

SPECIFICATIONS

FOR

Bingham County Courthouse Chiller Replacement

Blackfoot, Idaho

February 2016

Prepared
by

Engineered Systems Associates, Inc.
1355 East Center
Pocatello, Idaho 83201
208-233-0501

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INVITATION TO BID

NOTICE IS HEREBY GIVEN that the Commissioners of Bingham County will, on or before the hour of 11:00 a.m. on the 21st day of March, 2016 receive sealed proposals for bids at the office of the County Clerk in the Bingham County Courthouse, 501 N. Maple Street, Blackfoot, Idaho, to be opened at a meeting by the County Commissioners to be held at 11:00 a.m. on the 21st day of March, 2016, for the following:

BINGHAM COUNTY COURTHOUSE CHILLER REPLACEMENT

Specifications or additional details (including bid forms) may be secured from Bingham County Offices, located at 501 N. Maple, Blackfoot, Idaho 83221. All bids must be on the forms furnished, all blank spaces filled in, and signed with the name, address, and license number of the Bidder. No qualified bids will be read.

Each bid shall be accompanied by a certified check, cashier's check or a bidder's bond (executed by a qualified surety company with the power to do business in the State of Idaho) in the sum of not less than five percent (5%) of the total bid, made payable to Bingham County Courthouse, 501 N. Maple, Blackfoot, Idaho 83221. This surety shall be forfeited by the bidder in the event of failure to enter into a contract. Compliance with Idaho Public Works Law is required.

The County Commissioners reserve the right to reject all bids, non-responsive bids, bids of non-responsible bidders, or to accept in whole or part such a bid or bids as may be deemed in the best interest of the County.

Plans, specifications, proposal forms, and other information are on file for examination at the following locations.

Engineered Systems Associates
1355 E Center St.
Pocatello, Idaho 83201

Bingham County Courthouse
501 N. Maple
Blackfoot, Idaho 83221

Bid shall be submitted in a sealed envelope bearing the bidder's name and plainly marked:

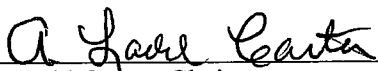
BINGHAM COUNTY COURTHOUSE CHILLER REPLACEMENT

A Public Works Permit is required to bid on this work and must be included in the sealed envelope along with the bid.

Individuals who need accessible communication or other accommodations in order to participate in this bid are invited to make their needs and preferences known to the ADA/504 Compliance Coordinator, Pamela W Eckhardt, Bingham County Clerk, at least 3 to 5 days in advance of the bid opening.

Dated this 1st day March, 2016.

IN BINGHAM COUNTY, IDAHO



A Ladd Carter, Chairman
Bingham County Commission
Blackfoot, Idaho

To be published: 03/04/16 & 03/11/16

INSTRUCTIONS TO BIDDERS

BIDS:

Sealed "Bids" will be received on or before the time and date set forth under "INVITATION TO BID."

The owner reserves the right to accept or reject any part or all bids.

Bidders submitting a "Bid" on this work will be required to figure and furnish everything as called for by these specifications and the requirements of the "Bid" sheet.

All bids shall be in a sealed envelope addressed to the Bingham Co. Courthouse. The following shall be written on the exterior of the envelope:

BIDS FOR *Bingham Co. Courthouse Chiller Replacement.*

Bid to be opened _____ at _____ for Bingham Co. Courthouse, 501 N. Maple, Blackfoot, Idaho 83221.

The successful low bidder shall, within 14 days of the Bid Opening, Provide A Bid Cost breakdown per building and trade, to the Engineer.

EVIDENCE OF QUALIFICATIONS:

Upon request of the owner, a bidder whose bid is under consideration for award of the contract shall submit, promptly, satisfactory evidence of his financial resources, his experiences, and the organization and equipment he has available for performance of the contract.

CONTRACTOR'S LICENSE:

In compliance with the Idaho Laws, the contractor must be registered with the State of Idaho, and hold the required Public Works Contractor's License before obtaining the contract documents and before submitting a bid for this work.

BID GUARANTEE:

As a guarantee that, if awarded the contract, the bidder will execute same and furnish bond, each bid will be accompanied by a Certified Check, Cashier's Check or Bid Bond for not less than five percent (5%) of the base bid payable to the Owner. **NO PERSONAL CHECKS WILL BE ACCEPTED.**

INSURANCE:

All contractors who provide goods or services to the District are required to provide the District with certificates of insurance for General Liability, Auto Liability, and Workers Compensation.

The General Liability and/or professional Liability certificate must name the District as an additional insured under the contractor's policy.

Certificates are to be provided to the district prior to any work commencing on District property. This would include the placement of any equipment or materials at the work site.

Minimum Insurance Limits

General Liability	\$1,000,000 per occurrence 1,000,000 products and completed operations 1,000,000 annual aggregate
Auto Liability	\$1,000,000 per occurrence
Workers' Compensation	Statutory

HOLD HARMLESS AGREEMENTS:

The District expects your work to conform with professional standards. The contractor is expected to hold the District harmless for all damages or claims arising out of the work performed by the contractor. The District will not agree to hold the contractor harmless for damages or claims.

PERFORMANCE BOND:

The successful bidder will be required to furnish a 100% performance bond when entering into the contract work, per Idaho Code Section 54-1926, "...conditioned upon the faithful performance of the contract in accordance with the plans, specifications and conditions thereof."

PAYMENT BOND:

The successful bidder will be required to furnish a 100% payment bond when entering into the contract work, per Idaho code Section 54-1926, "solely for the protection of persons supplying labor or materials, or returning, leasing, or otherwise supplying equipment to the contractor or his subcontractors in the prosecution of the work provided for in such contract."

FORM WH5:

Per Idaho Code Section 54-1904A, within thirty (30) days of award of bid the contractor shall file with the state Tax Commission a form WH-5, Public Works Contract Report. The contractor will also provide the owner with a copy of the completed form WH-5.

5% RETAINAGE:

The Owner will retain 5% of the Contractor's earned sum to ensure faithful performance and verify that all taxes are paid on projects. The State Tax Commission requires up to 30 days to provide the verification to the Owner. Upon receipt of verification, the Owner will release the 5% retainage to the Contractor.

OWNER/CONTRACTOR AGREEMENT:

Unless otherwise required in the Bidding documents, the Agreement of the Work will be written on a contract similar to AIA Document A101, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a stipulated sum.

EMPLOYMENT OF RESIDENTS OF IDAHO:

In compliance with Idaho Laws, Sections 44-1001 and 44-1002 Idaho Code, the contractor "...must employ ninety-five percent (95%) bona fide Idaho residents as employees on any such contracts except where under such contracts fifty (50) or less persons are employed the contractor may employ ten percent (10%) nonresidents, provided however, in all cases such employers must give preference to the employment of bona fide Idaho residents in the performance of such work..."

END OF INSTRUCTIONS TO BIDDERS

Bingham Co. Courthouse Chiller Replacement
BID FORM

TO: Bingham County Commissioners.

GENTLEMEN:

The Undersigned hereby submits the following proposals:

1. BID ITEM:

Having carefully examined the Specifications and Drawings entitled:

FOR
Bingham Co. Courthouse Chiller Replacement

as well as the premises and conditions affecting the work, the undersigned proposes to furnish all labor and materials and to perform all work as required by and in strict accordance with the above-named documents for the following sum:

BASE BID: _____

(\$ _____)

2. CONTRACT:

If the undersigned be notified of the acceptance of this proposal,
_____ agrees to execute a contract for
the above work, for a compensation of the above stated amount.

3. COMPLETION DATE:

The Undersigned hereby also agrees to complete the work contemplated on or before _____.

The Undersigned acknowledges receipt of addenda numbers ____, ____, ____.

Dated at _____ this _____ day
of _____ 2016 _____.

Very truly yours,

Bidder

Street or Building Address

By

City State Zip

Idaho Public Works License No. _____

Telephone

SUB-CONTRACTORS WHO SHALL BE UTILIZED ON THIS CONTRACT:

PLUMBING: (name) _____

(Address): _____

Idaho Public Works Contractors License No.: _____

Idaho Plumbing Contractors License No.: _____

HEATING & AIR CONDITIONING (Name) : _____

(Address): _____

Idaho Public Works Contractors License No.: _____

HYDRONIC PIPING (Name): _____

(Address): _____

Idaho Public Works License No.: _____

ELECTRICAL (Name): _____

(Address): _____

Idaho Public Works License No.: _____

Idaho Electrical Contractor's License No.: _____

END OF BID FORM FOR **Bingham Co. Courthouse Chiller Replacement.**

THIS AGREEMENT MADE THE _____ day of
in the year Two Thousand and Sixteen
By and Between
hereinafter called the CONTRACTOR and

hereinafter called the OWNER.

WITNESSETH: That the CONTRACTOR and the OWNER for the consideration hereinafter named agree as follows:

FIRST: SCOPE OF THE WORK - The CONTRACTOR shall furnish all the materials and perform all the work shown on the Diagrams and described in the Specifications entitled:

Bingham Co. Courthouse Chiller Replacement

prepared by Engineered Systems Associates, 1355 E. Center, Pocatello, Idaho 83201, all in accordance with the Contract Documents.

SECOND: TIME OF STARTING - The work to be performed under this contract shall be commenced on award of contract.

THIRD: TIME OF COMPLETION - The work shall be completed no later than

FOURTH: CONTRACT SUM - The contract sum shall be determined as follows:

(\$ _____)

FIFTH: PROGRESS PAYMENTS - The OWNER shall make payments on account of contract upon requisition by the CONTRACTOR as follows:

On or about the Tenth of each month, Ninety-five percent of the value, based on the contract prices of labor and materials incorporated in the work and of materials suitably stored at the site thereof up to the first day of that month, as submitted by the Contractor and reviewed by the Engineer, less the aggregate of previous payments; and upon substantial completion of the entire work, a sum sufficient to increase the total payments to Ninety-five percent of the Contract Price.

SIXTH: ACCEPTANCE AND FINAL PAYMENT - Final payments shall be due thirty days after completion of the work, including operating tests and final adjustment, provided the Contract be then fully performed, subject to the conditions of the Contract Documents.

SEVENTH: CONTRACT DOCUMENTS - Contract Documents are as noted herein in Article 1 of the General Conditions. The following is an enumeration of the Drawings and Specifications.

Advertisement for Bids
Instructions to Bidders
Form of Bond
Agreement
Specifications
Drawings

Addenda Nos. ____, ____, ____.

IN WITNESS WHEREOF, the said parties have caused this Agreement to be executed in the day and year first above mentioned.

Contractor _____
By: _____

Owner _____
By: _____

END OF AGREEMENT

KNOW ALL MEN: That we _____, Principal,
_____, Surety,

are held firmly bound unto _____, Owner,

in the sum of

_____ Dollars

(\$ _____)

for the payment of which we bind ourselves, our legal representatives, successors, and assigns, jointly and severally, firmly by the presents.

WHEREAS, Principal has executed contract with Owner, dated

for

copy of which contract is by reference made a part hereof.

NOW, THEREFORE, if Principal shall faithfully perform such contract and pay all persons who have furnished labor or material for use in or about the improvement and shall indemnify and save harmless the Owner from all cost and indemnify and save harmless the Owner from any defect or defects in any of the workmanship or materials entering into any part of the work which shall develop or be discovered within one year after the final acceptance of such work, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

Provided, that the liability hereunder for defects in materials or workmanship for a period of one year after final acceptance of the work shall not exceed the sum of: _____ Dollars

(\$ _____)

All persons who have furnished labor or materials for use in or about the improvement shall have a direct right of action under the bond, subject to the Owner's priority.

The Contract, including the completion thereof after default, if any, shall be prosecuted under full supervision of a duly qualified Engineer.

Any payment of payments under the bond shall reduce its penalty to the extent of such payment of payments.

No suit or action may be maintained under the bond unless it shall have been instituted within two years from date on which final payment under the contract falls due.

The Owner and Engineer shall cooperate with and assist Surety in prosecuting its rights and claims, if any, against Principal and others by supplying testimony, books, records, and documentary evidences in their possession.

The Surety hereby waives notice of any alterations, extensions, or forbearance made or extended by the Owner or Principal.

In event Principal is in default under the contract as defined therein, Surety will (a) within fifteen days of determination of such default, take over and assume completion of said contract and become entitled to the payment of the balance of the contract price, or (b) pay the Owner in cash the reasonable cost of completion, less the balance of the contract price including retained percentage. The cost of completion shall be fixed by taking bids from at least three responsible contractors, one chosen by the Owner, one by the Engineer, and one by the Surety. The Surety will make such payment within fifteen days after the cost of completion shall have been so determined.

Signed and sealed this _____ day of _____ 20 _____.

(Principal)

(Surety)

DIVISION 01000 - GENERAL PROVISIONS**01002 SCOPE OF WORK**

1. The work to be done under this specification includes the furnishing of all labor, equipment, and materials to do all work as specified and shown on the drawings. It is the intent of these specifications that the work shall be complete and ready for operation before acceptance. The work shall include, but is not necessarily limited to, the following:
 - A. Bingham County Courthouse

01005 INTERPRETATIONS

1. Questions regarding drawings and specifications should be addressed to Engineered Systems Associates, 1355 East Center, Pocatello, Idaho 83201. Questions will be answered by bulletin or addendum addressed to all Bidders. All addenda issued during the time of bidding will be incorporated into the contract.

