SPECIFICATIONS

FOR

Bid No. 15-23

Chiller Replacement
at the
Joseph Ferderbar Elementary School

Neshaminy School District
1200 Langhorne-Newtown Road
Langhorne, PA 19047

March 14, 2014

Prepared by

CONSOLIDATED ENGINEERS
1022 James Drive
Leesport, PA 19533

Phone: 610-916-1600
FAX: 610-916-1610

CE Project No. 14-2256-1

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DIVISION 16 - ELECTRICAL SPECIFICATIONS

SCHEDULE OF DRAWINGS

DRAWING NUMBER	DRAWING NAME
M-1	Partial Floor Plan and Roof Plan
M-2	Schedules and Details

SECTION 00030 - ADVERTISEMENT FOR BIDS

The Board of Directors of the Neshaminy School District is soliciting bids for:

Chiller Replacement at the Joseph Ferderbar Elementary School – Bid No. 15-23.

Sealed proposals will be received by Mr. Tom Sizgorich, Director of Purchasing, until 10:00 a.m., prevailing time, Friday, April 4th, 2014. At that time sealed proposals will be publicly opened and read in the Purchasing Department of the Neshaminy School District at 2001 Old Lincoln Highway, Langhorne, Pennsylvania. The District will not be responsible for late delivery of mail and no bid will be accepted after 10:00 a.m.

A **mandatory pre-bid meeting** will be held on Friday, March 21st, 2014 at 10:00 a.m. at The Joseph Ferderbar Elementary School located at 300 Height Lane, Feasterville, PA, 19053.

Each bid shall be accompanied by a certified check, a cashier's check or the bid bond of an approved Surety Company, in an amount of not less than 10% of the amount of the proposal. Check or bond shall be drawn in favor of the Neshaminy School District.

Bid documents are at the Neshaminy School District Site at www.neshaminy.org. Click on the bid tab and look for bid#15-23.

Technical questions pertaining to the bid specifications should be directed to Paul Minotti or Jerry Rutledge at (215) 809-6250. Questions regarding Division 1 on the specifications should be directed via email to tsizorich@neshaminy.k12.pa.us.

The School District reserves the right to waive any informality in bids, or to reject any or all proposals, and to make the award in the best interest of the School District.

Mr. Tom Sizgorich
Director of Purchasing

END OF SECTION 00030

BID FORM

BID No. 15-23
CHILLER REPLACEMENT
AT
JOSEPH FERDERBAR ELEMENTARY SCHOOL
FOR
NESHAMINY SCHOOL DISTRICT

Proposal of: Chiller Replacement at Joseph Ferderbar Elementary School for the Neshaminy School District, Bid No. 15-23.

To: Mr. Tom Sizgorich
Director of Purchasing
Langhorne, PA

In conformity with the Drawings and Specifications as prepared by Consolidated Engineers, 1022 James Drive, Leesport, Pennsylvania, after an examination of the site and the Bidding and Contract Documents, including the Advertisement, Instructions to Bidders, Proposals, Bid Form, Bid Bond, Qualification Statement, General Conditions, Supplementary Conditions, Standard Form of Agreement, Performance Bond and Payment Bond, Certificate of Insurance, and Technical Specifications and Drawings, the undersigned submits this proposal and encloses herewith as a bond on the form enclosed, furnished by Neshaminy School District, in an amount of not less than ten percent (10%) of the total of the hereinafter stated Base Bid, made payable to or indemnifying Neshaminy School District, 1200 Langhorne-Newtown Road, Langhorne, PA. which it is understood will be held by Neshaminy School District as security as provided in the Instructions to Bidders, if this proposal or any part thereof is accepted by the School District and the undersigned shall fail to furnish approved bonds and execute the Agreement within ten (10) days from the date of issuance of the award. Should the School District fail to make an award on this project through no fault or failure on the part of the Bidder, then the School Board shall return said bid security.

It is hereby certified that the undersigned is the only person(s) interested in this proposal as principal, and that the proposal is made without collusion with any person, firm, or corporation.

The Bidder submits herewith, as such, a Non-Collusion Affidavit in accordance with the provisions of the Pennsylvania Antibid-Rigging Act of October 28, 1983.

Bidder hereby agrees to execute the Agreement and furnish surety company bonds in the form incorporated in the Contract Documents, in the amount of one-hundred percent (100%) of the contract price for the Performance Bond and Payment Bond, within ten (10) days after mailing by the School Board of notice of award, and to begin work within ten (10) days after date of Notice to Proceed.

Bidder guarantees that, if awarded contract, he will furnish and deliver all materials, tools, equipment, tests, transportation, secure all permits and licenses, do and perform all labor, superintendence and all means of construction, pay all fees and do all incidental work, and to execute, construct and finish, in an expeditious, substantial and workmanlike manner, in accordance with the Drawings and Specifications, to the complete satisfaction and acceptance of the School Board for the Chiller Replacement at Joseph Ferderbar Elementary School.

It is understood that the School Board reserve the right to reject any or all proposals, or part thereof, or items therein and to waive technicalities required for the best interest of the School District. It is further understood that competency and responsibility of bidders will receive consideration before the award of the contract. A certified copy of the Contractor's Qualification Statement, AIA Document A305 will be submitted as requested.

Bidder submits this proposal with the understanding that the work shall be completed on or before the dates stipulated in the Advertisement for Bids and Instructions to Bidders; in accordance with the phased completion schedule; and, that time for completion of the work shall be considered as of the essence of this Contract.

A detailed breakdown sheet of the work, and the contract price of the work involved, will be submitted to the Engineer, within fifteen (15) calendar days after the execution of the Contract.

The bidder agrees that he will not assign his bid or any of his rights or interests thereunder without the written consent of the School Board.

UNIT PRICES govern addition to or deduction from quantity included in the Base Bid and amounts actually installed on the job. Where existing work is indicated, price includes removal and replacing. Unit prices shall include all labor, materials, equipment, bailing, shoring, removal, supervision, overhead, profit, insurance, bond, etc. required to complete work specified. All quantities shall be verified by the Engineer.

THE BID, as called for, is submitted as follows:

BASE BID

For all Construction Work as shown and specified in the Contract Documents, the sum of:

_____Dollars

($_____)

ALTERNATE BID

ALTERNATE BID M-1 (Aaon Chiller)

The base bid includes the installation of a “TRANE CHILLER”. State the amount to be added to, or deducted from the contract to install an “AAON CHILLER” in lieu of the base bid chiller as here-in specified.

ADD

_____Dollars

($_____)

DEDUCT

_____Dollars

($_____)

ALTERNATE BID M-2 (Carrier Chiller)

The base bid includes the installation of a “TRANE CHILLER”. State the amount to be added to, or deducted from the contract to install an “CARRIER CHILLER” in lieu of the base bid chiller as here-in specified.
.

ADD

_____Dollars

($_____)

DEDUCT

_____Dollars

($_____)

In submitting this proposal, I have received and included in this Bid, the instructions and information contained in the following Addenda:

Addendum No.	Dated
_____	_____
_____	_____
_____	_____

The undersigned certifies that the Contract Documents have been considered, in their entirety, both before and in the preparation of this Proposal. The undersigned, in submitting this Proposal, intends to be legally bound by this Proposal.

IN WITNESS WHEREOF, the undersigned has caused this Proposal to be executed as of

_____.
Date

When the Bidder is an Individual:

_____ _____(SEAL)
Witness Bidder

*****

When the Bidder is a Partnership:

_____ _____(SEAL)
Witness By:

_____(SEAL)

_____(SEAL)

_____(SEAL)
Partners

*****

When the Bidder is a Corporation: (CORPORATE SEAL)

_____

ATTEST:

_____ By:_____

Secretary President

_____ is a Corporation organized

and existing under the Laws of _____ and has (has not) been granted a Certificate of to do Business in Pennsylvania, as required by the Business Corporation Law, approved May 5, 1933, P. L. 364, as amended to date.

