clips: MSS Type 26. (For support of uninsulated piping not subject to expansion or contraction.)
- N. Pipe Saddle Supports: MSS Type 36, including steel pipe base- support and cast-iron floor flange. (To support pipe from floor stanchion, using floor flange to secure stanchion to floor 4" to 36".)
- O. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange. (To Type 36 except U-bolt provided for retaining pipe.)

2.2 VERTICAL-PIPING CLAMPS:

- A. General: Except as otherwise indicated, provide factory- fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- B. Two-Bolt Riser Clamps: MSS Type 8. (For support and steadying of pipe risers; 3/4" to 20". Also supports pipe covering or insulation.)
- C. Four-Bolt Riser Clamps: MSS Type 42. (When longer ends are required for riser clamps.)

2.3 HANGER-ROD ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory- fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. Steel Turnbuckles: MSS Type 13. (For adjustment up to 6" for heavy loads.)
- C. Steel Clevises: MSS Type 14. (For use on high temperature piping installations.)
- D. Swivel Turnbuckles: MSS Type 15. (For use with split pipe rings, MSS type 11.)
- E. Malleable Iron Sockets: MSS Type 16. (For attaching hanger rod to various types of building attachments.)

2.4 BUILDING ATTACHMENTS AND IN-BEDS:

- A. General: Except as otherwise indicated, provide factory- fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
- B. Concrete Inserts: MSS Type 18. (For upper attachment for suspending pipe hangers from concrete ceiling.)
- C. Top Beam C-Clamp: MSS Type 19. (Use under roof installations with bar joist construction, for attachment to top flange of structural shape.)
- D. Side Beam or Channel Clamps: MSS Type 20. (For attachment to bottom flange of beams, channels, or angles.)
- E. Center Beam Clamps: MSS Type 21. (For attachment to center of bottom flange of beams.)
- F. Welded Beam Attachments: MSS Type 22. (For attachment to bottom of beams where loads are considerable and rod sizes are large.)
- G. C-Clamps: MS Type 23. (For attachment to structural shapes.)
- H. Top Beam Clamps: MSS Type 25. (For attachment to top of beams when hanger rod is required tangent to edge of flange.)
- I. Side Beam Clamps: MSS Type 27. (For attachment to bottom of steel I-beams.)
- J. Steel Beam Clamps with Eye Nut: MSS Type 28. (Same as Type 28 with link extensions.)
- K. Linked Steel Clamps with Eye Nut: MSS Type 29. (Same as Type 28 with link extensions.)
- L. Malleable Beam Clamps: MSS Type 30. (For attachment to structural steel.)
- M. Steel Brackets: One of the following for indicated loading:
 - 1. Light Duty: MSS Type 31, to 570 pounds.
 - 2. Medium Duty: MSS Type 32, to 1,500 pounds.
 - 3. Heavy Duty: MSS Type 33, to 3,000 pounds.
- N. Side Beam Brackets: MSS Type 34. (For use on sides of steel or wooden beams.)
- O. Plate Lugs: MSS Type 57. (For attachment to steel beams where flexibility at the beam is desired.)
- P. Horizontal Travelers: MSS Type 58. (For supporting piping systems subject to linear horizontal movements where head room is limited.)

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2.5 SADDLES AND SHIELDS:

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Saddles: MSS Type 39; see section Mechanical Insulation for void fill requirements. Use for roller supports and on all pipes 10" and larger.
- C. Protection Shields: See section Mechanical Insulation.
- D. Thermal Hanger Shields: See section Mechanical Insulation.
- E. Manufacturer; Subject to compliance with requirements, provide thermal hanger shields of one of the following:
 - 1. Elcen Metal Products Co.
 - 2. Pipe Shields, Inc.

2.6 MANUFACTURERS OF HANGERS AND SUPPORTS:

- A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - 1. Kin-Line, Inc.
 - 2. Fee & Mason Mfg. Co.; Div. Figgie International
 - 3. ITT Grinnel Corp.
 - 4. B-Line
 - 5. Unistrut

2.7 MISCELLANEOUS MATERIALS:

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration. Use Embeco grout for non-shrink applications.
- D. Heavy Duty Steel Trapezes: Fabricate from factory built channel (Unistrut) system and use factory fasteners for channel steel shapes, selected for loads required; weld steel in accordance with AWS standards.

PART III - EXECUTION

3.1 INSPECTION:

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- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION:

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.
- B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.3 INSTALLATION OF BUILDING ATTACHMENTS:

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms.

Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the tops of inserts.

3.4 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Install hangers, supports, clamps and attachments to rigidly support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- C. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by isolating with foam rubber covering or 30 mil insulating tape.
- D. Provisions for Movement:
 - 1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

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- 2. Install supports within 2 feet of non-vertical flex connectors.
- E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- G. Insulated Piping: Do not allow hangers to come in contact with pipe where pipe is specified to be insulated.
- H. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
- I. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install galvanized steel protective shields. Install calcium silicate blocks (12" long minimum) at support points.
- J. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.5 INSTALLATION OF ANCHORS:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer for loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.6 EQUIPMENT SUPPORTS:

- A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 15. Size bases to extend a minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

3.7 ADJUSTING AND CLEANING:

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

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- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 15140

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SECTION 15170 - MOTORS, DRIVES AND ELECTRICAL REQUIREMENTS FOR MECHANICAL WORK

PART I - 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 work of this section.
- B. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 16.

1.2 SUMMARY:

- A. This section specifies the basic requirements for motors and drives furnished by this Division and for electrical components which are an integral part of packaged mechanical equipment. Package components include, but are not limited to factory installed motors, starters, and disconnect switches, etc.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are noted within these documents.

1.3 QUALITY ASSURANCE:

- A. Provide electrical components and materials which are UL labeled.

1.4 SUBMITTALS:

- A. Submit product data for motors, belts, drives, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections. Verify project electrical characteristics with submittal. Confirm suitability for altitude, maintaining full nameplate rating plus service factor. Include this data in maintenance manual in accordance with Division 15195 "Operation and Maintenance Manuals".

1.5 REFERENCES:

- A. NEMA Standards MG 1: Motors and Generators.
- B. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.
- C. NEMA Standards 250: Enclosures for Electrical Equipment.
- D. NEMA Standards KS 1: Enclosed Switches.
- E. Comply with National Electrical Code (NFPA 70).

PART II - PRODUCTS

2.1 MOTORS:

- A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
 2. Motor sizes large enough so that the driven load will not require the motor to operate in the service factor range.
 3. Two-speed motors with 2 separate windings for poly-phase motors. Confirm 2-speed starter requirements with Division 16000.
 4. Single speed motors of the permanent split capacitor type. (PSC)
 5. Temperature Rating: Minimum rate for 40°C environment with maximum 90°C temperature rise for continuous duty at full load (Class H Insulation for altitude, Class B leads allowed).
 6. Starting Capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly timed spaced starts per hour for manually controlled motors.
 7. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors, 1.0 for TEFC motors.
 8. Pump motors with an end shield with ventilation openings beneath the motor.
 9. Motor Construction: NEMA Standard MG 1, general Purpose, continuous duty, design "B", except "C" where required for high starting torque.
 10. Frames: NEMA Standard No. 48 or 54; T-frame, use driven equipment manufacturer's standards to suit specific application.
 11. Bearings:
 - a. Ball or roller bearings with inner and outer shaft seals;
 - b. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance;
 - c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor;
 - d. For fractional horsepower, light duty motors, sleeve type bearings are permitted;

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12. Enclosure Type:
 - a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation;
 - b. Guarded drip-proof motors where exposed to contact by employees or building occupants;
 - c. Weather protected type I for outdoor use, Type II where not housed;
13. Overload Protection: built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
14. Noise Rating: "Quiet"
15. All motors one HP and above shall be high efficiency with efficiency ratings consistent with NEMA Standard MG 1-12, 55A, Efficiency Levels of Energy Efficient Polyphase Squirrel - Cage Induction Motors. Values are found in Table 12-6C of the NEMA Standard. Motors used with Variable Frequency Drives shall be compatible and designed for use with Variable Frequency Drives. Any "explosion proof" motor for classified areas, scheduled for use with VFD's, shall be listed for inverter duty applications.
16. Nameplate: indicate the full identification of manufacturer. ratings, characteristics, construction, special features and similar information.
17. Acceptable Manufacturers: Allis-Chalmers, Baldor, Century, General Electric, Gould, Lincoln, Louis-Allis, Marathon, Reliance, U.S. Motors, Westinghouse.

END OF SECTION 15170

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SECTION 15190 - MECHANICAL IDENTIFICATION

PART I - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.
- B. Division 15 Basic Mechanical Materials and Methods sections apply to work of this section.
- C. Cross reference Division 9 for basic painting requirements. Use this section to identify extent of painting for pipes, ducts, etc. and color coded identification.

1.2 SUMMARY:

- A. All new heating equipment and piping, new automatic temperature control equipment (excluding thermostats and relays), and distribution systems shall be labeled. Electrical switches and starters for mechanical equipment shall also be labeled.