01010 ORDINANCES

1. The work shall be installed in accordance with the local plumbing and electrical codes, any other government code or ordinance that pertains to this type of work, and to the rules and regulations of the local utility companies.
2. Should these specifications and drawings conflict with any regulatory codes, the most stringent requirement shall govern the proper installation of the work and no extra charge shall be made for any changes required to comply with the code.

01015 WORKMANSHIP

1. Workmanship shall be the best quality of its kind for respective industries, trades, crafts, and practices and shall be acceptable in every respect to the Owner, making good and perfect work in all details of construction.

01018 EXAMINATION OF SITE AND CONDITIONS

1. Before submitting a proposal, Bidders shall carefully examine the drawings and specifications, visit the site of the work and fully inform themselves of all existing conditions and limitations, and shall include in their proposal a sum to cover the cost of all items included in the contract and shall rely entirely on their own examination in making their proposal.

01020 FEES & PERMITS

1. The Contractor shall procure all necessary permits, pay for the same and shall obtain all official license for the construction of the work and for temporary obstructions, enclosures, openings of streets for pipes, walls, etc. arising from the construction and completion of the work as mentioned in the specifications. He shall be responsible for all violations of the law for any reason in connection with the construction of the work or caused by obstructing streets, sidewalks, etc., and he shall give all requisite notice to public authorities.

01040 HOLD HARMLESS AGREEMENT

1. In addition to obtaining insurance coverage as required by the Contract Documents above, Contractor shall indemnify and save harmless Owner from and against any and all liability, demands, causes of action, or claims thereof, whether well-founded or otherwise, including the cost of defending the same, for bodily injury to any person whomsoever, (including employees of Owner) or damage to property of any person in the course of, or in connection with, the operations by Contractor under this Contract. No subcontract shall relieve the Contractor of any of his liability or obligations under the contract. Contractor agrees that he is fully responsible to Owner for acts or omissions of his sub-contractors and their material men and of persons either directly or indirectly employed by them.

01045 LIENS AND ENCUMBRANCES

1. The Contractor, before receiving final payment of the job, shall furnish evidence of satisfactory and complete release on all liens and encumbrances of any nature that he may have placed thereon.
2. All sub-contractors furnishing material must be paid in full and receipted bills therefrom be submitted before final payment is made.

01050 EXECUTION, CORRELATION AND INTENT OF DOCUMENTS

1. Perfect coordination of all the documents comprising the contract is sought in their preparation. The formal contract document shall, however, be construed as precedent to and as superseding provisions in, or inferences drawn from provisions in any or all other documents of the contract in disagreement therewith. In case of disagreement between the drawings and the specifications, the specifications' requirements shall prevail. Requirements shown on the drawings and not cited or contradicted in the specifications or requirements cited in the specifications and not shown on the drawings, shall be as binding upon the parties as though cited in the specifications and shown on the drawings.

01055 DETAIL DRAWINGS AND INSTRUCTIONS

1. Contractor shall check all drawings and any supplementary drawings which may be furnished by the Engineer and shall promptly notify the Engineer of any discrepancies. Each Contractor shall compare all drawings and verify figures before laying out his work and will be responsible for any errors which might have been avoided thereby. When measurements are affected by conditions already established, the Contractor shall take measurements, notwithstanding the giving of scale, or figure, dimensions on the drawings. All questions regarding the figures, drawings, plans and specifications and the interpretation thereof and resolving of conflicts and inconsistencies therein shall be determined by the Engineer, and the work shall be performed in accordance with such determinations and instructions of the Engineer.
2. The omission from the drawings or specifications or the description of details of work which is evidently necessary to carry out the intent of the drawings and specifications, or which is customarily performed, shall not relieve the Contractor from performing such omission and details of work but they shall be performed as if fully, correctly set forth and described in the drawings and specifications.

01060 CHANGES IN THE WORK

1. The owner, without invalidating the contract, may order extra work or make changes by altering, adding to or deducting from the work, the contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract, except that any claim for extension of the time caused thereby shall be adjusted at the time of ordering such change.
2. The total allowance for combined overhead and profit for changes shall be included in the total cost to the owner and shall be based on the following schedule: A. For the Contractor, 10% over cost.; B. For the Sub-Contractor, 15% over cost to be divided 10% for Sub-Contractor and 5% for Contractor; and C. For any Sub-Subcontractor, 15% over cost to be divided 5% for Contractor, 5% for Sub-Contractor, and 5% for Sub-Subcontractor.

01065 BRAND NAMES AND SUBSTITUTIONS

1. Reference in this specification to any product or material by name, make or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limited competition. The Contractor may, at his option, use any product or material that conforms with this specification for which he has received written approval three days prior to bid opening.

01070 EQUIPMENT SUBMITTAL

1. Equipment and materials proposed for installation shall be submitted in triplicate to the Engineer by the Contractor for the Engineer's approval or rejection. The schedules shall include catalogs, cuts, drawings and such other descriptive data or samples that are requested by the Engineer. The submittals must be in the Engineer's office not later than ten (10) days after award of contract. Contractor shall not order any equipment until he has received written approval from the Engineer.

01075 CONTRACTOR SHALL VISIT THE SITE

1. The Contractor shall visit the site before placing his bid in order to become familiar with existing conditions. No extra charge will be paid to the Contractor due to his failure to completely ascertain existing conditions.

01080 MATERIALS, EQUIPMENT AND ACCESSORIES

1. Unless otherwise specified, all equipment, accessories and materials shall be new and undamaged, and the workmanship shall be of the best quality for use intended and shall be acceptable to the Engineer or Owner.
2. Equipment, accessories and materials shall be essentially the standard products of the manufacturer, or as specified herein. Where two or more units of the same class of new equipment are required, these units shall be products of a single manufacturer.
3. The contractor shall make arrangement and coordinate with the Maintenance Dept. for storage of materials and equipment. Any damages of life or property caused by storage of materials on the above indicated place shall be paid for by the contractor, who shall hold the owner harmless for any damages concerning the same.

01085 REMOVING OF DEBRIS, ETC.

1. The contractor shall at all times keep the premises free from accumulations of waste material or rubbish caused by his employees or work, and at the completion of the work he shall remove all his rubbish from and about the building and all tools and surplus materials and shall leave his work clean. In case of dispute, the owner shall remove the rubbish and surplus materials and charge the cost to the contractor.
2. Upon completion of the work remove all surplus materials and rubbish. Clean all spots resulting from this work from hardware, floors, glass, walls, etc. Do all required patching up and repair of work of other trades damaged by this division of the work and leave the premises in a clean, orderly condition.

01090 INSPECTIONS

1. The Contractor must at all times allow the Owner's authorized representative to come on the job for the purpose of inspection and lend any assistance necessary to help this work along.

01092 MAINTENANCE & OPERATING MANUALS

1. Prior to the pre-final project review, this Contractor shall compile two (2) sets of Maintenance and Operating Instructions. Bind each set in a three-ring loose leaf binder. Manuals shall include, but shall not be limited to, the following:
 - a. Provide a master index at beginning of Manual showing items included. Use plastic index tabs for sections of Manual.
 - b. First section shall have an index tab labeled "General" and shall contain the following information:
 1. One sheet consisting of names, addresses, and phone numbers of Mechanical & Electrical Engineers, General Contractor, and Mechanical, Plumbing, Sheet Metal, Refrigeration, Temperature Control, & Electrical Contractors.
 2. One sheet entitled List of Suppliers which gives a complete list of equipment installed with name, address, and phone number of vendor for each item of equipment.
 3. Sheets entitled Description of System which give a general description of the mechanical system. The information should be broken into three categories:
Major Equipment Location

Descriptions of Systems and Operations

Suggested Maintenance and Routines:

- a) Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
 - b) List of mechanical equipment used indicating name, model, serial number, and name plate data of each item together with number and name associated with each system item.
- c. The second section shall have an index tab labeled "Equipment" and shall be followed by an index tab for each type of equipment, including plumbing fixtures and temperature controls.
1. Include approved copies of submittals for each piece of equipment. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
 2. Include manufacturer's published maintenance and operating instructions for each piece of equipment.
 - a) Instructions shall include name of vendor, installation instructions, parts numbers & lists, operation instructions of equipment, and maintenance & lubrication instructions.
 - b) Step-by-step procedure to follow in putting each piece of mechanical equipment into operation.
 - c) Provide schematic control diagrams for each separate fan system, refrigeration system, heating system, control panel, etc. Each diagram shall show locations of start-stop switches, insertion thermostats, room thermostats, thermometers, firestats, pressure gauges, automatic valves, and refrigeration accessories. Mark correct operating settings for each control instrument on these diagrams.
 - d) Provide diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks, electrical switches, and relays.
 - e) Provide a drawing of each temperature control panel identifying components on the panels and their function.
 - f) Provide a sequence of control as part of the temperature control section.
- d. Provide an index tab for the Air Balance and Test Run Reports and insert the reports.
2. These manuals shall be submitted to the Engineer for approval and distribution prior to the pre-final project review.

01100 BUILDING DAMAGE TO FURNISHINGS

1. This Contractor shall be responsible for any damage to the building, carpets, furnishings, etc., caused by his workmen. Special care shall be taken to cover carpets near the boiler room and leading to the rest rooms. If carpets are soiled by this Contractor, he shall clean the carpets at his expense. If building walls outside of the boiler room are soiled, he shall be required to clean the walls or repaint them. Take special care in moving about in this building facility.

01105 CONTRACTOR USE OF BUILDING FACILITIES

1. This Contractor will be allowed the use of the building rest room facilities but will not be allowed the use of showers, cooking facilities, refrigerators, etc., or to occupy other areas of the building such as classroom facilities. Lunches and food should be eaten in the boiler room or outside of the building. The Contractor will be responsible to clean the rest room facilities if he leaves them in a dirty condition.

01110 CO-ORDINATION AND SCHEDULING

1. Contractor shall confer with the Owner at site to determine most suitable time to perform the work. Once started, the installation shall be completed promptly to get the system back in service as soon as practical.

01115 TEST RUN

1. Contractor shall operate system for such time as necessary to demonstrate satisfactory performance. Make required adjustments and instruct Owner's representative in its proper operation and maintenance.

01120 GUARANTEE

1. Contractor shall warrant and guarantee all work performed by him directly and by his sub-contractors, and shall make good any defect in workmanship or materials which may develop in his work within one year from the date of final acceptance thereof. Any repairs, adjustments or replacements must be made promptly after notification from the Owner of such defects.

01122 PATCHING AND PAINTING

1. Necessary openings shall be cut to approximately the required size with neat workmanship and with openings properly located for the proper operation of the system and the utility of the space considered. Necessary patching shall be done in such a way that brick and concrete if removed shall be restored as it was. Plaster shall be restored as it was; plaster shall be spackled or re-plastered as required. All surfaces shall be restored with first quality materials of a color to properly match the existing materials surrounding the opening or place where patching has been done.
2. All equipment furnished in finished painted condition by this Contractor shall be left without mark or scratch. Any necessary refinishing to match original shall be done.

01125 APPLICATIONS FOR PAYMENTS

1. At least ten (10) days before the request for the first payment on the contract the Contractor shall furnish to the Engineer, for his approval, a schedule of values or a breakdown of the various parts of the work as subdivided in the specifications (for the total equaling the contract price) on forms approved by the Engineer in triplicate. The approved values shall become the basis for determining progress payments and for negotiating change orders. Reference be made to the Contract Agreement, a copy of which is bound with these specifications.
2. At least ten (10) days before each payment falls due, the Contractor shall submit to the Engineer three copies of a statement of the form described above showing the proportionate part of the work performed and materials on the site up to the first of the month, which date shall be the termination of the period covered by the payment. Such statement shall be made in the form approved by the Engineer, but it shall not be binding against the Engineer's judgment.
3. Application for payments dated on or prior to the 25th of the month, shall be made by the 15th of the following month. Application for payments dated after the 25th of the month, payment shall be made within 30 days.

01130 CONTRACTOR'S LIABILITY FOR TAXES

1. In accordance with Section 3, Chapter 246, Idaho Session Laws, 1937, the Contractor in consideration of securing the business of erecting or construction public works in the state, recognizing that the business in which he is engaged is of a transitory character and that in the pursuit thereof, his property contained therein may be without the state when taxes, excises or license fees to which he is liable become payable, agrees:
 - a. To pay promptly when due all taxes (other than real property) and license fees due to the state, its subdivisions and municipal or quasimunicipal corporation therein accrued or accruing during the term of this Contract, whether or not the same shall be payable at the end of such term.
 - b. That if said taxes, excises and license fees are not payable at the end of such term, both liability for the payment thereof, exists, even though the same constitute liens upon his property to secure the same to the satisfaction of the respective officers charged with the collection thereof;
 - c. That, in the event of his default in the payment of securing of such taxes, excises and license fees, to consent that the department, officer, board or taxing unit entering into the Contract may withhold from any payments due him hereunder the estimated amount of such accrued and accruing taxes, excises and license fees for the benefit of all taxing units to which said Contractor is liable.
 - d. The Contract Sum and any agreed variations there, includes all Federal, State and Local taxes imposed by law.