END OF SECTION 00300

SECTION 00480 - NON-COLLUSION AFFIDAVIT

INSTRUCTIONS FOR NON-COLLUSION AFFIDAVIT

This Non-Collusion Affidavit is material to any contract awarded pursuant to this bid. According to the Pennsylvania Antibid-Rigging Act, 73 P.S., 1611 et seq., governmental agencies may require Non-Collusion Affidavits to be submitted together with bids.

This Non-Collusion Affidavit must be executed by the members, officer, or employee of the bidder who makes the final decision on prices and the amount quoted in the bid.

Bid rigging and other efforts to restrain competition, and the making of false sworn statements in connection with the submission of bids are unlawful and may be subject to criminal prosecution. The person who signs the Affidavit should examine it carefully before signing and assure himself or herself that each statement is true and accurate, making diligent inquiry, as necessary, of all other persons employed by or associated with the bidder with responsibilities for the preparation, approval, or submission of this bid.

In the case of a bid submitted by a joint venture, each party to the venture must be identified in the bid documents, and an Affidavit must be submitted separately on behalf of each party.

The term "complementary bid" as used in the Affidavit has the meaning commonly associated with that term in the bidding process, and includes the knowing submission of bids higher than the bid of another firm, any intentionally high or noncompetitive bid, and any other form of bid submitted for the purpose of giving a false appearance of competition.

Failure to file an Affidavit in compliance with these instructions will result in disqualification of the bid.

NON-COLLUSION AFFIDAVIT

CONTRACT Boiler Replacement at the Neshaminy Maple Point Middle School

STATE OF Pennsylvania:

COUNTY OF Bucks:

I state that I am _____ of
(Title)

_____,
(Name of Firm)

and that I am authorized to make this affidavit on behalf of my firm, its owners, directors and officers. I am the person responsible in my firm for the price(s) and the amount of this bid.

I state that:

1. The price(s) and amount of this bid have been arrived at independently and without consultation, communication or agreement with any other contractor, bidder, or potential bidder.

2. Neither the price(s) nor the amount of this bid, and neither the approximate price(s) nor approximate amount of this bid, have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed before bid opening.

3. No attempt has been made or will be made to induce any firm or person to refrain from bidding on this contract, or to submit a bid higher than this bid, or to submit any intentionally high or noncompetitive bid or other form of complementary bid.

4. The bid of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid.

5. My firm, its affiliates, subsidiaries, owners, directors, officers and employees are not currently under investigation by any governmental agency and have not, in the last three (3) years, been convicted or found liable for any act prohibited by State or Federal law, in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract, except as follows:

   _____

6. A statement above that a person or firm has been so convicted or found liable does not prohibit

   _____
   (Name of Public Entity)

from accepting a bid from or awarding a contract to such bidder, but may be a ground for consideration by

_____
(Name of Public Entity)

on the question of declining to award a contract to the bidder on the basis of a lack of responsibility.

I state that _____
(Name of Firm)

understands and acknowledges that the above representations are material and important, and will be relied on by

_____
(Name of Public Entity)

in awarding the contract(s) for which this bid is submitted. I understand and my firm understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from

_____
(Name of Public Entity)

of the true facts relating to the submission of bids for this contract.

_____
(Signature)

_____
(Name and Title)

_____
(Name of Firm)

SWORN TO AND SUBSCRIBED BEFORE ME ON THIS

_____ DAY OF _____, 20___.

_____
(NOTARY PUBLIC)

MY COMMISSION EXPIRES ON: _____.

END OF SECTION 00480

INSTRUCTIONS AND GENERAL CONTRACT TERMS AND CONDITIONS

INSTRUCTIONS

For all bids exceeding Two Thousand Dollars ($2,000.00) a certified check, bank cashier's check, trust company treasurer's check or a Bid Bond from a surety company legally authorized to do business in the Commonwealth of Pennsylvania, and having the highest rating services, in an amount no less than ten percent (10%) of the total stated bid shall accompany the bid and shall be made payable to the Neshaminy School District. Such Guarantee or Bid Bond shall be forfeited to and retained by the School District as liquidated damages if the bid or any part thereof is accepted by the School District and the Bidder fails to carry out all of the provisions of the bid.

All bids will be publicly opened and read in the **Purchasing Department of the Neshaminy School District at 2001 Old Lincoln Highway, Langhorne, Pennsylvania** on the dates and times specified in the bid documents.

Award(s), if made, will be made to the lowest responsible Bidder for the separate bid selected and to include Alternate Bids, if any, which the School District chooses to accept and which results in the lowest aggregate bid. The determination of who constitutes the "lowest responsible Bidder" shall be within the sole discretion of the School District.

Bidders are expected to examine the specifications and all instructions. Failure to do so will be at the bidder's risk. ALL bids must conform to the specifications as listed.

> Bidder shall furnish the information required by the Bid Form. The bidder shall type or print his name on the lists and each continuation sheet thereof on which he makes an entry. Erasures or other changes must be initialed by the person signing the bid. The bid must be signed by an authorized officer or agent of the bidding company.
>
> No bid will be entertained unless properly made out in ink or typed, signed by the bidder and clearly marked on the envelope: **"SEALED BID - CHILLER REPLACEMENT AT JOSEPH FERDERBAR ELEMENTARY SCHOOL.**

In order to fully establish the extent of the work and all requirements incident to the work under this heading, the Contractor must visit the project site and attend the Mandatory Pre-Bid Meeting to be held on Friday, March 21, 2014, at The Joseph Ferderbar Elementary School located at 300 Height Lane, Feasterville, PA, 19053. Arrivals later than one half hour after announced starting time will not be accommodated. Bidder(s) shall review project site and are required to verify their own dimensions. Any questions concerning the work shall be addressed to the School Authority representative. Questions or clarifications will be answered in writing, by mail, to all in attendance.

Contractor shall complete all work from June 30th, 2014 and complete by August 15th, 2014. If the Contractor does not comply with construction schedules they will be declared "non responsible" and the contract/purchase order will be canceled. The work will be rebid and all additional costs will be the responsibility of the "non responsible" Contractor and deducted from their final payment.

AWARD OF CONTRACT

The School District reserves the right to reject any and all bids, or the waive informality in the bidding if it is in the interest of the School District to do so. Further, the School District reserves the right to make its award for one or for more of the articles set forth in the specifications or make its award for all of the articles set forth in these specifications.

Whenever two (2) or more bids of equal amounts are the lowest bids submitted by responsible Bidders the School District may award the bid to any one of such Bidders in its sole discretion. The School District has the right to select any and all of the bids, although they may not be awarded to the same bidding Contractor.

The award of the bid by the School District together with the issuance of a Purchase Order to the successful Bidder shall be deemed to result in a binding contract between the Bidder and the School District.

DESIGNATED PRODUCTS OR ARTICLES

If awarded the contract, the Bidder agrees to furnish and/or install the articles or products set forth in the bid specifications at such times, at such places and in such quantities as specified and all such articles and products shall be subject to the inspection and approval of the School District. In the event any of the articles or products shall be rejected as unsuitable or not in conformance with these specifications, such articles and products shall at once be removed and returned to the Bidder at his expense and other articles or products of proper quality set forth in these specifications shall be furnished in their place at the expense of the successful Bidder.

In the event that the successful Bidder neglects or refuses to furnish and deliver the articles or products or any part thereof as provided in the specifications or to replace any products or articles which are rejected by the School District, then the School District is authorized and empowered to purchase such articles or products in conformity with the bid specifications from such other party and in such quantities and in such manner as the School District shall select at the expense of the successful Bidder or to cancel this contract and reserve all rights for damages which may be incurred by the School District.