PART II - GENERAL MECHANICAL MATERIALS AND METHODS

2.1 EQUIPMENT, VALVE PIPE AND DUCT IDENTIFICATION:

A. Equipment Identification:

- 1. Identify all equipment including, but not limited to, gauges, meters, all mechanical equipment, ATC panels, controller, etc., and all other devices shall be identified with signs made of laminated plastic with 1/8" or larger engraved letters.
- 2. Each equipment shall have its own unique equipment number.
- 3. Information on sign shall include name of equipment, identification on plans and schedules, rating, maintenance instructions and any other important data not included on factory attached name plate.
- 4. Signs shall be attached to equipment so they can be easily read. Attachment shall be by rust proof screws or rivets. Glue shall not be used.
- 5. Sample identification signs for equipment shall be as follows:
 - a. "Boiler B-1"
Rating: 2,000 MBtu Input
 - b. "ATC Panel A"

(Note: Avoid using only the engineer's designations as used on plans; identify equipment as to area or zone served.)

B. Valve Tagging:

- 1. All newly install valves shall be designated by distinguishing numbers and letters

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and these new designations indicated on existing charts. In the event an existing chart is not available the contractor shall provide a new chart for the newly installed valves. Note that all newly installed VAV box three way valves shall retain there existing valve tags, however there designation shall be changed on the existing chart. In the event that these existing valves are not tagged, new tags shall be constructed for the valves and noted on a revised or new chart.

2. Valve Identification:
 - a. All valves, regardless of size, shall have brass tags at least 1" by 3" in size and 0.051 inches thick. Legend on tag shall use engraved lettering at least 1/8" high. Each valve on the drawing shall be identified separately, and valve tags shall match the drawing identification.
 - b. Valve tags shall include the following minimum information:
 - (1) Plan Identification
 - (2) Normal Position
 - (3) Duty
 - (4) Area Served
 - (5) Valve Type
 - c. Tags shall be securely fastened to valves with steel rings or brass jack chain, in a manner to permit easy reading. Do not attach to valve wheel or the handle.
3. A chart of all newly installed valves shall be furnished as part of O & M Manual by the Contractor. Charts shall indicate the following items:
 - a. Valve identification number
Location
Service or purpose
Normal position
4. Sample Identification Chart is as follows:

VALVE IDENTIFICATION CHART

Number	Description	Location*	Normal Position
1	VAVR Heating Water Control Valve	Mech Rm #121	Open

* The above room numbers shall be the room numbers actually used. DO NOT USE ARCHITECTURAL ROOM NUMBERS ON PLANS. Use institution actual assigned room numbers.

- C. Pipe Identification:
 1. All new pipes are to be labeled and color coded with contents clearly identified and arrows indicating direction of flow. This applies to piping run above the ceilings as well as pipe exposed in equipment rooms and finished areas. Pipes shall be identified at the following locations:
 - a. At the point of new connection to existing piping.
 - b. At every point of entry and exit where piping passes through a wall or floor.

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- c. On each riser and junction.
 - d. Adjacent to all special fittings or devices (regulating valves, etc.)
 - e. Connection to equipment.
2. Apply markers so they can be read from floor. Labels and markers shall be of the self-sticking, all temperature, permanent type as manufactured by W. H. Brady Co., 727 West Glendale Avenue, Milwaukee, Wisconsin; or Seton Name Plate Corp., 592 Boulevard, New Haven, Connecticut.
 3. Identifying lettering shall be painted or stenciled on duct or pipe. Self-adhesive or glue-on type labels are acceptable. Letters shall be 2" high for duct and larger piping 3" or more, 1" high for 1-1/4" to 2-1/2" pipe, and 1/2" high for 1" pipe and smaller.
 4. Arrows to indicate direction of flow shall be painted in the same color as the lettering. The arrow shall point away from the lettering. On duct and large piping 3" or more in diameter, the "shaft" of the arrow shall be 2" long and 1" wide. Smaller piping, 2-1/2" or less, shall have arrows with a shaft 1/2" wide and 2" long. Use a double-headed arrow if the flow can be in either direction.
 5. Pipe color coding shall be uniform throughout. Background colors shall be as follows:
 - a. Yellow: Dangerous Materials (high pressure steam, natural gas, condensate, high pressure refrigerant, high voltage, etc.)
 - b. Red: Fire Protection Equipment (fire sprinkler water, fire protection water).
 - c. Bright Blue: Protective Materials (filtered water).
 - d. Green: Safe Materials (chilled water, cold water, instrument air, sanitary sewer, etc.)
 6. Piping and duct shall be identified with the following colors:

Abbreviation & Medium In Pipe or Duct	Identifying Lettering	Marker Field Color	Lettering Color
Water:			
Heating Water Supply	HWS	Yellow	Black
Heating Water Return	HWR	Yellow	Black
Drain	Black		

7. Markers shall be installed in strict accordance with manufacturer's instructions.

On chalky and loose insulation, soft, porous, fiber filled or fiberglass coverings, a spiral wrap of pipe banding tape shall be made around the circumference of the pipe. Sufficient spiral wraps shall be made to accommodate the horizontal

dimension of the pipe marker.

On bare pipes, painted pipes, and pipes insulated with a firm covering pipe banding tape matching the background color of the marker shall be used for 360 color coding. After applying pipe markers, wrap pipe banding tape around pipe at each end of marker. Tape should cover 1/4" to 1/2" to 1" on itself. Be sure pipe surface is dry and free of dirt or grease before applying markers or bonding tape.

8. Stenciling may be used in lieu of the above labels and markers if finished application gives the same overall appearance. If stenciling is used, letter heights, background colors, banding and arrows shall be as specified above. Submit samples before proceeding with work.

2.2 PANEL IDENTIFICATION:

- A. All panel devices shall have engraved black face formica with white engraved lettering labels on panel faces.
- B. All internal panel components shall have engraved black face formica labels with white engraved lettering. Fasten label beneath each device.
- C. All panel wiring and tubing shall be numerically or alphabetically coded.

END OF SECTION 15190

SECTION 15240 - MECHANICAL SOUND, VIBRATION AND SEISMIC CONTROL

PART I - GENERAL:

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is Division-15 Mechanical Sound, Vibration and Seismic Control section, and is part of each Division-15 section making reference to mechanical sound, vibration and seismic control specified herein.
- C. Division-15 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY: Furnish and install complete seismic restraint and vibration control systems for all work installed under Division 15. Work to be responsive to the intent of the Uniform Building Code, latest adopted edition, for the respective seismic zone. Zone 3, importance factor of 1.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Engage the services of an independent seismic and vibration control subcontractor who has the technology, experience, computer capabilities and manufactured products to prepare the required computations, shop drawings and special devices to meet the minimum requirements described herein. Select from the following:
 - 1. Amber Booth
 - 2. Kinetics
 - 3. Mason
- B. The seismic and vibration control subcontractor shall visit the site during construction at a minimum of two specific periods.
 - 1. When equipment is set in place, prior to placement of seismic restraint devices for the purposes of directing the contractor in properly locating and installing the approved devices.
 - 2. At the completion of the project, prior to final mechanical inspection, for the purpose of verifying the correctness of the seismic restraint and vibration isolation device installation and preparing certification of the seismic vibration-isolation work.
- C. The seismic subcontractor shall exercise the quality control for this work and shall include, but not be limited to instructions direct to the Mechanical (Division 15) Contractor concerning:
 - 1. Anchoring of all mechanical equipment.
 - 2. Vibration mounting of equipment.
 - 3. Bracing and anchoring of piping and conduit.
 - 4. Provision for expansion and vibration of piping.

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- 5. Concrete and/or steel pads or bases to assure proper mounting of restraints and isolators.
 - D. The subcontractor shall be responsible for identifying the need for the size and location of steel sole plates and their attachment to structural steel or concrete.
 - E. The subcontractor shall certify in writing that he has inspected the installation and that all isolation, anchors and seismic restraint materials are installed correctly and functioning properly. Certification shall be provided after all corrective work has been completed.
- 1.4 SUBMITTALS:
- A. Submittal data is required and shall consist of computations, vibration isolation selection, equipment anchors, anchor bolt sizes, supports, seismic restraints, sole plate data, restraint locations and type of restraints.
 - B. Submittal data shall identify dimensions, load deflection data, center of gravity, standard connections, manufacturer's recommendations, behavior problems including vibrations, thermal expansion, building expansion joints, etc., associated with equipment, ductwork, piping and conduit.
 - C. Calculations need not be submitted when restraint devices for piping, conduit and ductwork are proposed in accordance with the SMACNA Guidelines for Seismic Restraints.
 - D. Selection of isolator anchors and restraints shall be clearly made known along with the basis for selection so that proposed systems can be reviewed.
 - E. Calculations furnished for anchors, anchor bolts, sole plates and other support steel for restraining devices shall be signed and stamped by an engineer licensed in one of the United States.

1.5 REFERENCES:

- A. Codes and Standards: (Latest adopted edition)

Uniform Building Code
NFPA bulletin 90A,
UL Standard 181

Guidelines for seismic restraint of Mechanical Systems and Plumbing Piping Systems. Published by the Sheet Metal Industry Fund of Los Angeles, California, and the Plumbing and Piping Industry Council, Inc., Los Angeles, California.

PART II - PRODUCTS:

- 2.1 MATERIALS - PRODUCTS: Restraint devices shall be especially designed to resist seismic forces in all directions.
- A. Piping, and Conduit Restraints: Restraint materials for exposed installation shall be standard fabricated flat steel, angle rod and channel members.

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Restraint members shall be bolt connected. Cabling materials and methods shall be used only in chases or concealed ceiling spaces.

PART III - EXECUTION

3.1 SEISMIC RESTRAINT GUIDELINE:

Guidelines for SMACNA seismic restraints for conduit, piping and ductwork are to serve as the basis for restraint methods. (Exception - no cabling shall be used in the restraint systems except as noted.)