01135 OWNERSHIP OF REMOVALS

1. The Contractor shall be responsible for any or all other removals as may be necessary and required to entirely complete the work included under this contract.
2. All apparatus, equipment, fixtures, electrical work, mechanical work, utilities, piping and all other salvageable materials of whatever character shall carefully be removed by the Contractor and/or Subcontractors and same shall be the property of the Contractor, except where specifically called out on the drawings.

01142 ASBESTOS

1. Any asbestos encountered shall be called to the attention of the engineer and the owner.
2. All asbestos removal work will be taken care of by Bingham County under separate contract.

01150 GENERAL CONDITIONS

1. By reference, the Standard Form of the American Institute of Architects for General Conditions of the Contract, A.I.A. Document A 201.

END OF DIVISION 01000

DIVISION 02000 - GENERAL WORK**02007 - PAINTING****PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Surface preparation and field application of paints and coatings.

1.2 SUBMITTALS

- A. Product Data: Provide data on all finishing products.
- B. Manufacturer's Instructions: Indicate any special surface preparation procedures and substrate conditions requiring special attention.
- C. Provide a schedule of paint and coating used, including manufacturer, type, and color.

1.3 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Applicator: Company specializing in performing the work of this section with minimum three years experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers - Paint
 - 1. Benjamin Moore.
 - 2. Columbia.
 - 3. Ponderosa.
 - 4. Sherwin Williams.
 - 5. Devoe.
- B. Manufacturers - Primer Sealers
 - 1. Benjamin Moore.
 - 2. Columbia.
 - 3. Ponderosa.
 - 4. Sherwin Williams.
 - 5. Devoe.
- C. Manufacturers - Block Filler
 - 1. Benjamin Moore.
 - 2. Columbia.
 - 3. Ponderosa.
 - 4. Sherwin Williams.
 - 5. Devoe.

2.2 MATERIALS

- A. Coatings: Ready mixed. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sages.

- B. Accessory Materials: Linseed Oil, Shellac, Turpentine, Paint thinners, and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- C. Patching Materials: Latex filler.
- D. Fastener Head Cover Materials: Latex filler.

2.3 FINISHES

- A. Refer to schedule at end of section for surface finish schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify site conditions.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

- A. Remove electrical plates, hardware, light fixture trim, escutcheons and fittings prior to preparing surfaces or finishing.
- B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.
- C. Seal with shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- F. Asphalt or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.
- G. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- I. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- J. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

3.3 SCHEDULE

- A. Steel - Unprimed:
 - 1. One coat of alkyd primer.
 - 2. Two coats of alkyd enamel, semi-gloss.

- B. Steel - Primed:
 - 1. Touch up with alkyd primer.
 - 2. Two coats of alkyd enamel, semi-gloss.

- C. Steel - Galvanized:
 - 1. One coat of galvanized primer.
 - 2. Two coats of alkyd enamel, semi-gloss.

END OF SECTION 02007

02010 - CAST-IN-PLACE CONCRETE SITE ELEMENTS**PART 1 GENERAL**

1.1 SUMMARY

- A. Includes But Not Limited To
 - 1. Compact sub-base for cast-in-place concrete site elements as described in Contract Documents.
 - 2. Furnish and install granular base for cast-in-place concrete site elements as described in Contract Documents.
 - 3. Furnish and install cast-in-place concrete site elements as described in Contract Documents.
 - 4. Furnish and install sealants as described in Contract Documents.

1.2 REFERENCES

- A. American Society For Testing And Materials
 - 1. ASTM D 1751-99, 'Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)'

PART 2 PRODUCTS

2.1 MATERIALS

- A. Formwork - Meet requirements specified in Section 03120.
- B. Granular Base
 - 1. Road Base type gravel or crushed rock, graded as follows -

<u>Sieve</u>	<u>Percent by Weight Passing Sieve</u>
1 inch	100
3/4 inch	85 - 100
No. 4	45 - 60
No. 10	30 - 50
No. 200	5 - 10 (non-plastic)
- C. Expansion Joints
 - 1. 1/2 inch thick.
 - 2. Manufactured commercial fiber type -
 - a. Meet requirements of ASTM D 1751
 - b. Acceptable Products -
 - 1) Conflex by Masonite Building & Industrial Products Group, Chicago, IL (800) 257-7885 www.masonite.com
 - 2) Sealtight by W R Meadows Inc, Hampshire, IL (800) 342-5976 www.meadows.com
 - 3) Equal as approved by Architect before installation.
 - 3. Recycled Vinyl -
 - a. Light gray color
 - b. Approved Products -
 - 1) Proflex by Oscoda Plastics Inc, Oscoda, MI (800) 544-9538 www.oscodaplastics.com
- D. Concrete - Meet requirements specified in Section 03313 for exterior concrete.

PART 3 EXECUTION

3.1 PREPARATION

- A. Sub-Base - Compact sub-base as specified in Section 02315.

3.2 INSTALLATION

- A. Granular Base - Except under mow strips, place 4 inches minimum of granular base, level, and compact as specified in Section 02315.
- B. Joints
 - 1. Align joints of sidewalk and curb and gutter.
 - 2. Expansion And Contraction Joints -
 - a. Spacing -
 - 1) Equipment pads - 50 feet on center
 - b. Install so top of expansion joint material is 1/4 inch below finished surface of concrete.
 - c. No expansion joint required between curbs and walks parallel to curb.
 - d. Provide expansion joint at end of walks perpendicular to and terminating at curb.
 - 3. Scored Control Joints -
 - a. Spacing -
 - 1) Equipment pads - 10 feet on center
 - b. Depth of control joints shall be approximately one quarter of concrete slab thickness, but not less than one inch.
- C. Finish
 - 1. Equipment pads -
 - a. Broom finish.
 - b. Round edges including edges formed by expansion joints.
 - c. Remove edger marks.
- D. Special Requirements
 - 1. Form vertical surfaces full depth. Do not allow concrete to flow out from under forms in any degree.
 - 2. Equipment pads -
 - a. Slope with cross slope of 1/8 to 1/4 inch per ft in direction of intended drainage.
 - b. Slope away from building one percent minimum.
 - c. Do not dust with cement.
 - B. Dusting with cement not permitted.

3.3 FIELD QUALITY CONTROL

- A. Inspection - To allow Architect's verification of grades and elevations, notify Architect three days minimum before placing concrete for specified concrete site elements.

END OF SECTION 02010

END OF DIVISION 02

DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING

23 0000 HEATING, VENTILATING, AND AIR-CONDITIONING

- 23 0501 COMMON HVAC REQUIREMENTS
- 23 0502 DEMOLITION AND REPAIR
- 23 0553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
- 23 0712 MECHANICAL INSULATION AND FIRE STOPPING
- 23 0713 CHILLED WATER SUPPLY AND RETURN PIPING INSULATION
- 23 0714 PREMOLDED ONE PIECE PVC FITTINGS INSULATION
- 23 0800 FIRE STOPPING
- 23 0933 AUTOMATIC TEMPERATURE CONTROLS
- 23 0953 TEMPERATURE CONTROLS (ELECTRIC)
- 23 0953 TEMPERATURE CONTROLS (DDC)
- 23 0953 TEMPERATURE CONTROLS (HONEYWELL)

23 2000 HVAC PIPING AND PUMPS

- 23 2113 HYDRONIC PIPING
- 23 2123 CIRCULATING PUMPS AND ACCESSORIES
- 23 2125 CLEANING AND FLUSHING STEAM AND WATER CIRCULATING SYSTEMS
- 23 2500 CHEMICAL WATER TREATMENT

23 6000 CENTRAL COOLING EQUIPMENT

- 23 6514 COOLING TOWER
- 23 6515 WATER COOLED CHILLER

END TABLE OF CONTENTS

SECTION 23 0501 – COMMON HVAC REQUIREMENTS**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Furnish labor, materials, and equipment necessary for completion of work as described in Contract Documents.
- B. It is the intent of these specifications that the systems specified herein are to be complete and operational before being turned over to the owner. During the bidding process, the contractor is to ask questions or call to the engineer's attention any items that are not shown or may be required to make the system complete and operational. Once the project is bid and the contractor has accepted the contract, it is his responsibility to furnish and install all equipment and parts necessary to provide a complete and operational system without additional cost to the owner.
- C. Furnish and install fire stopping materials to seal penetrations through fire rated structures and draft stops.
- D. Includes But Not Limited To:
 - 1. General procedures and requirements for HVAC.
- E. Related Sections:
 - 1. Section 23 0593: Testing, Adjusting, and Balancing for HVAC.

1.3 SUBMITTALS

- A. Substitutions: By specific designation and description, standards are established for specialties and equipment. Other makes of specialties and equipment of equal quality will be considered provided such proposed substitutions are submitted to the Architect for his approval, complete with specification data showing how it meets the specifications, at least 5 working days prior to bid opening. A list of approved substitutions will be published as an addendum.
 - 1. Submit a single copy of Manufacturer's catalog data including Manufacturer's complete specification for each proposed substitution.
 - 2. The Architect or Engineer is to be the sole judge as to the quality of any material offered as an equal.
- B. Product Data, Shop Drawings: Within 30 days after award of contract, submit 10 sets of Manufacturer's catalog data for each manufactured item.
 - 1. Literature shall include enough information to show complete compliance with Contract Document requirements.
 - 2. Mark literature to indicate specific item with applicable data underlined.
 - 3. Information shall include but not be limited to capacities, ratings, type of material used, guarantee, and such dimensions as are necessary to check space requirements.
 - 4. When accepted, submittal shall be an addition to Contract Documents and shall be in equal force. No variation shall be permitted.
 - 5. Even though the submittals have been accepted by the Engineer, it does not relieve the contractor from meeting all of the requirements of the plans and specifications and providing a complete and operational system.
- C. Drawings of Record: One complete sets of blue line mechanical drawings shall be provided for the purpose of showing a complete picture of the work as actually installed.
 - 1. These drawings shall serve as work progress report sheets. Contractor shall make notations neat and legible therein daily as the work proceeds.
 - 2. The drawings shall be kept at the job at a location designated by the Mechanical Engineer.
 - 3. At completion of the project these "as-built" drawings shall be signed by the Contractor, dated, and returned to the Architect.
- D. Operating Instructions and Service Manual: The Mechanical Contractor shall prepare 2 copies of an Operation and Maintenance Manual for all mechanical systems and equipment used in this project. Manuals shall be bound in hard-backed binders and the front cover and spine of each binder shall indicate the name and location of the project. Use plastic tab indexes for all sections. Provide a section for each different type of equipment item. The following items

shall be included in the manual, together with any other pertinent data. This list is not complete and is to be used as a guide.

1. Provide a master index at the beginning of the manual showing all items included.
 2. The first section of the manual shall contain:
 - a. Names, addresses, and telephone numbers of Architect, Mechanical Engineer, Electrical Engineer, General Contractor, Plumbing Contractor, Sheet Metal Contractor, and Temperature Control Contractor.
 - b. List of Suppliers which shall include a complete list of each piece of equipment used with the name, address, and telephone number of vendor.
 - c. General Description of Systems including –
 - 1) Location of all major equipment
 - 2) Description of the various mechanical systems
 - 3) Description of operation and control of the mechanical systems
 - 4) Suggested maintenance schedule
 - d. Copy of contractor's written warranty
 3. Provide a copy of approved submittal literature for each piece of equipment.
 4. Provide maintenance and operation literature published by the manufacturer for each piece of equipment which includes: oiling, lubrication and greasing data; belt sizes, types and lengths; wiring diagrams; step-by-step procedure to follow in putting each piece of mechanical equipment in operation.
 5. Include parts numbers of all replaceable items.
 6. Provide control diagram and operation sequence, along with labeling of control piping and instruments to match diagram.
 7. Include a valve chart indicating valve locations.
- E. Include air balance and/or water balance reports.

1.4 SUBMITTALS FOR COMMON HVAC REQUIREMENTS

- A. Samples: Sealer and gauze proposed for sealing ductwork.
- B. Quality Assurance / Control:
 1. Manufacturer's installation manuals providing detailed instructions on assembly, joint sealing, and system pressure testing for leaks.
 2. Specification data on sealer and gauze proposed for sealing ductwork.
- C. Quality Assurance
 1. Requirements: Construction details not specifically called out in Contract Documents shall conform to applicable requirements of SMACNA HVAC Duct Construction Standards.
 2. Pre-Installation Conference: Schedule conference immediately before installation of ductwork.

1.5 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 1. Perform work in accordance with applicable provisions of local and state Plumbing Code, Gas Ordinances, and adoptions thereof. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
 2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Architect in writing of such differences.
- B. Applicable Specifications: Referenced specifications, standards, and publications shall be of the issues in effect on date of Advertisement for Bid.
 1. "Heating, Ventilating and Air Conditioning Guide" published by the American Society of Heating and Air Conditioning Engineers.
 2. "Engineering Standards" published by the Heating, Piping, and Air Conditioning Contractors National Association.
 3. "2012 International Building Code", "2012 International Mechanical Code", and "2012 International Fire Code" as published by the International Conference of Building Officials.
 4. 2012 International Plumbing Code as published by the International Association of Plumbing and Mechanical Officials.
 5. "National Electrical Code" as published by the National Fire Protection Association.
 6. "2012 International Energy Conservation Code".
- C. Identification: Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

1.6 INSPECTIONS AND PERMITS

- A. Pay for permits, fees, or charges for inspection or other services. Local and state codes and ordinances must be properly executed without expense to Owner and are considered as minimum requirements. Local and state codes and ordinances do not relieve the Contractor from work shown that exceeds minimum requirements.