Approval of Materials: Where the bid specifications describe or specify a particular product or article, alternate bids covering articles or products equal in all respects are permitted, unless otherwise stated. Where a bid specification specifies an article or product and the Bidder intends to furnish another product or article which he considers equal, then the name and grade of the “equivalent” product or article must be identified in the Bid. Whenever an article or one class of material is specified by the trade name or the manufacturer, the bidder must submit an alternate or equivalent ten (10) days prior to his bid date for review and acceptance along with savings to the Engineer. In addition, the proposed Contractor must include all associated costs for redesign of the concrete foundation, mechanical work, electrical work, and equipment modification or details, as well as, Fire Marshall approval at his expense. All of this must be done in an expeditious manner so that the schedule for delivery of the equipment is not modified. The Contractor must be aware of the importance of delivery of this equipment within the time constraints, to insure completion of the overall project.

The “Equivalent” must be equal in quality, finish and durability and be equally as serviceable for the purpose intended. Final determination of equality is wholly reserved to the School District / Engineer and its representatives.

With respect to any such articles or products, the Bidder shall be responsible for notifying the School District of any price advantage to the School District if the order of any such articles or products are increased to the next higher price or break point for that article or product. Should such price break point exist, such notice shall be given at the time the bid is submitted.

The School District is exempt from the payment of excise taxes and should the Bidder desire to be exempt from such tax, then the Bidder agrees to present, to the School District, properly prepared exemption certificates for execution. Such certificates will be presented only for articles or products furnished under the bid, will list the articles or products and their quantities and will state the names and addresses of the manufacturers and suppliers of such articles and products which are subject to excise tax.

LIQUIDATED DAMAGES

All work required to be performed under the bid specifications shall be started within ten (10) days from date of Purchase Order or notice to proceed, if this is applicable, and shall be completed in accordance with the bid specifications by the guaranteed completion date. Should the Bidder fail to complete the work before the expiration of the completion date set forth in the bid specifications, the Authority will then back charge the bidder the sum of Four Hundred Dollars ($400.00) per day for each calendar day the work remains uncompleted after the completion date. The parties agree that said sum is a proper measure of liquidated damages which the Authority shall sustain per diem as a result of the failure of the Bidder to complete the work within the time required. In no event shall this sum be construed as any form of penalty being imposed upon the Bidder. Liquidated damages shall be assessed after completion date of August 15th, 2014.

Should the Bidder be delayed in the completion of the work set forth in the bid specifications by reason of unforseen circumstances beyond his control and without his fault or negligence, including but not limited to acts of God or of the public enemy, acts of neglect of the School District, acts of other contractors, if any, fires, floods, epidemics, strikes, civil disturbances or freight embargos, the date specified in the bid specifications as the completion date shall be extended by such times as shall be fixed by the Authority, provided however, that any and all claims for extensions of time shall be made by the Bidder in writing within five (5) days after the termination of the event for which the Bidder seeks an extension of time. Otherwise, any claim for an extension by reason of said event shall have been waived by the Bidder.

INSURANCE, INDEMNIFICATION AND STATUS OF PARTIES

The Bidder shall not commence work until he has obtained all insurance required hereunder from carriers legally authorized to do business in the Commonwealth of Pennsylvania and assigned the highest rating available from independent rating services, nor shall the Bidder allow any Subcontractor to commence work on his subcontract until all similar insurance required of the Subcontractor has been so obtained. In this regard, the Bidder shall be required to maintain the following insurance during the term of this contract:

Workers' Compensation Insurance coverage to be statutory for all of his employees employed at the site of the project, and in case any work is sublet, the Bidder shall require the Subcontractor to provide similar Workers' Compensation for all of the Subcontractor's employees unless such employees are covered by the protection afforded by the Bidder.

Public Liability and Property Insurance in an amount of not less than One Million Dollars ($1,000,000.00) for injuries, including accidental death, to any one (1) person, and subject to the same limit for each person in an amount not less than One Million Dollars ($1,000,000.00) on account of one accident, and insurance property damage in an amount not less than One Million Dollars ($1,000,000.00), provided however, that the Authority may accept insurance covering a subcontractor in amounts less than the requirements set forth herein where such requirements appear excessive because of the extent of the work to be performed by such subcontractors. All required by this paragraph shall be secured through a policy providing coverage on an "occurrence basis".

Public Liability and Property Motor Vehicle Insurance in an amount not less than One Million Dollars ($1,000,000.00) for personal injury, One Hundred Thousand Dollars ($100,000.00) for property damage.

Proof of Workers' Compensation Insurance effective for the duration of the work to be performed, must be provided prior to the commencement of work.

Prior to the commencement of any work, Certificates of Insurance evidencing such insurance shall be supplied to the School District. Such Certificates shall also provide that at least thirty (30) days prior notice be given to the School District of the cancellation of such insurance. The insured is the Neshaminy School District.

Conditions

All certificates to contain thirty (30) day notice of cancellation.

It is the obligation of the Bidder to obtain and furnish Certificates for any subcontractors subject to the above terms and conditions.

All insurance policies and/or bonds will be written with insurance companies licensed to do business in the Commonwealth of Pennsylvania and subject to the approval of the School District.

On larger contracts, an umbrella liability policy will be provided with a minimum limit of $3,000,000.00.

Notwithstanding anything to the contrary set forth herein or the acquisition of the insurance described herein, the Bidder hereby agrees to indemnify and hold the Neshaminy School District harmless from and against any and all liability, loss, damage, cost and expense, including court costs and attorney's fees, (Whether or not litigation be commenced) of whatever nature or type, that the School District may hereafter suffer or incur by reason of:

Any injury or harm sustained or reported to have been sustained by any person, including the employees of the Bidder, as a result of the work, duties or obligations being performed by the Bidder under the Bid Specifications;

Any other act or omission of the Bidder, its agents, representatives or employees, including but not limited to Subcontractors or laborers who are on any structure or real property of the Neshaminy School District during the course of the work being performed under the Bid Specifications; or

Any breach or default of the Bidder in the performance of the work, duties and obligations set forth in the Bid Specifications.

In performing the work set forth in the Bid Specifications, the Bidder will at all times be acting and performing as an independent contractor and not as an employee of the School District. The School District shall neither have nor exercise any control or direction over the methods utilized by the Bidder and the sole interest of the School District is to insure that the work set forth in the Bid Specifications is performed by the Bidder in a competent, efficient and satisfactory manner.

In the event contractor breaches or defaults under this contract or fails to perform fully with respect to the specifications set forth herein, the Neshaminy School District shall be entitled to not only the damages for such breach, default or failure to perform, but also its reasonable attorneys' fees, costs and expenses, including but not limited to expert witness fees, in order to remedy the breach, default or failure to perform.

PROTECTION AND NON-INTERFERENCE WITH DISTRICT'S OPERATIONS

The Bidder shall be responsible for the protection of the buildings, facilities and improvements within the areas where the work is being performed. Any disturbance or damage to the work being performed by the Bidder or to the existing building, improvements or equipment or any other impairment of the facilities resulting from the Bidder's performance, shall be promptly restored, repaired or replaced by the Bidder at no extra cost to the School District.

Each Bidder shall be responsible for performing his work in such a manner so as to maintain essential ingress and egress for visitors and occupants to the buildings and facilities and to continuously maintain all required emergency exits from and circulation between existing facilities. Passageways for emergency exits shall be kept continuously open and free from debris, construction equipment, tools, materials or other hazards. The Bidder shall provide all necessary temporary work which may be required to maintain all such ingress, egress and circulation requirements. The Bidder shall be responsible for providing coordination of this temporary work between himself and all Subcontractors and all temporary work shall be removed when no longer required.

Each Bidder shall commence the work and so schedule his work so as to avoid interference with the School's operations. Unavoidable interference with the School's operations shall not be carried out without the School District's approval obtained not less than forty-eight (48) hours prior to the anticipated interference. The bidder is advised that the School's operations during the school year are on an eight-hour day, five days per week basis.

To insure non-interference with the School's operation during the performance of the work, the Bidder shall remove from the buildings, facilities and improvements where the work is being performed all trash, combustible materials and debris of all kind being created during the performance of the work and upon completion of the work. This obligation shall also include all debris created by any subcontractors or men engaged by the Bidder in performing the work. Such debris shall be disposed of off-site by the Bidder.