3.2 SEISMIC RESTRAINT-PIPING AND CONDUIT:

A. General: All piping and conduit shall be protected in all planes by restraints, designed to accommodate thermal movement while at the same time restraining seismic motion. Tanks and vessels connected to piping shall be restrained in the same manner as the piping.

B. Locations of the restraints shall include, but not be limited to:

1. At all drops or risers to equipment connections.
2. At all changes in direction of piping and conduit.
3. At all horizontal runs of pipe and conduit to keep it in alignment and prevent sagging with restraints not to exceed the following:

Transverse bracing at 40'-0" O.C. maximum.
Longitudinal bracing at 80'-0" O.C. maximum.

4. Provide flexibility in joints where pipes pass through building seismic or expansion joints.
5. On both sides of flexible connectors.

C. Exceptions:

1. Conduit under 2-1/2" size and piping under 1-1/2" size need not be additionally seismically restrained except as follows:
 - a. Brace all piping and conduit 1-1/4" and larger in boiler rooms, mechanical rooms, electrical equipment rooms and refrigeration machinery rooms.
 - b. Brace all fuel gas and oil piping, medical gas piping and compressed air piping 1" and larger.
2. Seismic bracing may be omitted:
 - a. When the top of the pipe is suspended 12" or less from the supporting structure member and the pipe or conduit is suspended by an individual hanger.
 - b. On all piping 3/4" and smaller.

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- 3.3 SEISMIC RESTRAINT INSULATED PIPING: Where piping is designated to be insulated, the points of support shall be protected by a 360° sheet metal shield. Insert insulation shall be of the same thickness as the adjoining pipe insulation. (Pipe Shields, Inc.)

The sheet metal shield wrapped around the insert shall be of the following lengths and gauge thickness.

PIPE SIZE	SHIELD LENGTH	MINIMUM GAUGE
1/2 - 1-1/2"	4"	20
2 - 6"	6"	20
8 - 10"	9"	16
12 - 18"	12"	16
20 and up	18"	16

- 3.4 SEISMIC RESTRAINT GROOVED PIPING:

- A. Where grooved piping is selected as the piping system, it must be seismically restrained as well as provide for thermal movement.
- B. Pipes may not be fastened to differently moving structures such as a wall or a ceiling, or a ceiling and a floor. The intent is to have the piping system move with the structure and not separate from it.
- C. In general, grooved piping shall be provided with additional flexible couplings to allow extreme deflections to occur, yet restrained to prevent movement beyond the limits of the flexible connections. Linear movement shall be incorporated as a part of the flexible connections or in a swing joint arrangement.
- D. Groove piping systems shall be separated, analyzed and submitted from threaded or welded piping systems.

- 3.5 VIBRATION ISOLATION - DUCTWORK AND PIPING:

- A. Furnish and install devices to isolate all piping from other moving equipment. Provide flex connections, spring hangers, grooved joint couplings for pipe, etc., as required.

END OF SECTION 15240

SECTION 15250 - MECHANICAL INSULATION

PART I - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections apply to work of this section.
- B. Division-15, Section 15000 - General Mechanical Requirements applies to work of this section.

1.2 SUMMARY:

- A. Extent of mechanical insulation required by this section is indicated on drawings and schedules as required by the current Model Energy Code, and by requirements of this section. Use no asbestos in this work. Include restorations of insulations of damaged work including repair of damaged existing insulation due to new work.
- B. Types of mechanical insulation specified in this section include the following:
 - 1. Piping Systems Insulation:
 - a. Fiberglass.
- C. Refer to Division-15 section "Mechanical Supporting Devices" for protection saddles, protection shields, and thermal hanger shields.
- D. Refer to Division-15 section "System Identification" for installation of identification devices for piping, ductwork, and equipment.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. **Installer's Qualifications:** Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- C. **Flame/Smoke Ratings:** Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.4 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. **Maintenance Data:** Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

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1.5 DELIVERY, STORAGE AND HANDLING:

- A. Deliver insulation, coverings, cements, adhesives and coatings to site in containers with manufacturer's stamp or label affixed showing fire hazard ratings of products.
- B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART II - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide mechanical insulation materials of one of the following (except as noted):
 - 1. Armstrong World Industries, Inc.
 - 2. Babcock and Wilcox Co., Insulating Products Div.
 - 3. CertainTeed Corp.
 - 4. Knauf Fiber Glass GmbH.
 - 5. Manville Products Corp.
 - 6. Owens-Corning Fiberglass Corp.
 - 7. Pittsburgh Corning Corp.

2.2 PIPING INSULATION MATERIALS:

- A. Preformed Fiberglass Piping Insulation: ASTM C 547. Class 1 for use to 450°F (230°C); Class 2 for use to 650°F (345°C); Class 3 for use to 1200°F (650°C).
- B. Jackets for Piping Insulation: All purpose (ASJ) fire retardant jacket, ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.
- C. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
- D. Encase exterior fittings and insulation with aluminum jacket with weather-proof construction.
- E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
- G. Insulation Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
- H. Thermal Hanger Shields: constructed of 360 degrees insert of high density, 100 psi, water-proofed calcium silicate, encased in 360 degrees sheet metal shield. Provide assembly of same thickness as adjoining insulation.
 - 1. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:

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- a. Elcen Metal Products Co.
- b. Pipe Shields, Inc.

2.3 PIPING SEALANT THROUGH WALLS:

- A. Sealant shall be a two-part foamed silicone elastomer equal to Dow Corning 3-6548 Silicone RTV foam or equivalent by 3M or "Spec Seal" by STI. Sealant shall be applied at any piping of pipe or duct penetration through fire or smoke walls to prevent air from passing through the opening.
- B. Sealant cell structure, foamed in place, shall be U.L. classified and shall meet the smoke development and fuel contribution ratings specified. Sealant shall be stable at extreme temperatures, and shall effectively confine such hazards as fire, smoke and gases.
- C. Sealant required at any fire/smoke wall penetration to be according to approved detail for each specific wall assembly. Contractor shall submit detail for engineer approval.

PART III - EXECUTION

3.1 GENERAL:

- A. Piping insulation shall be fiberglass one-piece preformed pipe insulation, class related to temperature, with all purpose (ASJ) fire retardant jacket, additional jacketing as noted.
- B. Fittings and valves shall be insulated and covered with preferred Zeston (PVC) covers.
- C. Fire and smoke hazard for a complete insulation system shall not exceed:
 - 1. Flame spread - 25
 - 2. Fuel contribution - 50
 - 3. Smoke development - 50
- D. Hangers shall not contact pipe where pipe is specified to be insulated. Insulation shall run continuous through the pipe hanger.

3.2 INSPECTION:

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.3 HVAC PIPING SYSTEM INSULATION:

- A. Insulation Omitted: Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on heating piping beyond control valve, located within heated space; on condensate piping between steam trap and union; and on unions, flanges, strainers, flexible connections, and expansion joints.
- B. Hot Pressure Piping (to 250°F):
 - 1. Application Requirements: Insulate the following hot low pressure HVAC piping systems (steam piping up to 100 psi, water piping up to 200 degrees F).

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- a. HVAC hot water supply and return piping, valves and fittings.
2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 1" thick for pipe sizes up to and including 1", 1-1/2" thick for pipe sizes 1-1/4" through 4", 2" thick for pipe sizes over 5".

3.4 INSTALLATION OF PIPING INSULATION:

- A. General: Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets on all pipe insulation, and protect to prevent puncture or other damage.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Provide neatly beveled edge at all terminations and interruptions of insulation.
- I. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.
- J. Saddles and Shields:
 1. General: Except as otherwise indicated, provide protection saddles or thermal hanger shields with protection shields under all piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and thermal shields for exact fit to mate with pipe insulation.
 2. Protection Saddles: See section Supports and Anchors for saddle. Fill interior voids with segments of insulation matching adjoining insulation.
 3. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation. Use on pipes 1-1/4" and smaller. Use with thermal hanger shields for pipes 1-1/2" and larger.

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4. Thermal Hanger Shields: High density calcium silicate encased in 360 degrees sheet metal shield. Provide assembly of same thickness as adjoining insulation. Use on pipes 1-1/2" to 8".

3.5 PROTECTION AND REPLACEMENT:

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during construction period to avoid damage and deterioration.

END OF SECTION 15250

SECTION 15515 - HYDRONIC PIPING AND SPECIALTIES

PART I - GENERAL

1.1 RELATED DOCUMENTS:

- A. All pertinent sections of Division - 15 "General Mechanical Requirements" are a part of the work described in this section.
- B. All pertinent sections of Division - 15 "General Pipes and Fittings" are a part of the work described in this section.
- C. Other Specification sections related to Insulation, System Commissioning, Testing and Balancing.

1.2 SUMMARY: Work shown on the drawings and required by these specifications including incidental work classified as "best practices of the trade".

- A. Heating water systems.
- B. Other work as indicated.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in the manufacture of hydronic piping products and equipment of types, materials and sizes required, whose products have been in service for not less than 5 years.
- B. **Installer's Qualifications:**
 - 1. Firm with at least 3 years history of successful experience on projects of similar nature.
 - 2. Licensed as a firm in the Contractor state of origin and in the State of Utah.
 - 3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.
 - 4. All workmen employed on the project shall carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

1.4 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's technical literature indicating source, brand, type, model, performance characteristics, installation instructions, etc.
- B. **Record Drawings:** See Division - 15.
- C. **Operation And Maintenance Information:** Provide information for all equipment including a comprehensive system operating description. See Section 15195.
- D. **Instruction Of Owner's Personnel:** Participate in specified instruction. See Division - 15.
 - 1. As part of the overall project warranty, furnish individual manufacturer warranties for each piece of equipment for a period of not less than one year from date of Owner's beneficial use (substantial completion).