1.7 ADDITIONAL WORK:

- A. Design is based on equipment as described in the drawing equipment schedule. Any change in foundation bases, electrical wiring, conduit connections, piping, controls and openings required by alternate equipment submitted and approved shall be paid for by this division. All work shall be in accordance with the requirements of the applicable sections.

PART 2 - PRODUCTS FOR COMMON HVAC REQUIREMENTS

- A. Finishes, Where Applicable: Colors as selected by Architect.
- B. Duct Hangers:
 - 1. One inch 25 mm by 18 ga 1.27 mm galvanized steel straps or steel rods as shown on Drawings, and spaced not more than 96 inches 2 400 mm apart. Do not use wire hangers.
 - 2. Attaching screws at trusses shall be 2 inch 50 mm No. 10 round head wood screws. Nails not allowed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Inspection:
 - 1. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.
 - 2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
- B. Drawings:
 - 1. Mechanical drawings show general arrangement of piping, ductwork, equipment, etc, and do not attempt to show complete details of building construction which affect installation. This Contractor shall refer to architectural, structural, and electrical drawings for additional building detail which affect installation of his work.
 - a. Follow mechanical drawings as closely as actual building construction and work of other trades will permit.
 - b. No extra payments will be allowed where piping and/or ductwork must be offset to avoid other work or where minor changes are necessary to facilitate installation.
 - c. Everything shown on the mechanical drawings shall be the responsibility of Mechanical Contractor unless specifically noted otherwise.
 - 2. Consider architectural and structural drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over mechanical drawings.
 - 3. Because of small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions. Do not scale drawings for locations of equipment or piping. Refer to large scale dimensioned drawings for exact locations.
- C. Insure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.
 - 1. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.
 - 2. If non-specified equipment is used and it will not fit job site conditions, this Contractor assumes responsibility for replacement with items named in Contract Documents.

3.2 PREPARATION

- A. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
 - 1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.

2. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
3. Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

3.3 INSTALLATION

- A. Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

3.4 STORAGE AND PROTECTION OF MATERIALS:

- A. Provide storage space for storage of materials and assume complete responsibility for losses due to any cause whatsoever. Storage shall not interfere with traffic conditions in any public thoroughfare.
- B. Protect completed work, work underway, and materials against loss or damage.
- C. Close pipe openings with caps or plugs during installation. Cover fixtures and equipment and protect against dirt, or injury caused by water, chemical, or mechanical accident.

3.5 EXCAVATION AND BACKFILL

- A. Perform necessary excavation of whatever substance encountered for proper laying of all pipes and underground ducts.
 1. Excavated materials not required for fill shall be removed from site as directed by Engineer.
 2. Excavation shall be carried low enough to allow a minimum coverage over underground piping of 5'-0" or to be below local frost level.
 3. Excess excavation below required level shall be backfilled at Contractor's expense with earth, sand, or gravel as directed by Engineer. Tamp ground thoroughly.
 4. Ground adjacent to all excavations shall be graded to prevent water running into excavated areas.
- B. Backfill pipe trenches and allow for settlement.
 1. Backfill shall be mechanically compacted to same density as surrounding undisturbed earth.
 2. Cinders shall not be used in backfilling where steel or iron pipe is used.
 3. No backfilling shall be done until installation has been approved by the Engineer.

3.6 COOPERATION

- A. Cooperate with other crafts in coordination of work. Promptly respond when notified that construction is ready for installation of work under Division 23000. Contractor will be held responsible for any delays which might be caused by his negligence or failure to cooperate with the other Contractors or crafts.

3.7 SUPERVISION

- A. Provide a competent superintendent in charge of the work at all times. Anyone found incompetent shall be removed at once and replaced by someone satisfactory, when requested by the Architect.

3.8 INSTALLATION CHECK:

- A. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment indicated in the equipment schedule shall visit the project to inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the project as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the Engineer.
- B. Each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying the following:
 1. Equipment has been properly installed and lubricated.
 2. Equipment is in accurate alignment.
 3. Equipment is free from any undue stress imposed by connecting piping or anchor bolts.
 4. Equipment has been operated under full load conditions.
 5. Equipment operated satisfactorily.
- C. All costs for this installation check shall be included in the prices quoted by equipment suppliers.

3.9 CLEANING EQUIPMENT AND PREMISES

- A. Properly lubricate equipment before Owner's acceptance.
- B. Clean exposed piping, ductwork, equipment, and fixtures. Repair damaged finishes and leave everything in working order.
- C. Remove stickers from fixtures and adjust flush valves.
- D. At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.
- E. Trap elements shall be removed during cleaning and flushing period. Replace trap elements and adjust after cleaning and flushing period.

3.10 TESTS

- A. No piping work, fixtures, or equipment shall be concealed or covered until they have been inspected and approved by the inspector. Notify inspector when the work is ready for inspection.
- B. All work shall be completely installed, tested as required by Contract Documents and the city and county ordinances and shall be leak-tight before the inspection is requested.
- C. Tests shall be repeated to the satisfaction of those making the inspections.
- D. Water piping shall be flushed out, tested at 100 psi and left under pressure of supply main or a minimum of 40 psi for the balance of the construction period.

3.11 WARRANTY

- A. Contractor shall guarantee work under Division 23 to be free from inherent defects for a period of one year from acceptance.
 - 1. Contractor shall repair, revise or replace any and all such leaks, failure or inoperativeness due to defective work, materials, or parts free of charge for a period of one year from final acceptance, provided such defect is not due to carelessness in operation or maintenance.
 - 2. In addition, the Contractor shall furnish all refrigeration emergency repairs, emergency service and all refrigerant required due to defective workmanship, materials, or parts for a period of one year from final acceptance at no cost to the Owner, provided such repairs, service and refrigerant are not caused by lack of proper operation and maintenance.
- B. In addition to warranty specified in General Conditions, heating, cooling, and plumbing systems are to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

3.12 SYSTEM START-UP, OWNER'S INSTRUCTIONS

- A. Off-Season Start-up
 - 1. If Substantial Completion inspection occurs during heating season, schedule spring start-up of cooling systems. If inspection occurs during cooling season, schedule autumn start-up for heating systems.
 - 2. Notify Owner 7 days minimum before scheduled start-up.
 - 3. Time will be allowed to completely service, test, check, and off-season start systems. During allowed time, train Owner's representatives in operation and maintenance of system.
 - 4. At end of off-season start-up, furnish Owner with letter confirming that above work has been satisfactorily completed.
- B. Owner's Instructions
 - 1. Instruct building maintenance personnel and Owner Representative in operation and maintenance of mechanical systems utilizing Operation & Maintenance Manual when so doing.
 - 2. Minimum instruction periods shall be as follows –
 - a. Mechanical - Four hours.
 - b. Temperature Control - Four hours.
 - c. Refrigeration - Two hours.
 - 3. Instruction periods shall occur after Substantial Completion inspection when systems are properly working and before final payment is made.
 - 4. None of these instructional periods shall overlap another.

3.13 PROTECTION

- A. Do not run heat pump, air handling units, fan coil units, or other pieces of equipment used for moving supply air without proper air filters installed properly in system.
- B. The mechanical systems are not designed to be used for temporary construction heat. If any equipment is to be started prior to testing and substantial completion, such equipment will be returned to new condition with full one year warranties, from date of substantial completion after any construction use. This includes, but is not necessarily limited to: Equipment, filters, ductwork, fixtures, etc.

3.14 COMMON HVAC REQUIREMENTS:

- A. INSTALLATION
 - 1. During installation, protect open ends of ducts by covering with plastic sheet tied in place to prevent entrance of debris and dirt.
 - 2. Make necessary allowances and provisions in installation of sheet metal ducts for structural conditions of building. Revisions in layout and configuration may be allowed, with prior written approval of Architect. Maintain required airflows in suggesting revisions.
 - 3. Hangers And Supports:
 - a. Install pair of hangers close to each transverse joint and elsewhere as required by spacing indicated in table on Drawings.
 - b. Install upper ends of hanger securely to floor or roof construction above by method shown on Drawings.
 - c. Attach strap hangers to ducts with cadmium-plated screws. Use of pop rivets or other means will not be accepted.
 - d. Where hangers are secured to forms before concrete slabs are poured, cut off flush all nails, strap ends, and other projections after forms are removed.
 - e. Secure vertical ducts passing through floors by extending bracing angles to rest firmly on floors without loose blocking or shimming. Support vertical ducts, which do not pass through floors, by using bands bolted to walls, columns, etc. Size, spacing, and method of attachment to vertical ducts shall be same as specified for hanger bands on horizontal ducts.
- B. CLEANING
 - 1. Clean interior of duct systems before final completion.

END OF SECTION 23 0501

SECTION 23 0502 - DEMOLITION AND REPAIR**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. Under this section remove obsolete piping and mechanical equipment and relocate, reconnect or replace existing piping affected by demolition or new construction. Remove concealed piping abandoned due to demolition or new construction, or cap piping flush with existing surfaces.

1.3 DRAWINGS AND EXISTING CONDITIONS

- A. All relocations, reconnections and removals are not necessarily indicated on the drawings. As such, the Contractor shall make adequate allowance in his proposal for this work as no extra charges will be allowed for these items.

PART 2 - NOT USED**PART 3 - EXECUTION**

3.1 TEMPORARY CONNECTIONS

- A. Where existing piping must remain in service to supply occupied areas during construction, provide temporary piping, connections, and equipment to maintain service to such areas. All shall be performed in a neat and safe manner to prevent injury to the building or its occupants.

3.2 EXISTING TO BE ABANDONED

- A. All required drilling, cutting, block-outs and demolition work required for the removal and/or installation of the mechanical system is the responsibility of this Contractor.
- B. No joists, beams, girders, trusses or columns shall be cut by any Contractor without written permission from the Architect.
- C. The patching, repair, and finishing to existing or new surfaces is the responsibility of this Contractor, unless specifically called for under sections of specifications covering these materials.
- D. Disconnect all equipment that is to be removed or relocated. Relocate any existing equipment that obstructs new construction.

3.3 EXISTING TO REMAIN IN USE

- A. Where affected by demolition or new construction, relocate, replace, extend, or repair piping and equipment to allow continued use of same. Use methods and materials as specified for new construction.

3.4 MATERIALS AND EQUIPMENT REMOVED

- A. All obsolete materials, piping, and equipment shall become the property of the Contractor and be removed from the site promptly.

END OF SECTION 23 0502

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. Furnish and install identification of equipment and piping as described in Contract Documents.
- B. Mechanical Contractor shall touch-up equipment where factory paint has been damaged. Repaint entire item where more than 20 percent of the surface is involved.
- C. Primary painting of walls, ceilings, ductwork, piping and plenums is covered in the general painting section of these Contract Documents.

PART 2 - PRODUCTS

2.1 PAINT

- A. Benjamin Moore Impervo or equivalent by Paint Manufacturer approved in Section 02 007.
- B. Use appropriate primer.

2.2 LABELS

- A. Black Formica with white reveal on engraving.

2.3 CODED BANDS

- A. Using colored bands and arrows to indicate supply and return, with colored reflective tape, color code all piping installed in this contract at not more than 20-foot intervals, at equipment, at walls, etc., in accordance with ANSI Standards.
- B. Approved Manufacturers:
 - 1. Seton
 - 2. Craftmark

2.4 PIPE IDENTIFICATION

- A. In addition to the colored bands, stencil with black paint in 1/2 inch high letters a symbol and directional arrow for all fluids handled or use Seaton coded and colored pipe markers and arrows to meet ANSI Standards.

2.5 EQUIPMENT IDENTIFICATION

- A. Provide an engraved plastic plate for each piece of equipment stating the name of the item, symbol number, area served, and capacity. Label all control components with plastic embossed mechanically attached labels. Sample:
 - 1. Supply Fan SF-1 - North Classrooms
 - 2. 10,000 CFM @ 2.5"

2.6 VALVE IDENTIFICATION

- A. Make a list of and tag all valves installed in this work.
 - 1. Valve tags shall be of brass, not less than 1"x2" size, hung with brass chains.
 - 2. Tag shall indicate plumbing or heating service.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Engraved Plates:
 - 1. Identify thermostats and control panels in mechanical rooms, furnaces, boilers and hot water heating specialties, duct furnaces, air handling units, electric duct heaters, and condensing units with following data engraved and fastened to equipment with screws –
 - a. Equipment mark noted on Drawings (i.e., SF-1)
 - b. Area served (i.e., North Classrooms)
 - c. Capacity (10,000 CFM @ 2.5)

- B. Stenciling:
 - 1. Locate identifying legends and directional arrows at following points on each piping system –
 - a. Adjacent to each item of equipment and special fitting.
 - b. At point of entry and exit where piping goes through wall.
 - c. On each riser and junction.
 - d. Every 50 feet on long continuous lines.
 - 2. Chilled Water & Valve Identification –
 - a. Identify specific pipe contents by stenciling pipe with written legend and placing of arrows to indicate direction of flow.

- C. Painting:
 - 1. Background Color - Provide by continuous painting of piping.