PAYMENT, PERFORMANCE, AND MAINTENANCE BOND

The Bidder shall promptly pay all laborers and mechanics employed for the work set forth in the Bid Specifications as well as for all materials. Before final payment is made, the Bidder shall furnish the School District with satisfactory evidence that all labor and materials have been paid. Such evidence may include but not be limited to General Releases and/or Releases of Liens duly signed by the Bidder and any Subcontractors or material men.

Upon acceptance of the bid by the Neshaminy School District, the School District shall give written notice to the Bidder of its intention to accept the bid and to award a contract to him through the issuance of a Purchase Order. Upon receiving such notice and as a condition precedent to the awarding of a contract, the Bidder shall be required to furnish to the School District from surety companies legally authorized to do business in the Commonwealth of Pennsylvania and having the highest ratings available from independent rating services, the following Bonds as required by Pennsylvania law:

Performance Bond or Certified Check in an amount equal to one hundred percent (100%) of the contract price, conditioned upon the faithful performance by the Bidder of the contract and the plans, specifications and conditions of the Contract.

A Payment Bond or Certified Check in an amount equal to one hundred percent (100%) of the contract price so as to protect those supplying labor or materials to the Bidder or to any of the Bidder's Subcontractors.

A Maintenance Bond or Certified Check in an amount equal to one hundred percent (100%) of the contract price, conditioned upon the faithful performance by the Bidder to remedy, without cost to the Owner, any break of warranty and/or defects which may develop during a period of two (2) years from the date of finial completion and acceptance of all the work performed under this contract.

The Bidder shall be required to file such Bonds or Certified Checks in the office of the Business Administrator within five (5) days of the School District's written notice to proceed or issuance of purchase order, whichever occurs first.

SCOPE OF WORK, WORKMANSHIP AND WARRANTY

The School District reserves the right to change, increase or reduce the work as set forth in the Bid Specifications and in such event shall notify the Bidder in writing, provided suitable adjustment is made in the original contract price. Further, the School District reserves the right to increase or decrease the quantity of any products or articles being installed as part of the work without affecting the unit price set forth in the Bid Specifications.

In performing the work, the Bidder agrees to fulfill all requirements with respect to the installation of any products or articles and hereby acknowledges that the Bid has been quoted on an installed basis. The Bidder acknowledges that he has accepted the responsibility for having visited the work site and familiarizing himself with all conditions which may affect such installation. The Bidder shall supply all material, tools, equipment, transportation, labor, supervision which may be required to complete the installation of such articles or products in a complete and approved manner.

All work shall be performed in a good and workmanlike manner and, when completed, shall show no signs of carelessness as a result of the work. During the term of the contract, all work and materials shall be subject to the inspection and approval of the School District and the School District reserves the right to reject any work or materials which in its judgement do not fulfill the requirements of the Bid Specifications.

All persons employed by the Bidder to perform the work required by the Bid Specifications shall be competent and first class workmen and mechanics as required by Section 752 of the Pennsylvania School Code of 1949, as amended.

The Bidder shall furnish to the School District, a written guarantee certifying that all defects in workmanship, materials or construction for a period of two (2) years from the date of issuance of final payment shall be corrected and repaired diligently and effectively but in no event later than thirty (30) days after Bidder's receipt of a written notice from the School District identifying such defect. All such corrections and repairs shall be performed by the Bidder at no additional cost to the School District.

The Contractor must submit documentation with his bid certifying that he has been actively engaged in this type of work for at least five (5) consecutive years.

SUBCONTRACTORS

Definition:

A Subcontractor is a firm or corporation or entity who has a direct Contract with the Contractor to perform any of the Work at the site. The term Subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative. The term Subcontractor does not include any separate Contractor or his Subcontractors.

A Sub-subcontractor is a person, firm or corporation who has a direct or indirect Contract with a Subcontractor to perform any of the Work at the site. The term Sub-subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Sub-subcontractor or any authorized representative thereof.

Award of Subcontracts and Other Contacts for Portions of the Work:

Unless otherwise required by the Contract Documents or the Bidding Documents, the Contractor, as soon as practicable after the award of the Contract and not later than fifteen (15) days after official Notice to Proceed, shall furnish to the Owner, through the Project Engineer in writing, the names of the persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each of the principal portions of the Work. The Project Engineer will promptly reply to the Contractor, in writing, stating whether or not the Owner or the Project Engineer has reasonable objection to any such proposed person or entity. Failure to reply promptly shall constitute notice of no reasonable objection.

The Contractor shall not contract with any such proposed person or entity to whom the Owner or the Project Engineer has indicated reasonable objection. The Contractor shall not be required to contract with anyone to whom he has a reasonable objection.

If the Owner or the Project Engineer has reasonable objection to any such proposed person or entity, the Contractor shall submit a substitute to whom the Owner or the Project Engineer has no reasonable objection, and the occasioned by such substitution, and an appropriate supplement shall be issued; however, no increase in the Contract sum shall be allowed for any such substitution unless the Contractor has acted promptly and responsively in submitting names as required.

The Contractor shall make no substitution for any Subcontractor, person or entity previously selected if the Owner or Project Engineer makes reasonable objection to such substitution.
If the contractor should list his name as performing certain listed subcontract Work, he shall be required to establish to the satisfaction of the Owner, through the Project Engineer, that he has performed this subcontract Work on previous projects and furnish a certified statement to this effect.

Subcontractual Relations:

By written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents assumes toward the Owner and Project Engineer. Said agreement shall preserve and protect the rights of the Owner, Project Engineer and the Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor, so that the Contractor-Subcontractor agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with his Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract, copies of the Contract Documents to which the Subcontractor will be bound by this Subcontractor any terms and conditions of the proposed subcontract which may be at variance with the Contract Documents. Each Subcontractor shall similarly make copies of such Documents available to his Sub-subcontractors.

Contractor shall be held responsible for assuring that his Subcontractors comply with Pennsylvania Workers' Compensation Act's provisions, including the Contractor's responsibility to Sections 203 and 302.

Payment to Subcontractors:

The Contractor shall pay each Subcontractor, upon receipt of payment from the Owner, an amount equal to the percentage of completion allowed to the Contractor on account of such Subcontractor's Work. The Contractor shall also require each Subcontractor to make similar payments to his Sub-subcontractors.

If the Project engineer fails to issue a Certificate for Payment for any cause which is the fault of the Contractor and not the fault of a particular Subcontractor, the Contractor shall pay that Subcontractor on demand, make at any time after Certificate for Payment should otherwise have been issued, for his Work to the extent completed, less the retained percentage.

The Contractor shall pay each Subcontractor a just share of any insurance monies received by the Contractor, and he shall require each Subcontractor to make similar payments to his Sub-subcontractors.

The Project Engineer may, on request and at his discretion, furnish to any Subcontractor, if practicable, information regarding percentages of completion certified to the Contractor on account of Work done by such Subcontractors.

Neither the Project Engineer nor the Owner shall have any obligation to pay or to effect the payment of any monies to any Subcontractor or Sub-subcontractor, except as may otherwise be required by law.

PAYMENT SCHEDULE AND FINAL PAYMENT

Payment to the Bidder of the contract price shall occur in accordance with the following schedule. This specification does not provide for periodic payments based upon a percentage of the work completed . Full payment will be made within forty-five (45) days upon completion of the work and receipt of all required documentation.

The acceptance by the Bidder of the final payment shall constitute a release of the School District by the Bidder with respect to all claims and all liability which the Bidder may assert against the School District, directly or indirectly, as a result of this contract including but not limited to any act or omission on the part by the School District relating to or arising out of the work under the contract, excepting the Bidder's claim for interest upon the final payment if the final payment is improperly delayed. However, the Bidder's acceptance of the final payment does not operate as a release of the Bidder and his sureties form any obligations under this contract with the School District or under the Performance Bond.