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2. Warrant the overall assembly of equipment, materials and labor comprising these systems.

1.5 REFERENCES:

- A. Standards: Comply with applicable sections, follow recommended practices.
 1. State Boiler and Pressure Vessel Regulations
 2. ASME Codes for Boilers and Pressure Vessels
 3. State and Local Plumbing and Mechanical Codes
 4. International Building Code/International Mechanical Code
 5. ASHRAE Handbooks

PART II - MATERIALS AND METHODS - HEATING WATER

2.1 PIPING AND FITTINGS (MATCH EXISTING):

- A. Schedule 40 black steel, A-53 with malleable steel threaded fittings up to 2" size and forged steel welding fittings 2-1/2" and larger. Contractor option to use a grooved joint system accommodating for additional support and insulation work.

Rigid type "K" or "L" copper, bronze or dielectric interface.
- B. Drains And Overflow: Install piping of any size from drains and overflows using standard weight galvanized steel piping with standard weight galvanized malleable fittings free from fins and burrs, with standard pipe threads. Drains and over flows shall be terminated over floor drains or drain funnels adjacent to equipment. Furnish drains from all pump bases to floor drains.

2.2 GENERAL SERVICE VALVES: Comply with Section "Valves".

- A. General: Provide valves complying with Division-15 General Mechanical Materials and Methods section "Valves", in accordance with the following listing.
 1. Sectional Valves:
 - a. 3" and Smaller: Ball valves.
 - b. 4" and Larger: Butterfly valves.
 2. Shutoff Valves:
 - a. 3" and Smaller: Ball valves.
 - b. 4" and Larger: Butterfly valves.
 3. Drain Valves:
 - a. 3" and Smaller: Ball valves.

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- 4. Check Valves:
 - a. All Sizes: Swing check valves where space permits, else use wafer type.
- 2.3 MISCELLANEOUS VALVES AND SPECIALTIES: See Section "Valves".
- 2.4 CIRCUIT BALANCE VALVES:
 - A. Circuit balance valve for flow balance complying with Section "Valves".
- 2.5 STRAINERS:
 - A. General: Y pattern, self cleaning, line size.
 - B. Acceptable Manufacturers: Subject to compliance with requirements, provide strainers of one of the following:
 - 1. Armstrong
 - 2. Watts
 - 3. Victaulic
 - 4. Mueller
 - 5. Spirex Sarco
 - 6. Metraflex
 - C. 2" and Smaller: Watts No. 77S or equal in Armstrong, 250 lb. iron body, threaded, Y-pattern, 20-mesh stainless steel screen, full size drain connection with ball valve.
 - D. 2-1/2" and Larger: Watts No. 77F-125 or equal in Armstrong, 125 lb. iron body, flanged, Y-pattern, stainless steel screen, drain connection with ball valve.
- 2.6 BALANCING COCKS:
 - A. 2" and Smaller: 175 psig WOG, cast iron body, square head, screwed ends, wrench operated, lubricated.
 - B. 2-1/2" and Larger: 200 psig WOG, cast iron body, square head, flanged ends, wrench operated, lubricated.

PART III - EXECUTION

- 3.1 INSPECTION:
 - A. General: Examine areas and conditions under which hydronic piping systems materials and products are to be installed.
- 3.2 GENERAL SYSTEM INSTALLATION:
 - A. Arrange system in a neat, orderly and functional manner. Maintain access around all equipment. Provide sleeves for all structural penetrations.
 - B. Plan ahead for seismic restraint and vibration isolation.
 - C. Verify adequate ventilation for heat producing equipment, watch out for possible freezing conditions.

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- D. Air Vents and Line Drains: Provide air vents at all high points of piping systems with vent line extended to valve installed in accessible location 5'-0" above the floor, vent line extended to drain. Provide drain valves at all equipment and at low points in the system, extend drain lines to drain funnel or floor sink.
- E. Provide pressure gauges and thermometers and pressure/temperature plugs as indicated on the flow diagrams, piping plans and equipment details.

3.3 INSTALLATION OF HYDRONIC PIPING:

- A. General: Install hydronic piping in accordance with Division-15 "General Pipes and Fittings."
- B. Install eccentric reducers where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush.
- C. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

3.4 INSTALLATION OF PIPING SPECIALTIES:

- A. Install piping specialties in accordance with Division-15 "Hydronic Piping and Specialties."

3.5 INSTALLATION OF SUPPORTS AND ANCHORS:

- A. Install supports and anchors in accordance with Division-15 "Mechanical Supporting Devices."

3.6 INSTALLATION OF VALVES:

- A. Install valves in accordance with Division-15 "Valves."
- B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves 2 or more hydronic terminals or equipment connections, and elsewhere as indicated.
- C. Shutoff Valves: Install on inlet and outlet of each mechanical equipment item, and on inlet of each hydronic terminal, and elsewhere as indicated.
- D. Drain Valves: Install on each mechanical equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain hydronic piping system.

3.7 EQUIPMENT CONNECTIONS:

- A. General: Connect hydronic piping systems to mechanical equipment as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union on supply and return, drain valve on drain connection.
- B. Hydronic Terminals: Install hydronic terminals with hydronic terminal shut-off valve and union on outlet; union, shutoff valve on inlet. Install manual air vent valve on element in accordance with manufacturer's instructions. Locate valves and balancing valves behind

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valve access doors for ease of maintenance. Where indicated, install automatic temperature control valve with unions on supply line.

3.8 INSTALLATION OF HYDRONIC SPECIALTIES:

- A. Balance Valves: At locations shown on drawings.
- B. Vent Valves:
 - 1. Manual Vent Valves: Install manual vent valves on each hydronic terminal at highest point, and on each hydronic piping drop in direction of flow for mains, branches, and runouts, and elsewhere as indicated.
 - 2. Automatic Vent Valves: Install automatic vent valves at top of each hydronic riser and elsewhere as indicated. Install shutoff valve between riser and vent valve, pipe outlet to suitable plumbing drain, or as indicated.

3.9 TESTS:

- A. Isolate sections of piping and equipment and pressure test to 175 psi or 1-1/2 times the maximum potential pressure of the system, but not to exceed the test pressure rating of a system component.

Conduct an air pressure test, using a soap solution to check for leaks. Establish the pressure, close off the pressure source and let stand for 24 hours. Given constant temperature, there should be no drop in pressure.

After the air test, fill the system with water, raise to test pressure and inspect for leaks. Repair all leaks. Repeat tests. Report and certify all tests.

- B. Test other system components as needed to verify proper assembly and installation.
- C. Participate in overall system test and balance work.

END OF SECTION 15515

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SECTION 15555 - BOILERS

PART I GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including general and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. All pertinent sections of Section 15000 - General Mechanical Requirements are a part of the work described in this section.
- C. Related Sections:
 - 1. Refer to other sections of Division 15 for piping, specialties, valves, field-installed automatic temperature controls, and field applied insulation.

1.2 SUMMARY:

- A. Includes But Not Limited To:
 - 1. Furnish and install the following boilers as described in the Contract Documents.
 - a. Packaged natural gas-fired heating water boiler of the size and capacity specified.

1.3 SYSTEM DESCRIPTION:

- A. Heating Water Boiler.
- B. Boiler shall be constructed, assembled, and delivered as a completely packaged unit.

1.4 QUALITY ASSURANCE:

- A. Codes and Standards:
 - 1. Boiler shall be UL listed and have IBR approved ratings.
 - 2. Bearing ASME stamp for 150 psi working pressure.
 - 3. UL listed and so labeled burner and controls.
 - 4. Local Boiler Code

1.5 SUBMITTALS:

- A. Submit shop drawings and product data.
- B. Include boiler and burner manufacturer installation instructions.
- C. Submit boiler and burner manufacturer descriptive literature, operating instructions, and maintenance instructions

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- 1.6 **WARRANTY:** The pressure vessel of boiler shall carry an unconditional, non-prorated 7 year warranty against leakage due to defective materials or workmanship. The heat exchanger tubes/combustion chamber assembly shall be warranted against failure due to thermal stress failure or condensate corrosion for a prorated five year period. A Warranty Certificate must be issued to the Owner from the manufacturer and a copy of warranty be submitted for engineer's approval. Warranty shall include both materials and labor, and incidental costs related to any repair.
- 1.7 **FIELD SERVICES:** Contractor shall provide the services of a local factory authorized representative to supervise all phases of equipment start-up. A letter of compliance with all factory recommendations and installation instructions shall be submitted to the engineer with operation and maintenance instructions.