Symbol	Name	Color
CHW	Chilled Water	Blue
CTW	Cooling Tower	Yellow

- 2. Identification stenciling and flow arrows shall be following colors for proper contrast:

<u>Arrows & ID Stenciling</u>	<u>Color Shade of Pipe</u>
White	Red, Grays, & black
Black	Yellows, Oranges, Greens, & White

END OF SECTION 23 0553

SECTION 23 0712 - MECHANICAL INSULATION AND FIRE STOPPING**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. Furnish and install mechanical insulation and fire stopping as described in Contract Documents including but not limited to the following:
 - 1. Chilled Water Cooling
 - 2. Fire Stopping

1.3 QUALITY ASSURANCE

- A. Insulation shall have composite (insulation, jacket or facing and adhesive used to adhere facing or jacket to insulation) fire and smoke hazard ratings as tested by Procedure ASTM E-84, NFPA 255 and UL 723 not exceeding: Flame Spread of 25 and Smoke Developed of 50.
- B. Insulation Contractor shall certify in writing, prior to installation, that all products to be used will meet the above criteria.
- C. Accessories, such as adhesives, mastics, cements, and tapes, for fittings shall have the same component ratings as listed above.
- D. Products, or their shipping cartons, shall bear a label indicating that flame and smoke ratings do not exceed above requirements.
- E. Any treatment of jacket or facings to impart flame and smoke safety shall be permanent.
- F. The use of water-soluble treatments is prohibited.

END OF SECTION 23 0712

SECTION 23 0713- CHILLED WATER SUPPLY & RETURN PIPING INSULATION**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this section.

1.2 SUMMARY

- A. Furnish and install insulation on piping mains, branches, risers, fittings, and valves, pump bodies and flanges as described in Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. 6 lb./cu.ft. heavy density fiberglass with fire retardant vapor barrier jacket with self sealing laps. Thickness shall be 1-1/2 inches on heating supply and return lines.
- B. Approved Manufacturers:
 - 1. Owens-Corning Fiberglass heavy density with ASJ-SSL jacket.
 - 2. Equals by Johns-Mansville or CTM.
 - 3. Zeston covers for valves and fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipes:

- 1. Install in accordance with manufacturer's directions on clean dry pipes.
- 2. Butt joints firmly together.
- 3. Seal vapor barrier longitudinal seam overlap with vapor barrier adhesive.
- 4. Wrap butt joints with four inch strip of vapor barrier jacket material cemented with vapor barrier adhesive.
- 5. Finish with bands applied as mid-section and at each end of insulation.

B. Valves & Fittings:

- 1. Insulate and finish by one of the following methods:
 - a. With hydraulic setting insulating cement, or equal, to thickness equal to adjoining pipe insulation.
 - b. With segments of molded insulation securely wired in place.
 - c. With prefabricated covers made from molded pipe insulation finished with vapor barrier adhesive.
 - d. Zeston covers and factory applied insulation diapers.
- 2. Finish fittings and valves with four ounce canvas and coat with vapor barrier adhesive or Zeston covers.

C. Piping located outdoors and exposes to the weather shall be insulated as indicated above except the thickness shall be determined according to the worst weather extremes expected. The insulation shall then be protected with one of the following weatherproof finishes as indicated on contract drawings:

- 1. Metal jacketing shall be 0.016" (0.4mm) minimum aluminum or stainless steel with moisture barrier, secured in accordance with the jacket manufacturer's recommendations. Joints shall be applied to they will shed water and shall be sealed completely.
- 2. UV resistant PVC jacketing may be applied in lieu of metal jacketing provided jacketing manufacturer's limitations with regard to pipe size, surface temperature, and thermal expansion and contraction are followed.
- 3. Fittings shall be insulated as prescribed above, jacketed with preformed fitting covers matching outer jacketing used on straight pipe sections, with all joints together sealed.

4. On outdoor chilled water and refrigerant lines, the insulation system shall be completely vapor sealed before the weather-resistant jacket is applied. The outer jacket shall not compromise the vapor barrier by penetration of fasteners, etc. Vapor stops at butt joints shall be applied at every pipe section joint and at each fitting to provide isolation of water incursion.

END OF SECTION 23 0713

SECTION 23 0714 – PREREMOLDED ONE PIECE PVC FITTINGS INSULATION**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. Furnish and install premolded one piece PVC fittings insulation as described in Contract Documents.

1.3 QUALITY ASSURANCE

- A. Fittings shall be UL rated 25/50 PVC.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Approved Manufacturers:
 - 1. Zeston

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Where factory premolded one piece PVC insulating fitting covers are to be used, proper factory precut Hi-Lo Temp insulation shall be applied to the fitting. Ends of Hi-Lo Temp insulation shall be tucked snugly into throat of fitting and edges adjacent to pipe covering tufted and tucked in. Fully insulate pipe fittings. One piece PVC fitting cover is then secured by stapling, tack fastening, banding or taping ends to adjacent pipe covering.
- B. Cold:
 - 1. Chilled water systems shall be insulated as "A" above and have all seam edges of cover sealed with Zeston's vapor barrier adhesive or equal.
 - 2. Circumferential edges of cover shall be wrapped with Zeston's vapor barrier pressure sensitive color matched Z tape.
 - 3. Tape shall extend over adjacent pipe insulation and have an overlap on itself at least 2" on downward side.

END OF SECTION 23 0714

SECTION 23 0800 – FIRE STOPPING**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. Furnish and install fire stopping as described in Contract Documents.

1.3 QUALITY ASSURANCE

- A. Fire stopping material shall meet ASTM E814, E84 and be UL listed.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Material shall be flexible, long lasting, intumescent acrylic seal to accommodate vibration and building movement.
- B. Caulk simple penetrations with gaps of 1/4" or less with:
 - 1. Dow Corning Fire Stop Sealant
 - 2. Pensil 300
- C. Caulk multiple penetrations and/or penetrations with gaps in excess of 1/4" with:
 - 1. Dow Corning Fire Stop Foam
 - 2. Pensil 200
 - 3. IPC flame safe FS-1900
 - 4. Tremco "Tremstop 1A"

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Follow manufacturer's installation instructions explicitly.
- B. Seal penetrations of ductwork, piping, and other mechanical equipment through one-hour and two-hour rated partitions as shown on Architectural and Mechanical Drawings.
- C. Install fire stopping material on clean surfaces to assure adherence.

END OF SECTION 23 0800

SECTION 23 2113 - HYDRONIC PIPING**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. This Section includes piping, special-duty valves, makeup water for these systems; blowdown drain lines; and condensate drain piping.

1.3 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride.
- B. PVC: Polyvinyl chloride.

1.4 SUBMITTALS

- A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.
- B. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Failed test results and corrective action taken to achieve requirements.
- E. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 23.
- F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1.6 COORDINATION

- A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe sleeve installations for foundation wall penetrations.
- C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations.
- D. Coordinate pipe fitting pressure classes with products specified in related Sections.

- E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.
- F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

1.7 EXTRA MATERIALS

- A. Water Treatment Chemicals: Furnish sufficient chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grooved Mechanical-Joint Fittings and Couplings:
 - a. Central Sprinkler Company; Central Grooved Piping Products.
 - b. Grinnell Mechanical Products.
 - c. Victaulic Company of America.
 - 2. Calibrated Balancing Valves:
 - a. Armstrong Pumps, Inc.
 - b. Flow Design, Inc.
 - c. Gerand Engineering Company.
 - d. Griswold Controls.
 - e. ITT Bell & Gossett; ITT Fluid Technology Corp.
 - f. Taco, Inc.
 - 3. Pressure-Reducing Valves:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Conbraco Industries, Inc.
 - d. ITT Bell & Gossett; ITT Fluid Technology Corp.
 - e. Spence Engineering Company, Inc.
 - f. Watts Industries, Inc.; Watts Regulators.
 - 4. Safety Valves:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Conbraco Industries, Inc.
 - d. ITT McDonnell & Miller Div.; ITT Fluid Technology Corp.
 - e. Kunkle Valve Division.
 - f. Spence Engineering Company, Inc.
 - 5. Automatic Flow-Control Valves:
 - a. Flow Design, Inc.
 - b. Griswold Controls.
 - 6. Expansion Tanks:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. ITT Bell & Gossett; ITT Fluid Technology Corp.
 - d. Taco, Inc.
 - 7. Air Separators and Air Purgers:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. ITT Bell & Gossett; ITT Fluid Technology Corp.
 - d. Taco, Inc.

2.2 PIPING MATERIALS

- A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Fittings: ASME B16.22.
- E. Wrought-Copper Unions: ASME B16.22.
- F. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.
- G. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

2.4 STEEL PIPE AND FITTINGS

- A. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless) or Type F (furnace-butt welded), Grade B, Schedule 40, black steel, plain ends.
- B. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, black steel, plain ends.
- C. Steel Pipe, NPS 14 through NPS 18: ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 30, black steel, plain ends.
- D. Steel Pipe, NPS 20: ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 20, black steel, plain ends.
 - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.
- E. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.
- F. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
- G. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
- H. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.
- I. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- J. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- K. Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47, Grade 32510 malleable iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.
- L. Grooved Mechanical-Joint Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
- M. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.
- N. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.

- O. Packed, Slip, Expansion Joints: 150-psig minimum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, packing ring, packing, limit rods, flanged ends, and chrome-plated finish on slip-pipe telescoping section.
- P. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- Q. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.5 PLASTIC PIPE AND FITTINGS

- A. CPVC Plastic Pipe: ASTM F 441, Schedules 40 and 80, plain ends.
- B. PVC Plastic Pipe: ASTM D 1785, Schedules 40 and 80, plain ends.
- C. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.
 - 1. CPVC Solvent Cement: ASTM F 493.
- D. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.
 - 1. PVC Solvent Cement: ASTM D 2564.

2.6 VALVES

- A. Gate, globe, check, ball, and butterfly valves are specified in Division 23 Section "Valves."
- B. Refer to Part 3 "Valve Applications" Article for applications of each valve.
- C. Calibrated Balancing Valves, NPS 2 and Smaller: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.
- D. Calibrated Balancing Valves, NPS 2-1/2 and Larger: Cast-iron or steel body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having flanged or grooved connections. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.
- E. Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown, and noncorrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.
- F. Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.
- G. Automatic Flow-Control Valves: Gray-iron body, factory set to maintain constant flow with plus or minus 5 percent over system pressure fluctuations, and equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case. Each valve shall have an identification tag attached by chain, and be factory marked with the zone identification, valve number, and flow rate. Valve shall be line size and one of the following designs:
 - 1. Gray-iron or brass body, designed for 175 psig at 200 deg F with stainless-steel piston and spring.
 - 2. Brass or ferrous-metal body, designed for 300 psig at 250 deg F with corrosion-resistant, tamperproof, self-cleaning, piston-spring assembly easily removable for inspection or replacement.
 - 3. Combination assemblies, including bronze ball valve and brass alloy control valve, with stainless-steel piston and spring, fitted with pressure and temperature test valves, and designed for 300 psig at 250 deg F.
- H. Plastic Ball Valves: 150-psig working pressure, 250 deg F maximum operating temperature, full port design, 1- or 2-piece body design, CPVC body and ball, polytetrafluoroethylene seats, EPDM seals, and tee handle; with threaded, socket, union, or flanged connections.
- I. Plastic Butterfly Valves: 150-psig working pressure, 250 deg F maximum operating temperature, PVC wafer body,

polytetrafluoroethylene seats, lever lock handle, and wafer style for installation between flanges.

2.7 HYDRONIC SPECIALTIES

- A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.
- B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.
- C. Expansion Tanks: Welded carbon steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. Include the following fittings and accessories:
 - 1. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Design tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
 - 2. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; designed to admit air to compression tank, drain water, and close off system.
 - 3. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.
- D. Expansion Tanks: Welded carbon steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Separate air charge from system water to maintain design expansion capacity by a flexible bladder securely sealed into tank. Include drain fitting and taps for pressure gage and air-charging fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Factory fabricate and test tank with taps and supports installed and labeled according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
- E. Tangential-Type Air Separators: Welded black steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature; perforated stainless-steel air collector tube designed to direct released air into expansion tank; tangential inlet and outlet connections; threaded connections for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger; threaded blowdown connection. Provide units in sizes for full-system flow capacity.
- F. In-Line Air Separators: One-piece cast iron with an integral weir designed to decelerate system flow to maximize air separation at a working pressure up to 175 psig and liquid temperature up to 300 deg F.
- G. Air Purgers: Cast-iron body with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal. Maximum working pressure of 150 psig and temperature of 250 deg F.
- H. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.
 - 1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.
- I. Diverting Fittings: 125-psig working pressure; 250 deg F maximum operating temperature; cast-iron body with threaded ends, or wrought copper with soldered ends. Indicate flow direction on fitting.
- J. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.
- K. Basket Strainers: 125-psig working pressure; high-tensile cast-iron body (ASTM A 126, Class B), flanged-end connections, bolted cover, perforated stainless-steel basket, and bottom drain connection.
- L. T-Pattern Strainers: 750-psig working pressure; ductile-iron or malleable-iron body, grooved-end connections, stainless-steel basket with 57 percent free area; removable access coupling and end cap for strainer maintenance.
- M. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged- or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

- N. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body with steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 250 deg F and pressures up to 150 psig.
- O. Packed, Slip, Expansion Joints: 150-psig minimum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, packing ring, packing, limit rods, flanged ends, and chrome-plated finish on slip-pipe telescoping section.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Heat Pump Water, NPS 2 and Smaller: Aboveground, use Type L drawn-temper copper tubing with soldered joints or Schedule 40 steel pipe with threaded joints. Belowground or within slabs, use Type K annealed-temper copper tubing with soldered joints. Use the fewest possible joints belowground and within floor slabs.
- B. Heat Pump Water, NPS 2-1/2 and Larger: Schedule 40 steel pipe with welded and flanged joints.
- C. Condensate Drain Lines: Type L drawn-temper copper tubing with soldered joints or Schedule 40, PVC pipe with solvent-welded joints.