SITE INSPECTIONS, PERMITS AND REGULATORY REQUIREMENTS

It will be the Bidder's responsibility to visit the site of the work prior to submitting his Bid so as to fully inform himself as to all of the conditions concerning construction and labor under which the work is to be performed including all rules, regulations and directives of all local, state and federal agencies having jurisdiction over the work. In this regard, all work shall be performed in accordance with all such applicable rules, regulations and directives which are incorporated herein by reference and made a part hereof.

The Bidder shall secure and pay for all permits required by all local, state and federal agencies having jurisdiction over the work, including but not limited to fees, licenses and inspections necessary for the proper performance and completion of the work.

ACCESS TO RECORDS

The Owner shall be afforded access to all of the Contractor's accounting records relating to this Contract, and the Contractor shall preserve all such records for a period of three years or longer as may be required by law after the final payment.

SALES AND USE TAX

The contractor agrees to assign and transfer to the Owner all its rights to sales and use tax which may be refunded as a result of a claim for refund for materials purchased in connection with this Contract. The Contractor agrees to require any Subcontractors to provide access to the Owner of accounting records relating to this contract and to obtain their agreement not to seek refund for any sales or use tax which is the subject of this assignment.

NON-COLLUSION AFFIDAVIT

Included in the specification packet is a “Non-Collusion Affidavit.” The bidder must execute this document, have it notarized and submit it, attached to the FORM OF PROPOSAL. Failure to comply with this provision will disqualify the bidder.

STATUTORY REQUIREMENT/GOVERNMENT REQUIREMENTS

In accordance with Section 755 of the Public School Code of 1949, as amended, the Pennsylvania Human Relations Act of 1955, as amended, the regulations of the Pennsylvania Human Relations Commission and the Governor’s Code of Fair Practice, neither the Bidder, Subcontractor, nor any person acting on behalf of the Bidder or Subcontractor shall discriminate or permit discrimination or intimidation of any employee hired for the performance of the work on the basis of race, color, religion or natural origin. Further, the School District reserves the right to deduct from the Contract price a penalty of Five Dollars ($5.00) for each calendar day during which such person was discriminated against or intimidated in violation of the foregoing provision and/or cancel its Contract with the bidder so that all money due or to become due under the Contract may be forfeited for a second or subsequent violation. Further, pursuant to the requirements of the Pennsylvania Human Relations Act, the Bidder agrees to comply with all requirements set forth therein and hereby acknowledges the remedies available to the School District in the event of a violation of such Act.

In accordance with Section 754 of the Public School Code of 1949, as amended and Act No. 182 of 1985, all laborers and mechanics employed by the Bidder under the contract shall be citizens of the United States and shall have been residents of the Commonwealth of Pennsylvania for at least ninety (90) days prior to their employment. The Bidder is notified that failure to comply with this provision shall be sufficient legal reason for the School District to refuse payment of the contract price to the Contractor.

In accordance with Section 10.F. of the Municipal Authorities Act, as amended; Section 751 of the Public School Code of 1949, as amended, and Section 1884 of the Steel Products Procurement Act of 1978, as amended, the Bidder agrees that if any steel products are to be used or supplied in the performance of the work set forth in the Bid Specifications, then such products shall be used or supplied in accordance with the terms of said Acts and any regulations issued pursuant thereto. Further, the Bidder acknowledges that the School District shall have available any and all remedies set forth in said Acts for a violation of said Acts or any regulations issued pursuant thereto.

In accordance with Section 111 of the Public School Code of 1949, as amended, the Bidder shall be required to submit for each of its employees as well as the employees of all Subcontractors engaged by the Bidder a report of criminal history information from the Pennsylvania State Police or a statement from the State Police that the State Police central repository contains no such information relating to an employee. The report or statement shall be no more one (1) year old and the Bidder must submit an original of the document before commencing any work under the contract. Should any employees of the bidder or any Subcontractor not be residents of the Commonwealth of Pennsylvania, then for such employees a report or statement of federal criminal history from the Federal Bureau of Investigation shall be submitted and such report or statement shall be no more than one (1) year old.

In accordance with House Bill Number 1969 enacted into law, Act No. 247 became effective on November 25, 1972. It requires that Bidders on construction contracts for the Commonwealth of Pennsylvania be advised of those provisions of Federal and State statutes, rules and regulations dealing with the prevention of environmental pollution and the preservation of public natural resources that affect the project on which bids are being received.

In accordance with Section 753 of the Public School Code of 1949 as amended and Section 165-1 to Section 165-17 of the Prevailing Wage Act, the Bidder shall pay all wage rates required by said Acts and comply with all reporting requirements of said Acts or any regulations issued pursuant thereto so as to insure that the laborers and mechanics employed to perform the work specified under the contract shall be paid at the rates required.

Pennsylvania Child Abuse History Clearance: See pages at the end of this section.

SPECIFICATIONS - CHILLER REPLACEMENT AT THE JOSEPH FERERBAR ELEMENTARY SCHOOL

GENERAL

It is the intent of this specification to be used as a guide by the bidder to establish a standard of quality for materials to be used on this project. It does not relieve the successful bidder from furnishing and properly installing all material that may be necessary for the completion of the work as determined by the Neshaminy School District.

STATUS OF THE PARTIES

In the performance of the work, duties and obligations assumed by the Contractor under these specifications, Contractor will at all times be acting and performing as an independent Contractor and not as an employee of the School District. The School District shall neither have nor exercise any control or direction whatsoever over the methods utilized by the Contractor. The sole interest and responsibility of the School District is to insure that the work, duties and obligations set forth in the bid specifications shall be performed and rendered by the Contractor in a competent, efficient and satisfactory manner.

INDEMNIFICATION

Contractor hereby agrees to indemnify and hold the Neshaminy School District and Consolidated Engineers harmless from and against any and all liability, loss, damage, cost and expense including court costs and attorney's fees (whether or not litigation be commenced) of whatever nature or type that the School District may hereinafter suffer or incur by reason of:

Any injury or harm sustained or purported to have been sustained by any person including the employees of the Contractor as a result of the work, duties or obligations being performed by the Contractor under the bid specifications.

Any other act or omission of the Contractor, its agents, representatives or employees including but not limited to Subcontractors or laborers who are on any structure or real property of the Neshaminy School District, during the course of work being performed under the bid specifications.

Any breach or default of the Contractor in the performance of the work, duties and obligations set forth in the bid specification.

INSTRUCTIONS TO BIDDERS

Bidders are expected to examine the specifications and all instructions. Failure to do so will be at the bidder's risk.

Bidder shall furnish the information required by the bid form. The bidder shall type or print his name on the lists and each continuation sheet thereof on which he makes an entry. Erasures or other changes must be initialed by the person signing the bid. The bid must be signed by an authorized officer or agent of the bidding company.

No bid will be entertained unless properly made out in ink or typed, signed by the bidder and clearly marked on the envelope:

"SEALED BID - "CHILLER REPLACEMENT AT THE JOSEPH FERERBAR ELEMENTARY SCHOOL"

Bids and modifications or withdrawals thereof received after the time set for opening same will not be considered.

In order to fully establish the extent of the work and all requirements incidental to the work under this heading, the Contractor must visit the project site and attend the pre-bid meeting to be held on Friday, March 21st, 2014 at 10:00 am, at The Joseph Ferderbar Elementary School located at 300 Height Lane, Feasterville, PA, 19053. Attendance by a representative of each bidding company is mandatory. Bidder(s) shall review project site, and any questions concerning the work shall be addressed to the School District representative. Questions or clarifications will be answered in writing, by mail, to all in attendance.

Sealed bids will be received at the Office of the Purchasing Department, Mr. Tom Sizgorich, 2001 Old Lincoln Highway, Langhorne, Pennsylvania 19047, until **Friday, April, 4th, 2014 at 10:00 AM prevailing time.**

The award of the contract by the Neshaminy School District and issuance of a purchase order to the successful bidder shall be deemed to result in a binding contract.