PART II PRODUCTS

2.1 MANUFACTURED UNITS: (AERCO Benchmark)

- A. **Heating Water Boiler:** Capacity and quantity as scheduled on the drawings. Boiler shall be UL Listed, FM/CSD-1 approved and ASME coded and stamped. The boiler control panel shall be of a modular component design with the boiler flame safeguard control, temperature controller and enunciator board field replaceable. The boiler shall be provided with a ASME approved relief valve.
1. **Construction:** The boiler shall be natural gas fired, condensing fire tube design with a modulating forced draft power burner and positive pressure vent discharge. The boiler burner shall be capable of a 20 to 1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves. The boiler shall be capable of handling return water temperatures down to 40°F without any concern of thermal shock or fireside condensation. The boiler shall have a maximum total water volume of 27 gallons. The boiler water pressure drop shall not exceed 1.7 psig at 170 gpm. The boiler water connections shall be 4" flanged 150 lb. ANSI rated. The boiler shall be designed so that the thermal efficiency increases as the firing rate decreases.
 2. **Heat Exchanger:** The heat exchanger shall be constructed of 316L stainless steel with a one-pass combustion gas flow design. The 316L fire tube wall thickness shall be no less than 0.65" wall thickness. The heat exchanger shall be ASME stamped for a working pressure not less than 150 psig. The exhaust manifold shall be of corrosion resistant porcelainized cast iron with a 8" diameter flue connection. The exhaust manifold shall have a gravity drain for the elimination of the condensation with collecting reservoir.
 3. **Flame Monitoring System:** The flame monitoring system shall incorporate a U/L recognized combustion safeguard system utilizing spark ignition and a rectification type flame sensor. An elector-hydraulic double seated safety shutoff valve with proof of closure switch shall be an inherent part of the gas train.
 4. **Safeties:** The boiler shall incorporate a electric type low water level cutoff with test and manual reset and dual over-temperature protection with manual reset and dual over-temperature protection with manual reset in accordance with ASME section IV and CSD-1. Remote fault alarm contacts, sensor failure detection and boiler status and failure detection and boiler status and failure enunciator shall be standard equipment. Module shall operate on 220v/1/60hz.

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5. Mode of Operation: Boiler shall include integral factory wired operating controls to control all operation and energy input of the boiler. The controller shall have the ability to vary boiler input throughout its full range to maximize the condensing capability of the boiler without header temperature swings.

The boiler will operate to maintain header discharge temperature at 180°F by varying firing rate based on heating water return temperature. Unit shall operate with an Inverse Efficiency Curve, with know Part Load Value Efficiencies. Maximum efficiency shall be achieved at minimum firing input. Main Header outlet temperature shall not be more than +/- 2F from setpoint at any point of operation. The boiler shall have LCD display for monitoring of all sensors and interlocks.

- B. Approved Manufacturer:
1. AERCO. No Substitutions

PART III - EXECUTION

3.1 INSTALLATION OF BOILER:

- A. General: Install boiler(s) in accordance with manufacturer's installation instructions, in accordance with State and local code requirements, and in accordance with requirements of local Utility Company. Install the unit(s) plumb and level on the existing housekeeping pad. Maintain manufacturer's recommended and code required clearances around and over the boiler(s).

Contractor shall provide inspection certificates of operation for new boilers from the Industrial Commission of Utah prior to project closeout.

Make any needed corrections regarding clearance, piping or vents, drains, power and control set up, etc.

- B. Erection: Assemble heater trim shipped loose, or unassembled for shipment purposes. Follow manufacturer's installation instructions.
- C. Electrical Work: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Contractor.
1. Verify that electrical work installation is in accordance with manufacturer's submittal. Do not proceed with equipment start-up until electrical work is acceptable.
- D. Boiler Trim: Install boiler trim and devices furnished with boiler but not factory-installed.
- E. Gas Piping: Refer to Division - 15 "Natural Gas Piping." Reconnect existing gas piping to new boilers providing required pressure regulators, unions and reducers to mate new valve train to existing piping.

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- F. Hot Water Piping: Refer to Division -15 "Hydronic Piping and Specialties." Connect supply and return boiler tapings as indicated, with shutoff valve and union or flange at each connection.
- G. Pipe Condensate: To floor drain, use stainless steel pipe and fittings for boiler condensate drain piping.
- H. Breeching: Connect breeching to boiler outlets, full size of outlet. Route as directed. Install complete. Slope horizontal runs in direction of flue gas flow. Capture condensate at point of vertical rise, pipe to floor drain. Provide inspection ports at base of rise, and at beginning ends of horizontal runs. Refer to Division -15 "Ductwork."

3.2 FIELD QUALITY CONTROL:

- A. Flush and clean boilers upon completion of installation, in accordance with manufacturer's start-up instructions.
- B. Start-up boilers, in accordance with manufacturer's start-up instructions, and in presence of boiler manufacturer's representative. Test controls and demonstrate compliance with requirements. Adjust burner for maximum burning efficiency. Replace damaged or malfunctioning controls and equipment. Refer to Division - 15 "System Commissioning, Testing and Balancing" for required participation with Test and Balance Contractor.

3.3 CLOSEOUT PROCEDURES:

- A. Participate in instruction of owner's personnel.

END OF SECTION 15555

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SECTION 15576 - APPLIANCE FLUES AND VENTS

PART I - 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 work of this section.
- B. All pertinent sections of Section 15000 - General Mechanical Requirements are a part of the work described in this section.
- C. Division 15 - Basic Materials and Methods sections apply to work of this section.

1.2 SUMMARY:

- A. Includes but not limited to.
 - 1. Furnish and install flues as described in the Contract Documents.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of Flues with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - 1. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects with flues and related systems.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING:

- A. Store flue piping and fittings in clean dry place. Protect from weather, dirt, fumes, water, and construction debris, and physical damage.

PART II - PRODUCTS

2.1 FLUES:

- A. Flues (AL29-4C)
 - 1. Sections shall be UL 1738 listed.
 - 2. Sections shall have:
 - a. Inner conduit constructed of AL29-4C superferritic stainless steel with a minimum thickness dictated by UL 1738. Closure systems shall be integral ring and tab (or equal) type. Joints shall be sealed with factory supplied sealant.
 - b. Outer casing shall be constructed of 430 stainless steel.
 - c. Insulating air space.
 - d. Capability of handling flue gas temperatures up to 550 deg F on continuous basis.

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3. Furnish and install items which form part of assembly including but not limited to:
 - a. Bracing and supports as recommended by Flue Manufacturer.
 - b. Necessary straight sections, necessary expansion joints.
 - c. Ventilated roof thimble.
 - d. Flashing and counter flashing.

4. Manufacturers:
 - a. United McGill
 - b. Ampco
 - c. Heat Fab

2.2 ACCESSORIES:

- A. Vent Caps
 1. Non-backdraft type
 2. Manufacturers:
 - a. Ameri-cap
 - b. Breidert
 - c. Triangle AFL
 - d. Dura - Vent

PART III - EXECUTION

3.1 INSTALLATION:

- A. Height of flue above roof shall be as required by local code.
- B. Every portion of flue connector shall have rise of one inch per ft minimum from appliance to vertical flue.
- C. Length of horizontal flues or flue connectors shall not be longer than 75 percent of height of vertical flue between point at which horizontal flue enters vertical flue to top of vertical flue. In no case shall horizontal run exceed 15 feet.
- D. Every gas appliance shall have a vent cap 'backdraft preventer' installed at the top of the flue.
- E. Paint portions of the flue which extend above the roof with a high heat flat black paint.

END OF SECTION 15576

SECTION 15955 - MECHANICAL CONTROL SYSTEMS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-15 General Mechanical Requirements sections apply to work of this section.

1.2 SUMMARY:

- A. Extent of control systems work required by this section is indicated on drawings and schedules, and by requirements of this section.
 - 1. See following sections for types of Control Systems included as a part of this section.
 - a. Section 15965 – Electrical Control Systems
 - b. Section 15970 – Direct Digital Control Systems (DDC)
 - 2. Control sequences are specified in this section under: "Sequence of Operation".
- B. Refer to other Division-15 sections for installation of instrument wells, valve bodies and dampers in mechanical systems.
- C. Refer to Division-16 sections for the following work.
 - 1. Power supply wiring from power source to power connection on controls and/or unit control panels. Includes starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
 - 2. Interlock wiring between electrically-operated equipment units; and between equipment and field-installed control devices.
 - a. Interlock wiring specified as factory-installed is work of this section.
- D. Provide the following electrical work as work of this section, complying with requirements of Division-16 sections:
 - 1. Control wiring between field-installed equipment, controls, indicating devices, and unit control panels. Control wiring in exposed spaces shall be run in conduit. Control wiring in crawl spaces and above lay-in ceilings may be plenum rated and run without conduit.
 - 2. 120 volt service required by control systems.
- E. Participate in "System Commissioning, Testing and Balancing".

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of electric control equipment, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firms and workmen specializing and experienced in electric control system installations for not less than 5 years.

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1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, and including installation instructions and start-up instructions.
- B. Shop Drawings: Submit shop drawings for each modified control system, containing the following information:
 - 1. Schematic flow diagram of system showing newly installed components as they relate to existing control devices.
 - 2. Label each control device with setting or adjustable range of control.
 - 3. Indicate all required electrical wiring from existing control points to newly installed equipment. Clearly differentiate between portions of work that are factory-installed and portions to be field-installed. Note contract responsibility to provide complete system regardless of delegation. Completely interface with and show existing installation in the existing building.
 - 4. Include verbal written description of sequence of operation. Confirm correct function of proposed sequences.
- C. Maintenance Data: Submit maintenance instructions and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Section 15995.

1.5 REFERENCES:

- A. Codes and Standards:
 - 1. Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA standards.
 - 2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.
 - 3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.
 - 4. Comply with NEPA 70, "National Electric Code" for all electrical installation.

1.6 DELIVERY, STORAGE, AND HANDLING: Provide factory shipping cartons for each piece of equipment, and control device. Maintain cartons through shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

1.7 WARRANTIES:

- A. As part of the overall project warranty, furnish individual manufacturer warranties for each piece of equipment for a period of not less than one year from date of Owner's beneficial use (substantial completion). Though some systems will be activated and functioning, warranty does not go into effect until final completion of the building and acceptance by the Owner.
- B. Warrant the overall assembly of equipment, materials and labor comprising these systems.