3.2 VALVE APPLICATIONS

- A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
 - 1. Shutoff Duty: Gate, ball, and butterfly valves.
 - 2. Throttling Duty: Globe, ball, and butterfly valves.
- B. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
- C. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.
- F. Install pressure-reducing valves on hot-water generators and elsewhere as required to regulate system pressure.

3.3 PIPING INSTALLATIONS

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.
- B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- C. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- F. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
- G. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- H. Anchor piping for proper direction of expansion and contraction.

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer. cal runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping; and solvent-welded joints for PVC and CPVC piping.

3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.
- C. Install dip-tube fittings in boiler outlet. Install piping to expansion tank with a 2 percent upward slope toward tank. Connect boiler-outlet piping.
- D. Install in-line air separators in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install drain valve on units NPS 2 and larger.
- E. Install combination air separator and strainer in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install blowdown piping with gate valve; extend to nearest drain.
- F. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above floor. Install feeder in bypass line, off main, using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.
- G. Install expansion tanks above air separator. Install gage glass and cocks on end of tank. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
 - 1. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, and fittings, plus weight of a full tank of water. Do not overload building components and structural members.
- H. Install expansion tanks on floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system design requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections shall be same as for equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If multiple, parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure and temperature gages at coil inlet connections.

3.8 CHEMICAL TREATMENT

- A. Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:
- B. Fill system and perform initial chemical treatment.

3.9 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush system with clean water. Clean strainers.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

- B. Perform the following tests on hydronic piping:
 - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - 2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
 - 3. Check expansion tanks to determine that they are not air bound and that system is full of water.
 - 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
 - 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.
 - 6. Prepare written report of testing.

3.10 ADJUSTING

- A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

- B. Perform these adjustments before operating the system:
 - 1. Open valves to fully open position. Close coil bypass valves.
 - 2. Check pump for proper direction of rotation.
 - 3. Set automatic fill valves for required system pressure.
 - 4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 - 5. Set temperature controls so all coils are calling for full flow.
 - 6. Check operation of automatic bypass valves.
 - 7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
 - 8. Lubricate motors and bearings.

3.11 CLEANING

- A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION 23 2113

SECTION 23 2123 – CIRCULATING PUMPS AND ACCESSORIES**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 0501 apply to this Section.

1.2 SUMMARY

- A. Furnish and install circulating water pumps and accessories as described in the Contract Documents.

PART 2 - PRODUCTS

2.1 SUSPENDED WET PIT PUMPS

- A. The pump casing shall have an integrally cast discharge flange. The suction strainer shall be fabricated 304 stainless steel with iron bottom plate.
- B. The impeller shall be semi-open and capable of passing 1 3/8" solids. The impeller shall contain a balancing ring and be cast in iron and be secured to shaft by taper fit, with Woodruff key, castellated nut, washer and cotter pin.
- C. All shafting shall be 316 stainless steel and shall be a minimum of 1 1/4" diameter between the coupling and the impeller. Column pipe shall be steel with welded flanges machined for registered fit.
- D. The pump bearing, located directly above impeller, shall be of bronze. Bearing housing shall be of 316 stainless steel.
- E. An intermediate bearing of the same materials as the pump bearing must be provided on pumps in excess of 6'-0" in length. On intermediate bearing for each additional 5'-0" pump length shall be furnished.
- F. Pump and intermediate bearings shall be water lubricated through separate lubrication lines terminating at the cover plate.
- G. The motor support shall be of cast iron, machined to assure positive alignment of motor and pump shaft, fitted with a high thrust angular contact bearing with moisture-proof enclosure and grease seals. External impeller and shaft axial adjustment shall be provided.
- H. Water make-up operation shall be controlled by a float operated switch. Float rod shall be fiberglass. Float shall be 304 stainless steel. Float stops shall be 304 stainless steel.
- I. The flexible coupling between the motor and pump shafts shall be Woods Sure-Flex spacer type coupling.
- J. Pumps shall be driven by a standard "C" face vertical electric motor.
- K. Approved Manufacturers:
 - 1. Bell & Gossett.
 - 2. Armstrong.
 - 3. Or Approved Equal.

2.2 EXPANSION JOINT PUMP CONNECTORS

- A. Precision machine molded neoprene and nylon construction internal reinforced by means of steel wire.
- B. Cadmium steel floating flanges tapped to mate with 150# ASA companion flanges.
- C. Capable of operating at a temperature of 20 deg. F. thru 220 deg. F. and at a pressure ranging from 10" HG vacuum thru 150 psi working pressure.
- D. Capable of 15 deg. angular deflection.

- E. Twin quiet-sphere design with control rods.
- F. Approved Manufacturers:
 - 1. Vibration Mountings & Controls, Inc.
 - 2. Metraflex

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturers instructions.
- B. Align pump and motor shafts in accordance with manufacturers requirements before starting equipment. Provide report in the M&O manual regarding pump alignment.
- C. Remove start-up filter screen on suction diffuser after system has been cleaned and flushed. Leave main filter screen in place.

END OF SECTION 23 2123

SECTION 23 2125 - CLEANING AND FLUSHING WATER CIRCULATING SYSTEMS**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. Furnish labor and materials to thoroughly clean water circulating systems as described in Contract Documents.
- B. Mechanical contractor shall procure the services of an independent treatment contractor as described in this specification.

1.3 QUALITY ASSURANCE

- A. System Additives: This Contractor shall not add any water treatment chemicals or "stop-leak" compounds to the system.

PART 2 - EXECUTION

2.1 FIELD QUALITY ASSURANCE

- A. Water circulating systems for project shall be thoroughly cleaned before placing in operation to rid system of dirt, piping compound, mill scale, oil, and other materials foreign to water being circulated.
- B. During construction extreme care shall be exercised to prevent dirt and other foreign matter from entering pipe or other parts of system. Pipe stored on project shall have open ends capped and equipment shall have openings fully protected. Before erection, each piece of pipe, fittings, or valve shall be visually examined and dirt removed.
- C. Side Stream Filtration and Flushing Valves
 1. The Mechanical Contractor shall install a bag style side stream filter in the main mechanical room. This filter shall be furnished with 12 clean polyester bags with a filtration rating of 5 micron. The filter shall be sized to provide a pressure drop equal to the pressure drop of the parallel component with 80% flow through the primary component and 20% through the filter. Minimum filter size shall be 18" high and 6" in diameter. If this minimum size allows excessive flow through the side stream filter a balance valve shall be installed to insure sufficient flow through the primary central plant component.
 2. Ball valves of full line size shall be installed at the end of each primary run. The valves shall have a nipple and cap installed.
- D. Hydronic Heat Pump Closed Loop Cleaning
 1. Prior to any introduction of fluids to the closed loop system the Mechanical Contractor shall close isolation valves at each heat pump and open the bypass valve to prevent flow through the strainer, flow control device and heat pump during the initial flushing and subsequent cleaning. The side stream filter bag shall be removed during the initial flushing process.
 2. The Mechanical Contractor shall fill each hydronic system with clean fresh water prior to cleaning and thoroughly leak check system piping. A cleaning and passivating agent supplied by the Chemical Treatment Contractor shall be added to the system at the direction of the Treatment Contractor during the leak check process to minimize initial corrosion. If the system is filled multiple times during the leak check and repair process the Mechanical Contractor shall coordinate with the Treatment Contractor to maintain this initial protection. The Treatment Contractor is responsible for providing chemical for up to two refills of the system. If additional chemical is required due to multiple refills the Mechanical Contractor shall be responsible for the additional time and chemical.
 3. Following leak check the closed system shall be flushed by the Mechanical Contractor until the leaving water runs clear. All primary runs shall be flushed at their ends to obtain maximum sweep of debris from the system. The inlet screens on the circulating pumps must be kept clear during this initial cleaning process and inspected following cleaning. When flushing is complete the system is to be left full.
 4. Prior to flushing the Mechanical Contractor shall coordinate with Treatment Contractor so that the Treatment Contractor can be available immediately following flush and final refill to add cleaning chemical within 4 hours to prevent initial corrosion.

5. Following initial flushing the Chemical Treatment Contractor shall refill all systems with cleaning and passivating agents raising the PH to a minimum of 10, circulate and flush until thoroughly clean. All primary piping runs shall be flushed at the ends during this cleaning process. When boiler operation is available the loop temperature should be raised to 110 to 120° to accelerate cleaning. Cleaning with availability of boiler operation should be anticipated to last 7 to 10 days or longer depending on initial loop conditions. If boiler operation is unavailable loop cleaning duration should be expected to double. The Chemical Treatment Contractor shall verify and adjust cleaning chemistry, and inspect side stream filter bags at a minimum of every two days, exception for weekends. Filter bags shall be changed as required during this cleaning process. Cleaning shall continue until these bags no longer show signs of debris.
6. Following cleaning process the Treatment Contractor shall close the bypass valves at each heat pump and open isolation valves for normal operation and check for leaks of local piping connections. Any leaks found shall be referred to the Mechanical Contractor for repair. The bypass valve handle shall be removed and tied to the valve. The system shall then be charged with final operating chemical to control long term corrosion and a clean bag filter shall be installed in the system.
7. The Treatment Contractor shall provide final inspection report for inclusion in the Operation and Maintenance Manual. Additionally the Treatment Contractor shall take loop samples approximately 12 months following completion, add or adjust chemical as required and provide a post construction report to the owner prior to warranty closeout. Chemical required is the responsibility of the Treatment Contractor.

END OF SECTION 23 2125

SECTION 23 2500 – CHEMICAL WATER TREATMENT**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. Procure services of Water Treatment Service Organization which will:
 - 1. Furnish and install required chemical feeding equipment and perform other related services as described in Contract Documents.
 - 2. Perform initial cleaning and flushing procedures.
 - 3. Provide chemicals required for cleaning and flushing systems.
- B. Related Work Specified Elsewhere:
 - 1. Owner will supply operating chemicals after start-up chemicals have been exhausted.

1.3 SUBMITTALS

- A. Quality Control:
 - 1. Submit written recommended treatment procedures, chemicals, chemical feeding equipment, and basic water analyses test equipment, based on its experience and chemical analysis of representative sample of water supply.

1.4 MAINTENANCE

- A. Test Equipment:
 - 1. Provide water analysis test kit and adequate supply of reagents suitable to control treatment chemical dosage requirements.

PART 2 - PRODUCTS

2.1 HOT WATER SYSTEMS

- A. Two Gallon bypass feeder complete, including piping, valves, and accessories.
 - 1. Provide adequate supply of Dearborn Aqua-Serv B-547 liquid borate-nitrite based corrosion inhibitor.
- B. Approved Manufacturers:
 - 1. M. A. Fleckenstein
 - 2. Neptune
 - 3. Wingert

2.2 COOLING TOWER SYSTEM

- A. Furnish and install a complete power pumped chemical feed system with water sensor, automatic control, feeder pump and 50 gallons of recommended chemical for use.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide initial start up and adjustment of all chemical systems.
- B. Provide instruction to owner in the use and operation of the test kit.
- C. Provide (2) two additional trips to the site during the warrantee period to check and adjust the chemical treatment system.

END OF SECTION 23 2500

SECTION 23 6514 – COOLING TOWER**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

- A. Furnish and install Cooling Tower, Water Treatment, Remote Sump and Tower Pump as described in Contract Documents.

PART 2 - PRODUCTS

2.1 COOLING TOWER

- A. General:
 - 1. Fiberglass cooling tower.
 - 2. Unit shall be single cell, induced draft, vertical discharge, counter-flow design, utilizing fiberglass reinforced polyester (FRP) materials in basin and casing of cooling tower structure.
 - 3. Tower shall be supplied as a field erected package complete with assembly and necessary components and accessories as required for complete installation.
- B. Cold Water Basin:
 - 1. Cooling tower basin shall be molded of corrosion-resistant fiberglass reinforced polyester (FRP) material to assure durability and long life.
 - 2. Basin shall be a multi-segment structure, equipped with provisions for connections to hot water inlet, cold water outlet, and basin drain for remote sump application.
- C. Tower Casing:
 - 1. Cooling tower casing shall be molded of corrosion-resistant fiberglass reinforced polyester (FRP) material to assure durability and long life.
 - 2. Casing shall be a multi-segment type, providing easy access to the fill media.
 - 3. Casing panels shall be capable of withstanding wind loads of at least thirty (30) pounds per square foot.
- D. Fans:
 - 1. Fan blades shall be slow speed, aerodynamically designed, propeller type with adjustable pitch to provide efficient use of power and to assure quiet operation.
 - 2. Fan blades and related hub shall be constructed of a special cast aluminum alloy material for corrosion-resistance and maintenance free operation.
- E. Fan Motor/Drive System:
 - 1. Multi-blade propeller type fan blade shall be driven by a special V-belt reducer unit to provide proper speed and to assure constant air flow thru fill media.
 - 2. Reducer assembly shall have provisions for belt adjustment and related maintenance without disassembly of drive system.
 - 3. Fan motor shall be a single speed totally enclosed, air-over (TEAO), permanently lubricated, ball bearing type, with 1.15 service factor, suitable for outdoor service.
 - 4. Motor/V-belt reducer and fan assembly shall be supported on a structural steel support protected by hot-dip galvanized coating.
 - 5. Suitable fan guard shall be included.
- F. Fill:
 - 1. Cooling tower fill shall be PVC (polyvinyl chloride) of corrugated and embossed design to provide maximum air to water contact for optimum heat transfer efficiency.
 - 2. Fill shall be provided in a circular configuration to enable easy replacement if required.
 - 3. The PVC material shall be fire resistant, and shall meet the provisions of ASTM Standard E-84 with a flame spread rate of 25.
 - 4. Fill must withstand a maximum water temperature of 130 deg. F. and be resistant to rot, decay, or biological attack.