Whenever a particular make of material is shown or specified, such make of material shall be regarded as a standard. Any other make of material will be accepted which is comparably equal to the specified quality, workmanship, economy in operation and suitability for the purpose intended.

The successful Bidding Contractor will carry out all rehabilitation work in strict accordance with the specifications, and any work not conforming will be reinstated or replaced at the Contractor's expense.

ALL bids must conform to the specifications as listed.

The right to reject any one or all bids or any materials furnished which are not in strict compliance with the requirements of the specifications is a privilege reserved by the School District.

Bidding Contractors are required to visit all sites and verify all dimensions.

The job shall proceed in a workmanlike manner and when completed, the areas shall show no signs of carelessness as a result of this work.

The Contractor shall take all necessary precautions to avoid injury or damage to buildings, driveways, sidewalks and lawns.

Every precaution shall be made to protect the facilities during the course of the work. ALL damage that occurs will be completely restored to the satisfaction of the School District before final payment will be made.

The School District reserves the right to change, increase or reduce the work as necessary and in such event, shall notify the Contractor in writing, provided suitable adjustment is made in the original contract price.

The Contractor shall furnish to the School District a written guarantee certifying that all defects in the materials and workmanship that occur from natural wear and tear in connection with equipment installed as part of this contract, within a period of two (2) years from the date of acceptance, shall be corrected and repaired diligently and effectively at no additional cost to the School District.

All bids must be accompanied by a bid bond in the amount of 10% of bid or certified check in the amount of 10% of the bid.

Contractor awarded this work shall furnish evidence of full insurance coverage including workers' compensation, public liability and property damage.

Each contractor shall be required to furnish and pay for a performance bond, payment bond and maintenance bond, each in the amount of 100% of the contract price. Sureties shall be satisfactory to the School District. The School District shall give written notice to the Contractor of intention to accept his proposal and to award a contract to him in accordance with his proposal, whereupon the Contractor shall furnish such bonds to the School District within such period as required hereby and by Pennsylvania law.

DEFINITIONS

"Owner": Neshaminy School District.

AIA DOCUMENTS

By reference, the following AIA documents shall be a part of this contract:

A-101	Standard Form of Agreement Between Owner and Contractor
A-201	General Conditions
A-305	Contractor's Qualification Statement
A-310	Bid Bond
A-312	Performance Bond and Payment Bond
G-701	Change Order
G-702/703	Application and Certificate for Payment
G-704	Certificate of Substantial Completion
G-705	Certificate of Insurance
G-706	Contractor's Affidavit of Payment of Debts and Claims
G-706A	Contractor's Affidavit and Release of Liens
G-707	Consent of Surety Company to Final Payment
G-710	Architect's Supplemental Instructions
G-713	Construction Change Authorization

END OF SECTION

PENNSYLVANIA CHILD ABUSE HISTORY CLEARANCE

COMPLETE SECTION I ONLY. PRINT CLEARLY IN INK. ENCLOSE $10.00 MONEY ORDER ONLY. PAYABLE TO DEPARTMENT OF PUBLIC WELFARE. DO NOT SEND CASH OR PERSONAL CHECK.

SEND TO CHILDLINE AND ABUSE REGISTRY, DEPARTMENT OF PUBLIC WELFARE, P.O. BOX 8170 HARRISBURG, PA 17105-8170

APPLICATIONS THAT ARE INCOMPLETE ILLEGIBLE OR RECEIVED WITHOUT FEE WILL BE RETURNED UNPROCESSED. IF YOU HAVE QUESTIONS CALL 717-783-6211

CHILDLINE USE ONLY

DATE RECEIVED BY CHILDLINE

SECTION I — APPLICANT IDENTIFICATION

IN THIS SPACE PRINT APPLICANTS FULL NAME AND ADDRESS (DO NOT USE INITIALS)

NAME

STREET

CITY, STATE
ZIP CODE

SOCIAL SECURITY NUMBER

AGE	DATE *OF* BIRTH	DAYTIME PHONE NO.
SEX ☐ M ☐ F	COUNTY YOU LIVE IN	

PREVIOUS NAMES USED SINCE 1975 (Include Maiden Name, Nicknames, Aliases)

(FIRST, MIDDLE, LAST)		(FIRST, MIDDLE, LAST)

PURPOSE OF CLEARANCE (Check ONE block ONLY)

☐ CHILD CARE
☐ FOSTER CARE
☐ ADOPTION
☐ SCHOOL

☐ VOLUNTEERS-A copy of your PROCESSED 'Request for Criminal Record'' (Form SP4-164) must be attached. Out-of-state residents must also attach a copy of their PROCESSED FBI clearance (Form FID-258).

☐ CWEP (Community Work Experience Program Participant)

SIGNATURE OF CAO REP — CAO PHONE NO

PREVIOUS ADDRESSES SINCE 1975 (Attach additional pages if necessary)

1.
2.
3.
4.

HOUSEHOLD MEMBERS (List everyone who lived with you at anytime since 1975 to the present).

NAME (First, Middle, Last) Do not use initials.	RELATIONSHIP	PRESENT AGE	SEX
1.			
2.			
3.			
4.			
5.			
6.			

I certify that the above information is accurate and complete to the best of my knowledge and belief and submitted as true and correct under penalty of law (Section 4904 of the Pennsylvania Crimes Code).

Applicants are required to show the Administrator the original document. Administrators are required to keep a copy of this child abuse history record on file. Any person altering the contents of this document may be subject to civil, criminal or administrative action.

APPLICANT'S SIGNATURE — DATE

DO NOT WRITE IN THIS SECTION - CHILDLINE USE ONLY

SECTION II — RESULTS OF HISTORY CHECK

☐ APPLICANT IS **NOT** LISTED IN A REPORT OF CHILD ABUSE OR A REPORT FOR SCHOOL EMPLOYEE.

☐ APPLICANT **IS** LISTED IN A REPORT OF CHILD ABUSE OR A REPORT FOR SCHOOL EMPLOYEE (SEE BELOW).

STATUS OF REPORT	DATE OF INCIDENT	STATUS OF REPORT	DATE OF INCIDENT
1.		3.	
2.		4.	

VERIFIER — DATE

VERIFIER'S SUPERVISOR — DATE

DO NOT WRITE IN THIS SECTION - CHILDLINE USE ONLY

SECTION III

VOLUNTARY CERTIFICATION FOR CHILD CARE SERVICES

_____ **has requested a certification which includes a clearance of his/her name against the child abuse, school employee, and criminal history reports.**

The results of the child abuse and school employee report clearances are listed in Section II on the reverse side. The results of the criminal history reports are listed below. Out-of-state residents must have criminal history clearance from both the Pennsylvania State Police and the FBI. The voluntary certification may be obtained every two years.

It is the responsibility of **parents** and **guardians to review this information to determine the suitability of the applicant as a substitute caregiver.**

PENNSYLVANIA CHILD ABUSE HISTORY CLEARANCE

- ☐ **Applicant is named as the perpetrator of a ''Founded'' child abuse or school employee report which occurred in the last five years.**
- ☐ **Applicant is named as the perpetrator of a ''Founded'' child abuse or school employee report which occurred over five years ago.**
- ☐ **Applicant is named as the perpetrator of an ''Indicated'' child abuse or school employee report.**
- ☐ **Applicant is not named as the perpetrator of any child abuse or school employee report contained in the Statewide Central Register.**

PENNSYLVANIA STATE POLICE CLEARANCE

- ☐ **Record exists and contains convictions which prohibit hire in a child care position. Report attached.**
- ☐ **Record exists, but convictions do not prohibit hire in a child care position. Report attached.**
- ☐ **Record exists, but no convictions are shown. This does not prohibit hire in a child care position. Report attached.**
- ☐ **No record exists. Report attached.**

FBI CLEARANCE

- ☐ **Record exists and contains convictions which prohibit hire in a child care position. Report attached.**
- ☐ **Record exists, but convictions do not prohibit hire in a child care position. Report attached.**
- ☐ **Record exists, but no convictions are shown. This may not prohibit hire in a child care position. Report attached.**
- ☐ **No record exists. Report attached.**
- ☐ **No FBI clearance required.**

VERIFIER	DATE	VERIFIER'S SUPERVISOR	DATE

SP 4-164 (12-99)

FOR CENTRAL REPOSITORY USE ONLY
(LEAVE BLANK)

PENNSYLVANIA STATE POLICE

REQUEST FOR CRIMINAL RECORD CHECK

PART I: TO BE COMPLETED BY REQUESTER
(INFORMATION WILL BE MAILED TO REQUESTER ONLY)

DATE OF REQUEST

***** TYPE OR PRINT LEGIBLY WITH INK *****

NOTE: IF THIS FORM IS NOT LEGIBLE OR NOT PROPERLY COMPLETED IT WILL BE RETURNED UNPROCESSED TO THE REQUESTER. A RESPONSE MAY TAKE THREE WEEKS OR LONGER TO PROCESS.