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1.8 **CLEANING AND LUBRICATION:** All instruments and control panels shall be thoroughly cleaned before final acceptance. Provide lubrication for all furnished equipment.

1.9 **TESTING AND ADJUSTING OF SYSTEM:**

- A. During the system commissioning, testing and balancing of the various building systems, have a controls representative(s) present and available to interpret and adjust controls as needed. Demonstrate and report the integrity and accuracy of each function and control point.
- B. At the termination of the testing period, the Controls representative shall spend a minimum of 4 hours instructing the Owner's operating personnel in the control system operation, and checking each system for day-night and manual override with the Owner's operating personnel on each system. A complete operating booklet shall be provided and used during the training period. Schedule this training with the Owner and Mechanical Contractor.
 - 1. Since system performance is partly a function of climatic conditions, the Controls contractor shall be available during the changing seasons of the warranty period to make further adjustments and modifications if required. A final complete check of all systems shall be made at the conclusion of the one year warranty period.

PART II - PRODUCTS

2.1 **CONTROL CABINETS:** Utilize existing adding new components as required.

2.2 **CONTROL VALVES:**

- A. Furnish automatic control valves required by the project. Design valves to pass the quantities of fluid at the pressure drop scheduled on the drawings.
- B. Mount all control valves with stems in the up-vertical position. Valves shall have stainless steel trim and renewable seats.
- C. Furnish valve operators with adequate capacity to operate the valve smoothly through the operating range. Provide oversized motors or operators as needed. Voltage ranges shall be adjustable, the equivalent of pilot positioning for electric functions.

PART III - CONTROL SEQUENCES

3.1 **GENERAL:**

- A. Review the operation of the existing control systems and modify the indicated control systems as required to implement the new control sequences.
- B. Modify the existing control panel located in the boiler room and at each required VAV Box as indicated on the drawings with terminal block connections for interface of the new boilers, and three way control valves.

3.2 **BUILDING HEAT CONTROL:**

- A. New Boilers: Two new boilers B-1 & B-2 are being installed as part of this project. The boilers shall be enabled by the existing DDC control system. Upon a call for heat the boiler isolation valve associated with boiler B-1 shall open and, safeties proven, the boiler shall fire to maintain the heating water temperature at 180° F (adjustable based on outside air). The boiler shall continue to fire as required to maintain heating water setpoint until disabled by the

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DDC system based on demand. In the event of a boiler failure an alarm shall be sent to the DDC system and the secondary boiler shall fire to maintain the heating water temperature, safeties proven.

1. Boiler Lead/Lag: The boilers shall be programmed to swap lead/lag position every 2 weeks in an effort to equalize run time during the heating season.
2. Peak Demand Firing: It is intended that the boilers installed on the project operate on a lead/lag basis with only one boiler firing at any given time. However the DDC system shall monitor the heating water supply temperature of the primary boiler and in the event that the primary boiler cannot maintain a minimum heating water supply temperature of 170° F while the outside air temperature is below 25° F (adjustable) the secondary boiler shall be enabled, the isolation valve shall open and the primary and secondary boilers shall fire together to maintain a 180° F supply water temperature. Note that peak demand firing shall only be authorized when the outside air temperature is below 25° F, once the outside air temperature rises above 25° F peak demand firing is disabled and the secondary boiler shall be lock out by the DDC system except when a primary boiler failure is detected.
3. HEATING WATER TEMPERATURE RESET: The heating water temperature shall be reset based on outside air temperature as follows:
 - a. 180 degrees F for outside air temperatures below 55 degrees F (adjustable).
 - b. 120 degrees F for outside air temperatures above 55 degrees F (adjustable).

B. Existing Heating Water Pumps: The building contains two existing heating water pumps which are enabled by the DDC system and controlled utilizing a differential pressure transducer and VFD. The differential pressure transducer control signal is being abandoned and the VFD's shall be programmed to run at 60Hz. continuously. The pumps shall continue to be enabled by the DDC system based on existing time schedules and programming. The controls contractor shall provide time to review the existing control sequence with the engineer and modify the existing programming to implement indicated changes.

C. Existing Air Handler Control Sequences: The building contains three existing air handlers, one constant volume and two VAV type. The control sequences for the air handlers shall remain as programmed with the exception of the heating water coil control sequences which shall be modified as follows: The heating coils shall be enabled by existing control points in the DDC system, upon a call for heating the 3 way control valve shall modulate and deliver heating water to the coil in a quantity sufficient to provide the discharge air temperatures indicated on the drawings. The heating coil circulation pump associated with each coil shall be energized only after the control valve reaches 30% open. The heating coil control valve shall continue to operate until the heating function is disabled by the DDC system as presently programmed. The controls contractor shall provide time to review the existing control sequence with the engineer and modify the existing programming to implement indicated changes.

3.3 EMERGENCY SWITCH CONTROL:

- A. Reconnect boiler scram switches to new boilers if equipped.

3.4 CHILLED AND HEATING WATER SYSTEM PRESSURE:

- A. The chilled and heating water systems are being equipped with pressure monitors. The contractor shall establish a baseline pressure of 20 psig for the heating water and 25 psig for the chilled water system. The pressure transducers shall be set to send a high pressure alarm to the DDC system if the pressure in either system exceeds 10 psig (adjustable) over the baseline pressure. The pressure transducers shall also be set to send a low pressure alarm to

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the DDC system if the pressure in either system drops 10 psig (adjustable) under the baseline pressure.

END OF SECTION 15955

SECTION 15965 - ELECTRICAL CONTROL SYSTEMS

PART I - GENERAL

- 1.1 RELATED DOCUMENTS: See Division 15 – “Mechanical Control Systems”.
- 1.2 SUMMARY:
 - A. Electric control functions and systems indicated on the drawings and specified herein.
 - B. Complete interrelationships with automation systems and mechanical equipment.
- 1.3 QUALITY ASSURANCE: See Division 15 – “Mechanical Control Systems”.
- 1.4 SUBMITTALS: Division 15 – “Mechanical Control Systems”.
- 1.5 DELIVERY, STORAGE AND HANDLING: Division 15 – “Mechanical Control Systems”.
- 1.6 INSTRUCTION OF OWNER'S PERSONNEL: Division 15 – “Mechanical Control Systems”.

PART II – MATERIALS AND METHODS

- 2.1 ELECTRICAL POWER SUPPLY:
 - A. Obtain power from existing Division 16 panel. Furnish appropriate circuit breakers and extend conduit and wiring assigned to this division.
 - B. Make all electrical installations in conformance with the National Electrical Code (current edition) and in accordance with Division 16.
 - C. Use same product lines for similar devices as used by Division 16000 to result in a coherent project.
 - D. Control Wiring
 - 1. In all building areas, i.e. electrical rooms, mechanical rooms, boiler rooms, above ceilings, within walls, etc., all control wiring will be installed in conduit per National Electrical Code. Installation will be square with the walls of the building.
 - 2. Number and code all wiring.
 - E. Use no wire smaller than 18 gauge, no conduit smaller than ¾”.
- 2.4 AUXILIARY RELAYS:
 - A. Light Duty – as required.
 - B. Heavy Duty – Square D, Class 8501, Type X.

PART III - INSTALLATION

- 3.1 CLEANING AND LUBRICATION: Division 15 – “Mechanical Control Systems”.
- 3.2 TESTING AND ADJUSTING OF SYSTEM: Division 15 – “Mechanical Control Systems”.

END OF SECTION 15955

SECTION 15970 – DDC CONTROL SYSTEMS

PART I - GENERAL

1.1 DESCRIPTION OF WORK

- A. The building contains an existing Johnson Controls Metasys N2 building management system. The contractor shall review the existing system ensuring that the software is the latest version that the hardware is capable of running and that all system patches have been installed.
- B. The DDC Controls Contractor shall provide all materials and perform all labor required to upgrade the programming on the existing DDC system as required to implement the control changes indicated on the contract drawings.

1.2 RELATED SECTIONS:

- A. Drawings and general provisions of the Contract, including General and supplementary Conditions and Division-1 specification sections, apply to work of this section.
- B. Products furnished but not installed under this section:
 - 1. Valves, flow switches, pressure sensors, thermowells and pressure taps to be installed under section 15000.
- C. Coordination with electrical:
 - 1. Installation of all line voltage power wiring by Division 16.
 - 2. Modification of existing VFD's to constant hertz operation.

1.3 QUALITY ASSURANCE

- A. The DDC contractor performing this work shall be a certified Johnson Controls technician with a minimum of 5 years experience.
- B. At the time of bid, any and all DDC System Application Specific Controllers and Programmable Equipment Controllers added to the system shall be listed as follows:
 - 1. Underwriters Laboratory, UL 916
 - 2. FCC Regulation, Part 15, Class B

1.4 SUBMITTALS

- A. Submit 6 complete sets of documentation in the following phased delivery schedule:
 - 1. Valve schedules
 - 2. Equipment data cut sheets for any equipment being added to the system.
 - 3. System schematics for added or modified equipment, including:
 - a. sequence of operations
 - b. point names
 - c. point addresses
 - d. point to point wiring
 - e. interface wiring diagrams
 - f. panel layouts

- B. Upon project completion, submit operation and maintenance manuals, consisting of the following for new equipment installed or modified on the system:
1. Index sheet, listing contents in alphabetical order
 2. Manufacturer's equipment parts list of all functional components of the system, disk of system schematics, including wiring diagrams
 3. Description of sequence of operations
 4. As-Built interconnection wiring diagrams
 5. User's documentation containing product, system architectural and programming information.
 6. Trunk cable schematic showing remote electronic panel locations, and all trunk data
 7. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
 8. Conduit routing diagrams
 9. Copy of the warranty/guarantee
 10. Operating and maintenance cautions and instructions
 11. Recommended spare parts list

PART II - PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS (Utilize existing Johnson Controls System providing new components as required.)
- 2.2 NETWORK AREA CONTROLLER (Minimum requirements for any and all NAC's added to the system.)
- A. The Network Area Controller (NAC) shall provide the interface between the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
1. Calendar functions
 2. Scheduling
 3. Trending
 4. Alarm monitoring and routing
 5. Time synchronization
 6. Integration of LonWorks controller data
 7. Integration of BACnet and MODBUS networks
- B. The NAC shall provide multiple, concurrent user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
- C. The NAC shall support standard Web browser access via the Intranet/Internet. It shall be capable of supporting multiple users, expandable to fifty.
- D. The NAC shall provide alarm recognition, storage, routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
1. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.

2. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
 3. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 4. Provide timed (schedule) routing of alarms by class, object, group, or node.
 5. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- E. Alarms shall be annunciated in any of the following manners as user defined:
1. Screen message text
 2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
 - a. Day of week
 - b. Time of day
 - c. Recipient
 3. Pagers via paging services that initiate a page on receipt of email message
 4. Graphic with flashing alarm object(s)
 5. Printed message, routed directly to a dedicated alarm printer
 6. Cell phones
- F. The following shall be recorded by the NAC for each alarm (at a minimum):
1. Time and date
 2. Location (building, floor, zone, office number, etc.)
 3. Equipment (air handler #, access way, etc.)
 4. Acknowledge time, date, and user who issued acknowledgement.
- G. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- H. A log of all alarms shall be maintained by the NAC and/or a server and shall be available for review by the user.
- I. Provide a "query" feature to allow review of specific alarms by user defined parameters.
- J. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- K. An Error Log to record system errors shall be provided and available for review by the user.
- L. Data Collection and Storage
1. The NAC shall collect data for any property of any object and store this data for future use.
 2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

- a. Designating the log as interval or deviation.
 - b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
 - c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
 - d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
 - e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
3. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a standard Web Browser.
 4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
 5. All log data shall be available to the user in the following data formats:
 - a. HTML
 - b. XML
 - c. Plain Text
 - d. Comma or tab separated values
 6. The NAC shall have the ability to archive it's log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
 - a. Archive on time of day
 - b. Archive on user-defined number of data stores in the buffer (size)
 - c. Archive when buffer has reached it's user-defined capacity
- M. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached it's user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
1. Time and date
 2. User ID
 3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.
- N. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time of day.
1. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
 2. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

- 2.6 PROGRAMMABLE EQUIPMENT CONTROLLERS (Minimum requirements for any and all PEC's added to the system.)
- A. Programmable Equipment Controllers (PEC's) shall be stand-alone, multi-tasking, real-time digital control processors.
 - B. The PEC's shall communicate via BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2001 or Lonworks FT110.
 - C. The PEC must communicate peer-to-peer with all of the network application specific, programmable controllers and third party LonMark devices.
 - D. The PEC software database must be able to execute all of the specified mechanical system controls functions. The programming software shall be able to bundle software logic to simplify control sequencing. All values, which make up the PID output value, shall be readable and modifiable at a workstation or portable service tool. Each input, output, or calculation result shall be capable of being shared/bound with any controller or interface device on the network.
 - E. Provide programming, engineering, and configuration tools used for the project duly licensed to the owner for owner's use.
 - F. PEC's shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
 - G. A single process shall be able to incorporate measured or calculated data from any and all other PEC's on the network. In addition, a single process shall be able to issue commands to points in any and all other PEC's on the network.
 - H. Each PEC shall support firmware upgrades without the need to replace hardware.
 - I. Each PEC shall continuously perform self-diagnostics, which include communication diagnosis and diagnosis of all components.
 - J. In the event of the loss of normal power, there shall be an orderly shutdown of all PEC's to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
 - 1. Upon restoration of normal power, the PEC shall automatically resume full operation without manual intervention.
 - 2. All PEC's control programming and databases must be stored in Flash memory, therefore eliminating data loss, downtime and re-load time.
 - K. Provide a separate PEC for each AHU or other HVAC system such that the inputs, calculations, and outputs shall reside on a single controller.
- 2.7 APPLICATION SPECIFIC CONTROLLERS (Minimum requirements for any and all ASC's added to the system.)
- A. Each Application Specific Controller (ASC) shall operate as a stand-alone Lon Mark or BacNet controller capable of performing its specified control responsibilities independent of other controllers in the network. Each ASC shall be a minimum 16-BIT microprocessor based, multi-tasking, multi-user, real time digital control processor.

- B. Controllers shall include all inputs and outputs necessary to perform the specified control sequences. Analog and digital outputs shall be industry standard signals such as 0-10V and 3-point floating control allowing for interface to a variety of industry standard modulating actuators. The ASC inputs and outputs shall consist of industry standards types. Inputs shall be electrically isolated from outputs, communications and power.
- C. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the network is not acceptable.
- D. The control program shall reside in the ASC. The application program and the configuration information shall be stored in non-volatile memory with no battery back-up required.
- E. After a power failure the ASC must run the control application using the current setpoints and configuration. Reverting to default or factory setpoints are not acceptable.

2.8 GRAPHICAL USER INTERFACE SOFTWARE (Utilize existing GUI and provide programming time to show any added points.)

2.9 FIELD DEVICES

- A. Provide automatic control valves, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer.
- B. Pressure Transmitters: Differential or Gauge (static) Pressure Transmitters shall be solid state capacitance type. Transmitters shall have an output of 4 to 20 MA DC or 0-5 volts in accordance with ISA Standard 550.1 and shall operate from a power supply of 15 to 35 volts DC. Total affects of hysteresis, linearity and repeatability shall be plus or minus 1.0 percent of full scale or less, and repeatability shall be less than 0.3 percent of full scale. Variations in output signal per input supply voltage shall not exceed 0.02 MA output per 1.0 volt input change. The transmitters shall be totally enclosed, and shall have factory set zero and span adjustments that are accessible without removing the cover. Transmitters shall not be damaged by pressures at five (5) times the full scale pressure and shall be selected for the appropriate pressure range. Provide transmitters with LCD readout.
- C. SWITCHES
 - 1. The DDC System Contractor shall furnish all electric relays and coordinate with the supplier of magnetic starters for auxiliary contact requirements. All electric control devices shall be of a type to meet current, voltage, and switching requirement of their particular application. Relays shall be provided with 24 VAC coils and contacts shall be rated at 10 amps minimum.
 - 2. Flow Switches: Motor status indications, where shown on the plans, shall be provided via flow switches. Flow switches shall be of the paddle type equipped with SPDT contacts to establish proof of flow.

PART III - EXECUTION

3.1 PROJECT MANAGEMENT

- A. Provide a project manager who shall, as a part of his duties, be responsible for the following activities:
 - 1. Coordination between the Controls Contractor and all other trades, Owner, local authorities and the design team.
 - 2. Scheduling of manpower, material delivery, equipment installation and checkout.
 - 3. Maintenance of construction records such as project scheduling and manpower planning and AutoCAD or Visio for project co-ordination and as-built drawings.
 - 4. Coordination/Single point of contact

3.2 INSTALLATION METHODS

- A. Install systems and materials in accordance with manufacturer's instructions, rough-in drawings and equipment details. Install electrical components and use electrical products complying with requirements of applicable Division-16 sections of these specifications.
- B. The term "control wiring" is defined to include providing of wire, conduit, and miscellaneous materials as required for mounting and connecting electric or electronic control devices.
- C. To run BACnet on the ethernet network, the installer is required to run, at minimum, plenum rated CAT 5e cabling for all runs associated with this network.
- D. All exposed wiring, low and line voltage subject to mechanical damage, shall be run in conduit. Line and low voltage wiring shall be run in separate conduits. Concealed but accessible wiring, except in mechanical rooms and areas where other conduit and piping are exposed shall run in UL plenum rated cable as approved by local codes unless expressly restricted by requirements in Division 16 specification.
- E. All Controllers, Relays, Transducers, etc., required for stand-alone control shall be housed in a NEMA 1 enclosure with a lockable door.

3.3 SYSTEM ACCEPTANCE

- A. General: All newly installed or modified components shall be complete and tested for proper operation prior to acceptance testing for the Owner's authorized representative. A letter shall be submitted to the Engineer requesting system acceptance. This letter shall certify all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing will commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative, the system will be accepted. The warranty period will start at this time.
- B. Field Equipment Test Procedures: Newly installed or modified DDC control panels and components shall be demonstrated via a functional end to end test. Such that:

1. All output channels shall be commanded (on/off, stop/start, adjust, etc.) and their operation verified.
 2. All analog input channels shall be verified for proper operation.
 3. All digital input channels shall be verified by changing the state of the field device and observing the appropriate change of displayed value.
 4. If a point should fail testing, perform necessary repair action and retest failed point and all interlocked points.
 5. Automatic control operation shall be verified by introducing an error into the system and observing the proper corrective system response.
 6. Selected time and setpoint schedules shall be verified by changing the schedule and observing the correct response on the controlled outputs.
- C. As-Built Documentation: After a successful acceptance demonstration, the Contractor shall submit as-built drawings of the completed project for final approval. After receiving final approval, supply "6" complete as-built drawing sets, together with AutoCAD or Visio diskettes to the owner.
- D. Operation and Maintenance Manuals: Submit four copies of operation and maintenance manuals. Include the following
1. Manufacturer's catalog data and specifications on sensors, transmitters, controllers, control valves, damper actuators, gauges, indicators, terminals, and any miscellaneous components used in the system.
 2. An operator's manual that will include detailed instructions for all operations of the system.
 3. An operator's reference table listing the addresses of all connected input points and output points. Settings shall be shown where applicable.
 4. A copy of the warranty/guarantee.
 5. Operating and maintenance cautions and instructions.