- G. Water Distribution: Water distribution shall be provided through a rotating sprinkler head system. Water from the inlet connection shall be forced thru the rotating sprinkler system under pump pressure and distributed evenly over the entire fill area. The rotating sprinkler head and related piping shall be non-ferrous, non-corrosive and self-rotating at low head loss. All sprinkler pipes shall have removable end caps for maintenance purposes.
- H. Eliminators: Special drift eliminators shall be attached to the sprinkler pipes to effectively reduce drift (carry-over) from the airstream. Drift loss shall be limited to 0.2 percent at design/operating conditions. Eliminators shall be of non-ferrous, non-corrosive materials.
- I. Hardware & Finish: All metal fasteners (nuts, bolts, washers) shall be stainless steel to resist corrosion. All supporting steel structure shall be Stainless Steel.
- J. All fiberglass reinforced polyester materials (FRP) shall contain UV (ultra-violet) inhibitors, fire retardant fillers to satisfy ASTM E-84-Class A and an exterior gel coat to protect the structural integrity of the basin and casing. Exterior surface shall have a cosmetically appealing surface that is durable, long lasting and eliminates the need for other finishing.
- K. The tower will be provided with an OSHA approved ladder adequate to allow inspection and accessibility to the fan/motor and upper portion of the tower cell. In addition, a suitable wire-grill fan guard will be provided. These items shall be protected with a hot-dip galvanized coating.
- L. Air inlet louvers of a PVC plastic material shall be provided to prevent objects from entering the water basin.
- M. Approved Manufacturers:
 - 1. AMCOT
 - 2. RSD
 - 3. Protec

END OF SECTION 23 6514

23 6515 - WATER COOLED CHILLER**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, and Section 15055 apply to this Section.

1.2 SUMMARY

- A. Furnish and install Trane, or approved equal, packaged chiller in accordance with the plans. Capacity of each chiller shall not be less than shown on the schedule. Unit EER (including condenser fan motors and control power) shall not be less than 21.5.
- B. Heat transfer vessels in contact with water or brine shall be selected to reflect the incorporation of a fouling factor of .0005 hr. sq. ft \square F/BTU, 0.000088m² \square C/W.
- C. All units shall be factory assembled, leak checked and run tested. Packaged chillers shall be furnished with a full operating refrigerant and oil charge. There shall be a maximum of one (1) compressor per refrigerant circuit for redundancy and to eliminate cross contamination and oil equalization problems. Each refrigerant circuit of a packaged chiller shall have as a minimum in the liquid line of removable core filter drier, solenoid valve, moisture indicating sight glass and thermal expansion valve as well as an insulated suction line.
- D. Indoor units must be furnished with a structural steel base for support and rigidity, and painted with a coat of vinyl based paint. Each part shall be individually painted using a multiple step coating system. The coating shall meet the requirements of ASTM B-117 for 500 hour spray testing. All units shall be designed for ease of service.
- E. The reciprocating compressors shall be of the serviceable hermetic design. All compressors shall be 1750 RPM direct drive and include manual suction and discharge service valves, a crankcase heater, and oil sight glass. Forced feed type oil equalization with an automatic reversing oil pump is standard on all packages. At least one compressor in every package larger than eight (8) tons must have an efficient means of cyclinder unloading to maximize package part load energy efficiency. To maximize reliability, all compressors shall start across the line and to minimize start-up current draw, motors shall be limited to 40 HP with a time delay between compressors.
- F. Cooler and condenser vessels shall be either U.L. listed or meet the requirements of ASME Code Section VIII, Div. 1 for unfired pressure vessels and are to be so stamped.
- G. Cast iron heads on the condenser shall be removable and interchangeable end-for-end job flexibility and to allow cleaning of the 3/4" OD seamless, extended surface copper tubes from either end. The condenser shall be circuited and sized for a minimum of 5 \square subcooling and full pumpdown capacity. A king valve shall be included on the condenser discharge for isolation and ease of service. Condenser refrigerant design pressure must be 406 PSIG or greater.
- H. Cooler vessels shall have seamless copper tubes with extended surface construction for heat transfer efficiency. The tubes shall be individually silver brazed into tubesheets for permanent leak proof joints. Internal baffles shall be positioned for maximum heat transfer with minimum fluid pressure drop. Vessel refrigerant design pressure must be 300 PSIG or greater.
- I. For serviceability, all vessels shall have bolted mounting brackets and be removable from its package. All water side design pressures must be 200 PSIG or greater.
- J. The package shall include a mounted starter/control panel with all power connections prewired to a single terminal block. All compressors shall have starters with external overload current protection in addition to either internal or external motor temperature protection. All required safety and automatic operating controls, including cutouts for high and low refrigerant pressure, low oil pressure, freeze and operating thermostats, shall be installed. A control circuit on-off switch shall be included on all models as well as an anti-recycle timer for each compressor. Interlock terminals are to be provided for chilled and condenser water pumps and flow switches. Numbered terminal strips and wires with labeled controls must be included as well as a permanently mounted and protected wiring diagram per JIC standard.

1.3 FACTORY INSTALLED OPTIONS

- A. Indicator lights
 - B. Control transformer and fuses
 - C. Under voltage and phase protection relay
 - D. Compressor Anti-Recycle Timer
 - E. Low oil pressure switch
 - F. Discharge, suction and oil pressure gauges
- 1.4 SHIPPED LOOSE ACCESSORIES
- A. Water flow switch
 - B. Rubber in Shear Isolators

END OF SECTION 23 6515
END OF DIVISION 23

DIVISION 26: ELECTRICAL

26 0000 ELECTRICAL

- 26 0501 COMMON ELECTRICAL REQUIREMENTS
- 26 0518 ELECTRICAL DEMOLITION REQUIREMENTS
- 26 0519 LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
- 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
- 26 0533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

26 2000 LOW (LINE) VOLTAGE DISTRIBUTION

- 26 2816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

END OF TABLE OF CONTENTS

SECTION 26 0501-- COMMON ELECTRICAL REQUIREMENTS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. General electrical system requirements and procedures.
 2. Make electrical connections to equipment provided under other Sections.
 3. Furnish and install Penetration Firestop Systems at electrical system penetrations as described in Contract Documents.
- B. Related Sections:
1. Section 07 8400: Quality of Penetration Firestop Systems to be used on Project and submittal requirements.

1.2 SUBMITTALS

- A. Product Data:
1. Provide following information for each item of equipment:
 - a. Catalog Sheets.
 - b. Assembly details or dimension drawings.
 - c. Installation instructions.
 - d. Manufacturer's name and catalog number.
 - e. Name of local supplier.
 2. Furnish such information for following equipment:
 - a. Section 26 2816: Enclosed switches and circuit breakers.
 3. Do not purchase equipment before approval of product data.
- B. Shop Drawings:
1. Indicate precise equipment to be used, including all options specified. Indicate wording and format of nameplates where applicable. Submit in three-ring binder with hard cover.
- C. Quality Assurance / Control:
1. Report of site tests, before Substantial Completion.
- D. Closeout:
1. Operations And Maintenance Manual Data:
 - a. Modify and add to requirements of Section 01 7000 as follows:
 - 1) Provide operating and maintenance instructions for each item of equipment submitted under Product Data.
 - 2) Include copy of approved shop drawings.

1.3 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
1. NEC and local ordinances and regulations shall govern unless more stringent requirements are specified.
 2. Material and equipment provided shall meet standards of NEMA or UL, or ULC, CSA, or EEMAC and bear their label wherever standards have been established and label service is available.
- B. Materials and equipment provided under following Sections shall be by same Manufacturer:
1. Sections 26 2416, 26 2816, and 26 2913: Panelboards, Enclosed Switches And Circuit Breakers, and Enclosed Controllers

1.4 OWNER'S INSTRUCTIONS

- A. Provide competent instructor to train maintenance personnel in operation and maintenance of electrical equipment and systems. Factory representatives shall assist this instruction as necessary. Schedule instruction period at time of final inspection.

PART 2 - PRODUCTS: Not Used**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. All relocations, reconnections, and removals are not necessarily indicated on Drawings. All such work shall be included without additional cost to Owner.
- B. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections.

3.2 INSTALLATION

- A. General:
1. Locations of electrical equipment shown on Drawings are approximate only. Field verify actual locations for proper installation.
 2. Coordinate electrical equipment locations and conduit runs with those providing equipment to be served before installation or rough-in.
 - a. Notify Architect of conflicts before beginning work.
 3. Work related to other trades which is required under this Division, such as cutting and patching, trenching, and backfilling, shall be performed according to standards specified in applicable Sections.
- B. Install Penetration Firestop System appropriate for penetration at electrical system penetrations through walls, ceilings, and top plates of walls.

3.3 FIELD QUALITY CONTROL

- A. Site Tests: Test systems and demonstrate equipment as working and operating properly. Notify Architect before test. Rectify defects at no additional cost to Owner.
- B. Measure current for each phase of each motor under actual final load operation, i.e. after air balance is completed for fan units, etc. Record this information along with full-load nameplates current rating and size of thermal overload unit installed for each motor.

END OF SECTION 26 0501

SECTION 26 0518-- ELECTRICAL DEMOLITION REQUIREMENTS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To
 - 1) Demolition involving electrical system as described in Contract Documents.
- B. Related Sections
 - 1) Section 26 0501 - Common Electrical Requirements
 - 2) New and replacement work specified in appropriate specification Section.

2.1 SCHEDULING

- A. Include on Construction Schedule specified in Section 01300 detailed sequence of individual electrical demolition operations.
- B. Coordinate with Owner for equipment and materials to be removed by Owner.

PART 2 - PRODUCTS - Not Used**PART 3 - EXECUTION****1.1 EXAMINATION**

- A. All relocations, reconnections, and removals are not necessarily indicated on Drawings. All such work shall be included without additional cost to Owner.

2.1 PREPARATION

- A. Disconnect equipment that is to be removed or relocated. Carefully remove, disassemble, or dismantle as required, and store in approved location on site, existing items to be reused in completed work.
- B. Where affected by demolition or new construction, relocate, extend, or repair raceways, conductors, outlets, and apparatus to allow continued use of electrical system. Use methods and materials as specified for new construction.

3.1 PERFORMANCE

- A. Perform drilling, cutting, block-offs, and demolition work required for removal of necessary portions of electrical system. Do not cut joists, beams, girders, trusses, or columns without prior written permission from Architect.
- B. Remove concealed wiring abandoned due to demolition or new construction. Remove circuits, conduits, and conductors that are not to be re-used back to next active fixture, device, or junction box.
- C. Patch, repair, and finish surfaces affected by electrical demolition work, unless work is specifically called for under other Sections of the specifications.

4.1 CLEANING

- A. Remove obsolete raceways, conductors, apparatus, and lighting fixtures promptly from site and dispose of legally.

END OF SECTION 26 0518

SECTION 26 0519— LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
 - 1. Quality of conductors used on Project except as excluded below.
- B. Related Sections:
 - 1. Section 23 0933: Conductors and cables for temperature control system.
 - 2. Section 26 0501: Common Electrical Requirements.

1.2 DEFINITIONS

- A. Line Voltage: Over 70 Volts.