WARNING: A PERSON COMMITS A MISDEMEANOR OF THE THIRD DEGREE IF HE/SHE MAKES A WRITTEN FALSE STATEMENT, WHICH HE/SHE DOES NOT BELIEVE TO BE TRUE.

REQUESTER NAME	
ADDRESS	
CITY	STATE ZIP

CONTACT TELEPHONE NUMBER INCLUDING AREA CODE)

[ ][ ][ ] - [ ][ ][ ] - [ ][ ][ ][ ]

REQUESTER IDENTIFICATION (ONLY CHECK ONE BLOCK)

☐ INDIVIDUAL/NONCRIMINAL JUSTICE AGENCY- ENCLOSE A CERTIFIED CHECK/MONEY ORDER IN THE AMOUNT OF $10.00 PAYABLE *TO:* *"COMMONWEALTH OF PENNSYLVANIA."* THE FEE IS NONREFUNDABLE.

☐ FEE EXEMPT NONCRIMINAL JUSTICE AGENCY

***** DO NOT SEND CASH OR PERSONAL CHECK *****

NAME/SUBJECT OF RECORD CHECK (LAST)	(FIRST)	(MIDDLE)

MAIDEN NAME AND/OR ALIASES	SOCIAL SECURITY NUMBER (SOC)	DATE OF BIRTH (DOB)	SEX	RACE

REASON FOR REQUEST (CHECK ONE BLOCK)

☐ EMPLOYMENT (IF APPLICABLE, CHECK ONE OF THE FOLLOWING) ☐ ELDER CARE ☐ CHILD CARE ☐ SCHOOL DISTRICT

☐ ADOPTION/FOSTER CARE

☐ OTHER (SPECIFY)

ONLY CHECK THIS BLOCK IF YOU WANT TO REVIEW *YOUR ENTIRE* CRIMINAL HISTORY

☐ INDIVIDUAL ACCESS AND REVIEW OR FIREARMS CHALLENGE-ENTIRE CRIMINAL HISTORY
(AVAILABLE ONLY TO SUBJECT OF RECORD CHECK OR LEGAL REPRESENTATIVE WITH LEGAL AFFIDAVIT OF LEGAL REPRESENTATIVE ATTACHED)

REQUESTER CHECKLIST

DID YOU ENTER THE FULL NAME, DOB, AND SOC?

DID YOU ENCLOSE THE $10.00 FEE (CERTIFIED CHECK/MONEY ORDER)?

***** DO NOT SEND CASH OR PERSONAL CHECK *****

DID YOU ENTER YOUR COMPLETE ADDRESS INCLUDING ZIP CODE AND TELEPHONE NUMBER IN THE BLOCKS PROVIDED?

AFTER COMPLETION MAIL TO

PENNSYLVANIA STATE POLICE
CENTRAL REPOSITORY - 164
1800 ELMERTON AVENUE
HARRISBURG, PA 17110-9758
717-783-9973
BUSINESS HOURS 8:15 am - 4:15 pm (Monday - Friday)

PART II: CENTRAL REPOSITORY RESPONSE ONLY

******DO NOT WRITE BELOW THIS LINE******

INFORMATION DISSEMINATED

☐ NO RECORD ☐ CRIMINAL RECORD ATTACHED

INQUIRY DISSEMINATED BY SID NUMBER

THE INFORMATION DISSEMINATED BY THE CENTRAL REPOSITORY IS BASED ON THE FOLLOWING IDENTIFIERS THAT MATCH THOSE FURNISHED BY THE REQUESTER.

☐ NAME ☐ SOCIAL SECURITY NUMBER
☐ DATE OF BIRTH ☐ RACE
☐ SEX ☐ MAIDEN/ALIAS NAME

CERTIFIED BY

(DIRECTOR, CENTRAL REPOSITORY)

This response is based on a comparison of data provided by the requester in Part I against the information contained in the files of the Pennsylvania State Police Central Repository only, and does not preclude the existence of criminal records which might be contained in the repositories of other local, state, or federal criminal justice agencies.

MAINTENANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS, That we, the undersigned

_____

_____
as Principal and

_____
(Surety Company)

_____
(Address)

a corporation organized and existing under the laws of the State of and authorized to transact business in Pennsylvania, as Surety, are held and firmly bound unto

Neshaminy School District
1200 Langhorne-Newtown Road
Langhorne, Pennsylvania 19047

as hereinafter set forth, in the full and just sum of

100% accepted alternate amount
_____Dollars ($ _____), for maintenance as designated below; lawful money of the United States of America, to be paid to the Neshaminy School District, its successors or assigns, to which payment, well and truly to be made and done, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

Sealed with our respective seals and dates this _____ day of _____, 20____.

WHEREAS, the above bounden Principal has entered into a contract with

Neshaminy School District
1200 Langhorne-Newtown Road
Langhorne, Pennsylvania 19047

dated the _____ day of _____, 20____, for

Chiller Replacement at the Joseph Ferderbar Elementary School, Bid No. 15-23.

upon certain terms and conditions in said contract more particularly mentioned; and WHEREAS, it is one of the conditions of the award of the Neshaminy School District, pursuant to which said contract is about to be entered into, that these presents be executed.

NOW, THEREFORE, the joint and several conditions of this obligation are such:

That, if the above bounden Principal shall remedy without cost to the Neshaminy School District any break of service and/or default of full responsibility from the end date of initial two (2) year Project warranty; provided, in the judgment of the Neshaminy School District or its successors having jurisdiction in the premises, such defects are caused by defective or inferior materials or workmanship, then this part of this obligation shall be void; otherwise, it shall be and remain in full force and effect. The duties and responsibilities incurred by the Principal pursuant to said Maintenance Bond shall in no way absolve the Principal of any duty, responsibility or obligations vested in the Neshaminy School District.

Recovery by any persons, co-partnership, association, or corporation hereunder shall be subject to the provisions of the Act of December 20, 1967, P.L. 869, Act No. 385 (8 P.S. 191 ET SEQ), as amended, which Act is incorporated herein and made a part hereof, as fully and completely as though its provisions were fully and at length herein recited, except that, where said Act refers to the Commonwealth of Pennsylvania or a Department thereof, it shall be deemed to refer to the State System of Higher Education.

IN WITNESS WHEREOF, the said Principal and Surety have duly executed this Bond under seal the day and year above written.

WITNESS:

_____ _____(SEAL)
Principal - Individual

(CORPORATE SEAL) _____
Surety

_____ BY _____
Attorney-in-Fact

WITNESS: _____

_____ _____ (SEAL)

_____ _____ (SEAL)

_____ _____ (SEAL)

_____ _____ (SEAL)

(CORPORATE SEAL) _____
Surety

_____ BY _____
Attorney-in-Fact

(CORPORATE SEAL)

_____
Principal - Corporation

_____
Secretary or Treasurer

BY _____
President or Vice President

(CORPORATE SEAL

_____
Surety

_____

BY _____
Attorney-in-Fact

APPROVED AS TO LEGALITY AND FORM

_____
Office of General Counsel

_____
Office of Attorney General

END OF SECTION

SECTION 01010 - PROJECT SUMMARY

This project consists of the removal and replacement of the existing 60 ton air cooler chiller, base mounted pumps, piping, controls, appurtenances and related electrical work.