3.4 TRAINING

- A. Contractor shall provide to the engineer a training class outline prior to any scheduled training.
- B. Factory trained control engineers and technicians shall provide training sessions for the Owner's personnel.
- C. The control contractor shall conduct six (6) four-hour training courses for the designated owners personnel in the maintenance and operation of the control system. One class shall be given before system acceptance and the others monthly into the warranty/guarantee time period.
- D. The course shall include instruction on specific systems and instructions for operating the installed system to include as a minimum:
 1. HVAC system overview

2. Operation of Control System
3. Function of each Component
4. System Operating Procedures
5. Programming Procedures
6. Maintenance Procedures

3.5 WARRANTY/GUARANTEE

- A. The control system shall be warranted/guaranteed to be free from defects in both material and workmanship for a period of one (1) year of normal use and service. This warranty/guarantee shall become effective the date the owner accepts or receives beneficial use of the system.

END OF SECTION 15975

SECTION 15995 - SYSTEM COMMISSIONING, TESTING AND BALANCING

PART I - GENERAL

1.1 GENERAL CONDITIONS:

- A. Work of this section shall be subject to the requirements of the General Conditions of this contract, the General Mechanical Requirements, General Electrical Requirements and other sections where this work shares a responsibility.
- B. System commissioning and startup of the mechanical systems shall be the responsibility of the Mechanical Contractor and his subcontractors with the participation of the Electrical Contractor related to electrical work and the General Contractor related to general construction items.
- C. Testing and Balancing shall be the responsibility of the Mechanical Contractor under the direction of the General Contractor with the full participation of all of the mechanical and electrical trades employed on the project and shall include the participation of an independent testing and balance contractor to coordinate all elements of the work and to perform special technical services outlined herein.

1.2 SYSTEM COMMISSIONING - EXTENT OF WORK:

- A. The work required by this section includes but is not necessarily limited to the following:
 - 1. The pre-startup inspection of all systems and subsequent correction of any incorrect items.
 - 2. The initial first run inspections.
 - 3. System operations inspection.
- B. The intent of this work is to provide for proper installation, startup, service and operation of the mechanical systems in preparation for system balancing.
- C. Repair, replacement or adjustment of each item shall be performed by the installing contractor.
- D. Involves all new construction and those elements of existing construction which are affected by this project.

1.3 TESTING AND BALANCING - EXTENT OF WORK:

- A. This work incorporates a confirming checkout of construction work, an individual component activation and an overall system activation into one work program which shall serve as the transition period from the Contractor's job to Owner's facility.
- B. The TAB Contractor shall be skilled in the operation and manipulation of systems and in the direction of parties involved in the work.
- C. Conduct and participate in the startup and shakedown of all mechanical systems installed and modified in this contract; test adjust and balance these systems to obtain optimum performance at a level which minimizes the required energy input, prepare and submit a complete report of work done and the final system condition obtained, participate in the instruction of Owner's personnel in the proper operation of systems and equipment.

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- D. Involves all new construction and those elements of existing construction which are affected by this project.

1.4 QUALIFICATIONS OF SYSTEM COMMISSIONING AND TAB TEAM:

- A. Representatives of the General Contractor, Mechanical Contractor, etc., and Electrical Contractor shall be available on a daily basis through the commissioning and adjustment period. These men shall be experienced journeymen with prior experience in system operation and with specific experience on the construction of this project.
- B. Balancing shall be done by an independent firm specializing in this work. A definition of independent shall mean the firm is not associated with any engineering, contracting, or manufacturing firm and derives its income solely from testing, adjusting and balancing mechanical systems. Approved firms to do this work are BTC Services, Salt Lake City, Utah or Certified Testing and Balancing, Inc, Riverton, Utah.
- C. The balancing work including hydronic portions shall be performed by the same firm having total responsibility for the final testing, adjusting and balancing of the entire system. A principal of the firm shall be directly involved in the project.
- D. The independent testing and balancing firm shall furnish all necessary tools, scaffolding and ladders that are required and shall provide all required instruments, take all readings and make all necessary adjustments.
- E. After all tests and adjustments are made a detailed written report shall be prepared and submitted for review, and shall bear the signature of the professional supervising the work. Final acceptance of this project will not be made until a complete and satisfactory report is received. Furnish four copies of the report.

PART II - EXECUTION, SYSTEM COMMISSIONING

2.1 PRE-STARTUP INSPECTION:

- A. The pre-startup inspection of all systems shall provide for verifying that each piece of equipment is properly installed and prepared for startup.
- B. All pertinent items shall be checked, including but not necessarily limited to the following:
 - 1. Safety controls, safety valves and high or low limits in operation.
 - 2. All systems properly filled.
 - 3. Pressure and temperature gauges installed.
 - 4. Voltages match nameplate.
 - 5. Control system is in operation.
 - 6. All interlocks are wired and verified.
 - 7. All controls have been connected and verified.
 - 8. All valves and operators are properly installed and operating.

9. All other items necessary to provide for proper startup.

2.2 FIRST RUN INSPECTION:

- A. Recheck all items outlined in pre-startup inspection to insure proper operation.
- B. Check the following items:
 1. Excessive vibration or noise.
 2. Loose components.
 3. Initial control settings.
 4. Motor amperages.
 5. Control system is properly calibrated and functioning as required.
- C. Correct all items which are not operating properly.

2.3 SYSTEM OPERATION INSPECTION:

- A. Observe mechanical systems under operating conditions for sufficient time to insure proper operation under varying conditions, such as day-night and heating-cooling.
- B. Periodically check the following items:
 1. Strainers.
 2. Control operation, on-off sequences, system cycling, etc.
 3. Visual checks of water flow, seals, packings, safety valves, operation pressures and temperature.
 4. Valves close tightly.
 5. System leaks.
 6. Proper combustion of fuels.
 7. All other items pertaining to the proper operation of the mechanical system whether specifically listed or not.

PART III - EXECUTION - TESTING AND BALANCING

3.1 TOTAL MECHANICAL SYSTEM BALANCE:

- A. Prior to beginning work, a written description of the anticipated sequence of action shall be submitted to the Engineer/Owner for review and comment.

3.2 HYDRONIC SYSTEMS:

- A. Before any adjustments are made, check temperature control valve operation, check pump rotation, etc.

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- B. Using system flow meters, pressure gauges, and/or contact pyrometer, adjust the quantity of fluid handled by each pump and supplied to each coil, piece of radiation, heat exchanger, etc., to meet design requirements. Use proportional balance techniques to minimize system pressure requirements.
- 3.3 MAJOR EQUIPMENT: The Testing and Balancing Contractor shall work with the Controls Contractor and Electrician in placing the new boilers in operation. The factory representative of the equipment manufacturer shall also participate in a team effort to place the system(s) in operation, adapt to all anticipated operating modes and make adjustments as required to obtain correct operation. The Design Engineer and the Owner's Representative shall witness the final operating sequences.
- A. Use proportional balance techniques so that in every case, at least one terminal valve is set for full flow at wide open, and at least one branch valve is wide open at full flow, others equivalent.
- 3.4 CONTROL SYSTEMS: The Testing and Balancing Contractor shall go through the entire control system with the Controls Contractor verifying proper operation of each and every device and the proper function of each system. Certify such effort in the report.
- 3.5 MISCELLANEOUS:
- A. Observe and note all furnished thermal overload protection in the data sheets. If thermal overload protection is incorrect, the trade which furnished the overload devices shall furnish and install the correct size overload protection devices. It shall be the responsibility of the balancing firm to confirm that proper overload protection has been installed at the completion of the job.
 - B. Measure and set any special conditions such as minimum air quantities; coordinate outside air, return air and relief air damper operation; check and adjust outside and return air intakes so that the system will deliver substantially the same volume on either; make tests and record data as required in "REPORT" below.
 - C. All balancing devices, i.e. dampers and valves, shall be clearly marked as to the final balanced position. Plug all test holes, replace access doors and belt guards.
 - D. Upon request, based on perceived need, make 24-hour space temperature recordings. Any required rebalance of the system shall be performed without additional cost.
 - E. Upon request, a representative of the balancing firm performing the work shall demonstrate fluid flow quantities shown in the report by reading back outlets or terminals selected specifically or at random by the Design Engineer. It is understood that the operating mode of the system shall be the same for read-back as it was during balancing.
- 3.6 REPORT:
- A. Provide a bound report in four copies containing a general information sheet listing instruments used, method of balancing, altitude correction, and manufacturer's grille, register and diffuser data.
 - B. Provide equipment data sheets listing make, size, serial number, rating, etc. of all mechanical equipment including fans, air controllers, pumps, motors, starters and drives. Operating data shall include rotational speed, inlet and outlet pressures, pump heads, and measured motor current and voltage.

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- C. Hydronic balancing data sheets shall list required temperature or pressure differentials used for balancing coils, radiations, condensers, etc. Sheets shall show in comparison final as-balanced versus design values.
- D. Note any abnormal or notable conditions not covered in the above.
- E. Keep a daily log of all work performed, with a list of work scheduled for each day and the workers on the job.

END OF SECTION 15995