PART 2 - PRODUCTS**2.1 COMPONENTS**

- A. Line Voltage Conductors:
 - 1. Copper with AWG sizes as shown:
 - a. Minimum size shall be No. 12 except where specified otherwise.
 - b. Conductor size No. 8 and larger shall be stranded.
 - 2. Insulation:
 - a. Standard Conductor Size No. 10 And Smaller: 600V type THWN or XHHW (75 deg C).
 - b. Standard Conductor Size No. 8 And Larger: 600V Type THW, THWN, or XHHW (75 deg C).
 - c. Higher temperature insulation as required by NEC or local codes.
 - 3. Colors:
 - a. 208Y / 120 V System:
 - 1) Black: Phase A.
 - 2) Red: Phase B.
 - 3) Blue: Phase C.
 - 4) Green: Ground.
 - 5) White: Neutral.
 - a) 480Y / 277 Volt System:
 - 1) Brown: Phase A.
 - 2) Orange: Phase B.
 - 3) Yellow: Phase C.
 - 4) Gray: Neutral.
 - 5) Green: Ground.
 - b. Conductors size No. 10 and smaller shall be colored full length. Tagging or other methods for coding of conductors size No. 10 and smaller not allowed.
 - c. For feeder conductors larger than No. 10 at pull boxes, gutters, and panels, use painted or taped band or color tag color-coded as specified above.
- B. Standard Connectors:
 - 1. Conductors No. 8 And Smaller: Steel spring wire connectors.
 - 2. Conductors Larger Than No. 8: Pressure type terminal lugs.
 - 3. Connections Outside Building: Watertight steel spring wire connections with waterproof, non-hardening sealant.
- C. Terminal blocks for tapping conductors:
 - 1. Terminals shall be suitable for use with 75 deg C copper conductors.
 - 2. Acceptable Products:
 - a. 16323 by Cooper Bussmann, St Louis, MO www.bussmann.com
 - b. LBA363106 by Square D Co, Palatine, IL www.squared.com.
 - c. Equal as approved by Architect before bidding. See Section 01 6000.

PART 3 - EXECUTION**3.1 INSTALLATION****A. General:**

1. Conductors and cables shall be continuous from outlet to outlet.

B. Line Voltage Conductors (Over 70 Volts):

1. Install conductors in raceway except where specifically indicated otherwise. Run conductors of different voltage systems in separate conduits.
2. Route circuits at own discretion, however, circuiting shall be as shown in Panel Schedules. Group circuit homeruns to panels as shown on Drawings.
3. Neutrals:
 - a. On three-phase, 4-wire systems, do not use common neutral for more than three circuits.
 - b. On single-phase, 3-wire systems, do not use common neutral for more than two circuits.
 - c. Run separate neutrals for each circuit where specifically noted on Drawings.
 - d. Where common neutral is run for two or three home run circuits, connect phase conductors to breakers in panel which are attached to separate phase legs so neutral conductors will carry only unbalanced current. Neutral conductors shall be of same size as phase conductors unless specifically noted otherwise.
4. Pulling Conductors:
 - a. Do not pull conductors into conduit until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.
 - b. Do not use heavy mechanical means for pulling conductors.
 - c. Use only listed wire pulling lubricants.

END OF SECTION 26 0519

SECTION 26 0526-- GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
 - 1. Furnish and install grounding for electrical installation as described in Contract Documents except as excluded below.
- B. Related Sections:
 - 1. Section 26 0501: Common Electrical Requirements.

1.2 QUALITY ASSURANCE

- A. Pre-Installation Conference: Participate in pre-installation conference specified in Section 03 3111.

PART 2 - PRODUCTS**2.1 COMPONENTS**

- A. Size materials as shown on Drawings and in accordance with applicable codes.
- B. Grounding And Bonding Jumper Conductors: Bare copper or with green insulation.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Grounding conductors and bonding jumper conductors shall be continuous from terminal to terminal without splice. Provide grounding for following.
 - 1. Conduits and other conductor enclosures.
 - 2. Non-current-carrying metal parts of fixed equipment such as motors, starter and controller cabinets, instrument cases, and lighting fixtures.
- B. Pull grounding conductors in non-metallic raceways, in flexible steel conduit exceeding **72 inches** in length, and in flexible conduit connecting to mechanical equipment.
- C. Provide grounding bushings on all feeder conduit entrances into panelboards and equipment enclosures.
- D. Bond conduit grounding bushings to enclosures with minimum #10 AWG conductor.
- E. Connect equipment grounds to building system ground.
 - 1. Use same size equipment grounding conductors as phase conductors up through #10 AWG.
 - 2. Use NEC Table 250-95 for others unless noted otherwise in Drawings.
- F. Run separate insulated grounding cable from each equipment cabinet to electrical panel. Do not use intermediate connections or splices. Affix directly to cabinet.
- G. On motors, connect ground conductors to conduit with approved grounding bushing and to metal frame with bolted solderless lug.

END OF SECTION 26 0526

SECTION 26 0533-- RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Quality of material and installation procedures for raceway, boxes, and fittings used on Project but furnished under other Divisions.
 2. Furnish and install raceway, conduit, and boxes used on Project not specified to be installed under other Divisions.
- B. Related Sections
1. Section 26 0501: General Electrical Requirements.

PART 2 - PRODUCTS**2.1 COMPONENTS**

- A. Raceway And Conduit:
1. **Sizes:**
 - a. **3/4 inch** for exterior underground use.
 - b. **1/2 inch** minimum elsewhere, unless indicated otherwise.
 2. **Types:** Usage of each type is restricted as specified below by product.
 - a. Galvanized rigid steel or galvanized intermediate metal conduit (IMC) is allowed for use in all areas. Where in contact with earth or concrete, wrap buried galvanized rigid steel and galvanized IMC conduit and fittings completely with vinyl tape.
 - b. Galvanized Electrical Metallic Tubing (EMT), Flexible Steel Conduit, And Metal-Clad Cable (Type MC):
 - 1) Allowed for use only in indoor dry locations where it is:
 - a) Not subject to damage.
 - b) Not in contact with earth.
 - c) Not in concrete.
 - 2) Flexible steel conduit or metal-clad cable required for final connections to indoor mechanical equipment.
 - c. Schedule 40 Polyvinyl Chloride (PVC) Conduit:
 - 1) Allowed for use only underground or below concrete with galvanized rigid steel or IMC elbows and risers.
 - d. Listed, Liquid-Tight Flexible Metal Conduit:
 - 1) Use in outdoor final connections to mechanical equipment, length not to exceed **36 inches**.
 - e. Pre-wired **3/8 Inch** Flexible Fixture Whips: Allowed only for connection to recessed lighting fixtures, lengths not to exceed **72 inches**.
 - f. Electrical Non-Metallic Tubing (ENT): Allowed for use only as a raceway for control voltage cables in concealed or inaccessible, indoor, dry locations.
 3. **Prohibited Raceway Materials:**
 - a. Aluminum conduit.
 - b. Armored cable type AC (BX) cable.
- B. Raceway And Conduit Fittings:
1. Rigid Steel Conduit And IMC: Threaded and designed for conduit use.
 2. EMT:
 - a. Compression type.
 - b. Steel set screw housing type.
 3. PVC Conduit:
 - a. PVC type. Use PVC adapters at all boxes.
 - b. PVC components, (conduit, fittings, cement) shall be from same Manufacturer.
 4. Flexible Steel Conduit: Screw-in type.
 5. Liquid-tight Flexible Metal Conduit: Sealtite type.
 6. Expansion fittings shall be equal to OZ Type AX sized to raceway and including bonding jumper.
 7. **Prohibited Fitting Materials:**
 - a. Crimp-on, tap-on, indenter type fittings.
 - b. Cast set-screw fittings for EMT.
 - c. Spray (aerosol) PVC cement.

C. Outlet Boxes:

1. Galvanized steel of proper size and shape are acceptable for all systems. Where metal boxes are used, provide following:
 - a. Provide metal supports and other accessories for installation of each box.
 - b. Equip outlets in plastered, paneled, and furred finishes with plaster rings and extensions to bring box flush with finish surface.
2. Plastic boxes may be used only in low voltage systems where conductors are not installed in conduit.
3. HVAC Instrumentation And Control:
 - a. Junction boxes in mechanical equipment areas shall be **4 inches** square.
 - b. Boxes for remote temperature sensor devices shall be recessed single device.
 - c. Boxes for thermostats shall be **4 inches** square with raised single device cover.

2.2 MANUFACTURERS

A. Contact Information:

1. Cooper B-Line, Highland, IL www.bline.com.
2. Hubbell Incorporated, Milford, CT www.hubbell-wiring.com.
3. Square D, Palatine, IL www.squared.com.
4. Steel City, Div Thomas & Betts, Memphis, TN www.tnb.com.
5. Thomas & Betts, Memphis, TN www.tnb.com.
6. Walker Systems Inc, Williamstown, www.wiremold.com.
7. Wiremold Co, West Hartford, CT www.wiremold.com.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Confirm dimensions, ratings, and specifications of materials to be installed and coordinate these with site dimensions and with other Sections.

3.2 INSTALLATION

A. Interface With Other Work:

1. Coordinate with Divisions 22 and 23 for installation of raceway for control of plumbing and HVAC equipment.
2. Before rough-in, verify locations of boxes with work of other trades to insure that they are properly located for purpose intended.
3. Install pull wires in raceways installed under this Section where conductors or cables are to be installed under other Divisions.

B. Conduit And Raceway:

1. Conceal raceways within ceilings, walls, and floors, except at Contractor's option, conduit may be exposed on walls or ceilings of mechanical equipment areas and above acoustical panel suspension ceiling systems. Install exposed raceway runs parallel to or at right angles to building structure lines.
2. Keep raceway runs **6 inches** minimum from hot water pipes.
3. Make no more than four quarter bends, 360 degrees total, in any conduit run between outlet and outlet, fitting and fitting, or outlet and fitting.
 - a. Make bends and offsets so conduit is not injured and internal diameter of conduit is not effectively reduced.
 - b. Radius of curve shall be at least minimum indicated by NEC.
4. Cut conduit smooth and square with run and ream to remove rough edges. Cap raceway ends during construction. Clean or replace raceway in which water or foreign matter have accumulated.
5. Install insulated bushings on each end of raceway **1-1/4 inches** in diameter and larger, and on all raceways where low voltage cables emerge. Install expansion fittings where raceways cross building expansion joints.
6. Installation In Framing:
 - a. Do not bore holes in joists or beams outside center 1/3 of member depth or within **24 inches** of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width.
 - b. Holes shall be **one inch** diameter maximum.
7. Conduit And Raceway Support:
 - a. Securely support raceway with approved straps, clamps, or hangers, spaced as required.
 - b. Do not support from mechanical ducts or duct supports without Architect's written approval. Securely mount raceway supports, boxes, and cabinets in an approved manner by:

- 1) Expansion shields in concrete or solid masonry.
 - 2) Toggle bolts on hollow masonry units.
 - 3) Wood screws on wood.
 - 4) Metal screws on metal.
8. Prohibited Procedures:
- a. Use of wooden plugs inserted in concrete or masonry units for mounting raceway, supports, boxes, cabinets, or other equipment.
 - b. Installation of raceway that has been crushed or deformed.
 - c. Use of torches for bending PVC.
 - d. Spray applied PVC cement.
 - e. Boring holes in truss members.
 - f. Notching of structural members.
 - g. Supporting raceway from ceiling system support wires.
 - h. Nail drive straps or tie wire for supporting raceway.

C. Boxes:

1. Boxes shall be accessible and installed with approved cover.
2. Do not locate device boxes that are on opposite sides of framed walls in the same stud space. In other wall construction, do not install boxes back to back.
3. Locate boxes so pipes, ducts, or other items do not obstruct outlets.
4. Install outlets flush with finished surface and level and plumb.
5. Support switch boxes larger than two-gang with side brackets and steel bar hangers in framed walls.
6. At time of substantial completion, install blank plates on uncovered outlet boxes that are for future use.
7. Install air / vapor barrier back boxes behind outlet boxes that penetrate vapor barrier.

END OF SECTION 26 0533

SECTION 26 2816-- ENCLOSED SWITCHES AND CIRCUIT BREAKERS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
 - 1.1 Furnish and install disconnects as described in Contract Documents, except those provided integral with equipment.
- B. Related Sections:
 - 1.1 Section 26 0501: Common Electrical Requirements.

PART 2 - PRODUCTS**2.1 EQUIPMENT**

- A. Disconnects:
 - 1.1 Heavy-duty quick-make, quick-break type, fused unless indicated otherwise.
 - 2.1 Provide interlock to prevent opening of door when switch is in ON position.
 - 3.1 Provide means to lock switch in OFF position with padlock.
 - 4.1 Disconnects for motor circuits shall be horsepower rated
 - 5.1 Disconnects For Furnace Units And Unit Heaters: Provide manual starter with thermal overload relay. Provide overload relay to match motor full load amps.
- 6.1 Enclosures:
 - a. Interior: NEMA / CEMA Type 1.
 - b. Exterior: NEMA / CEMA Type 3R.
- 7.1 Fuses:
 - a. Fuse fused disconnects with dual-element time delay fuses and equip with rejection type fuse holders.
 - b. Fuses on Project shall be from single manufacturer.
 - c. Category Four Approved Manufacturers. See Section 01 6000 for definitions of Categories.
 - 1) Cooper Bussmann, Chicago, IL www.bussmann.com.
 - 2) Edison Fusegear, Des Peres, MO (314) 391-3443.
 - 3) GEC Alsthom Electrical Equipment, Hawthorne, NJ (800) 678-9322 or (201) 869-7777.
 - 4) Ferraz Shawmut, Newburyport, MA www.ferrazshawmut.com.
 - 5) Littelfuse Inc, Des Plaines, IL www.littelfuse.com.
- 8.1 Category Four Approved Manufacturer. See Section 01 6000 for definitions of Categories.
 - a. Same as Manufacturer of Project's main panelboard.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Label disconnects to indicate equipment served, such as Condensing Unit CU-1. Use **1/16 inch** thick laminated plastic composition material with contrasting color core. Engraved letters shall be **1/4 inch** high. Attach labels with screws.

END OF SECTION 26 2816
END OF DIVISION 26