Coordination of the installation of the above work with the day-to-day operations of the Owner is required, and any disruptions must be worked out in advance.

END OF SECTION 01010

SECTION 01027 - APPLICATIONS FOR PAYMENT

Schedule of Values: Coordinate preparation of the Schedule of Values with the Contractor's Construction Schedule.

Correlate line items in the Schedule of Values with other schedules and forms, including:

Contractor's Construction Schedule
Application for Payment form
List of subcontractors
List of products
Schedule of submittals

Submit the Schedule of Values to the Engineer at the earliest date, but no later than seven (7) days before the date scheduled for submittal of the initial Application for Payment.

Break Contract Sum down in enough detail to facilitate evaluation of Applications for Payment. Break subcontract amounts down into several line items. Round amounts off to the nearest dollar; the total shall equal the Contract Sum.

For each item where an Application for Payment includes products purchased or fabricated and stored, but not installed, provide separate line items for initial cost, each subsequent stage of completion, and installed value.

Each item in the Schedule of Values and Applications for Payment shall be complete including total cost and share of overhead and profit.

Update and resubmit the schedule when Change Orders or Construction Change Directives change the Contract Sum.

Applications for Payment: Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and paid for by the Owner.

Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for the application.

Application Preparation: Complete every entry, including notarization and execution by person authorized to sign on behalf of the Owner. Incomplete applications will be returned without action.

Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.

Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the period covered by the application.

Transmittal: Submit 3 executed copies of each application to the Engineer within 24 hours; one copy shall be complete, including waivers of lien and similar attachments.

Transmit each copy with a transmittal listing attachments, and recording information related to the application.

Waivers of Lien: With each application, submit waivers of lien from every entity who may file a lien arising out of the Contract, and related to the Work covered by the payment.

Submit partial waivers on each item for amount requested, prior to deduction for retainage, on each item.

When an application shows completion of an item, submit final or full waivers.
Waiver Delays: Submit each application with Contractor's waiver of lien for the period covered by the application.

Submit final Application for Payment with final waivers from every entity involved with performance of Work covered by the application who could be entitled to a lien.

Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.

Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include:

List of subcontractors
List of suppliers and fabricators
Schedule of Values
Contractor's Construction Schedule (preliminary if not final).
Submittal Schedule (preliminary if not final).
Copies of building permits
Copies of licenses from governing authorities
Certificates of insurance and insurance policies
Performance and payment bonds (if required)

Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions. Administrative actions and submittals that precede or coincide with this application include:

Occupancy permits, if required
Warranties and maintenance agreements
Test/adjust/balance records
Maintenance instructions
Meter readings
Final cleaning
Application for reduction of retainage, and consent of surety

Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment application include:

Completion of Project closeout requirements
Completion of items specified for completion after Substantial Completion
Transmittal of required Project construction records to Owner
Proof that taxes, fees and similar obligations have been paid

END OF SECTION 01027

SECTION 01040 - PROJECT COORDINATION

This Section specifies requirements for project coordination including:

Coordination
Administrative and supervisory personnel
General installation provisions
Cleaning and protection

Coordination: Coordinate activities included in various Sections to assure efficient and orderly installation of each component. Coordinate operations included under different Sections that are dependent on each other for proper installation and operation.

Where installation of one component depends on installation of other components before or after its own installation, schedule activities in the sequence required to obtain the best results.

Where space is limited, coordinate installation of different components to assure maximum accessibility for maintenance, service and repair.

Make provisions to accommodate items scheduled for later installation.

Prepare memoranda for distribution to each party involved outlining required coordination procedures. Include required notices, reports, and attendance at meetings.

Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

Administrative Procedures: Coordinate scheduling and timing of administrative procedures with other activities to avoid conflicts and ensure orderly progress. Such activities include:

Preparation of schedules
Delivery and processing of submittals
Progress meetings
Project closeout activities

Coordination Drawings: Prepare Coordination Drawings where close coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space necessitates maximum utilization of space for efficient installation of different components.

Show relationship of components shown on separate Shop Drawings.

Indicate required installation sequences.

Inspection of Conditions: The Installer of each component shall inspect the substrate and conditions under which Work is performed. Do not proceed until unsatisfactory conditions have been corrected.

Manufacturer's Instructions: Comply with manufacturer’s installation instructions and recommendations, to the extent that they are more stringent than requirements in Contract Documents.

Inspect material immediately upon delivery and again prior to installation. Reject damaged and defective items.

Provide attachment and connection devices and methods necessary for securing each construction element. Secure each construction element true to line and level. Allow for expansion and building movement.

Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints to obtain the best effect. Refer questionable choices to the Engineer for decision.

Recheck measurements and dimensions, before starting installation.

Install each component during weather conditions and project status that will ensure the best results. Isolate each part from incompatible material as necessary to prevent deterioration.

Coordinate temporary enclosures with inspections and tests, to minimize uncovering completed construction for that purpose.

Mounting Heights: Where mounting heights are not indicated, install components at standard heights for the application indicated. Refer questionable decisions to the Engineer.

Cleaning and Protection: During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

Clean and maintain completed construction as often as necessary through the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

Limiting Exposures: Supervise operations to ensure that no part of construction, completed or in progress, is subject to harmful or deleterious exposure. Such exposures include:

Excessive static or dynamic loading
Excessive internal or external pressures
Excessive weathering
Excessively high or low temperatures or humidity
Air contamination or pollution
Water or ice
Chemicals or solvents
Heavy traffic, soiling, staining and corrosion
Rodent and insect infestation
Unusual wear or other misuse
Contact between incompatible materials.
Theft or vandalism

END OF SECTION 01040

SECTION 01045 - CUTTING AND PATCHING

Refer to other Sections of these Specifications, including Divisions-15 and -16, for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

Structural Work: Do not cut and patch structural elements in a manner that would reduce the load-carrying capacity or load deflection ratio. Obtain approval of the cutting and patching proposal before cutting and patching structural elements.

Operational and Safety Limitations: Do not cut and patch operating elements or safety components in a manner that would reduce their capacity to perform as intended, or would increase maintenance, or decrease operational life or safety. Obtain approval of the cutting and patching proposal before cutting and patching operating elements or safety related systems:

Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

Materials: Use materials identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible. Use materials with which performance will equal or surpass of existing materials.

Inspection: Before cutting, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

Temporary Support: Provide temporary support of Work to be cut.

Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions that might be exposed during cutting and patching operations.

Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

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

Performance: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

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

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

Where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

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

Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

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

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

Cleaning: Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove paint, mortar, oils, putty and similar items. Thoroughly clean piping, conduit and similar features before painting or finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 01045

SECTION 01090 - DEFINITIONS AND STANDARDS

Summary: This Section specifies requirements for compliance with governing regulations, codes and standards. Requirements include obtaining permits, licenses, and inspections, as well as payments, statements and requirements associated with regulations, codes and standards.

Refer to General and Supplementary Conditions for requirements for compliance with governing regulations.

Definitions: The following definitions supplement definitions contained in the Agreement, General and Supplementary Conditions and other Contract Documents. They apply generally to the Work.

Indicated refers to graphic representations, notes or schedules on Drawings, or paragraphs or schedules in Specifications, and similar requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help locate the reference.

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

Approve, used in conjunction with action on submittals, applications, and requests, is limited to the Engineer's duties and responsibilities stated in General and Supplementary Conditions. Approval shall not release the Contractor from responsibility to fulfill Contract Document requirements.

Regulation includes laws, ordinances, statutes, and lawful orders of authorities having jurisdiction, and rules, conventions and agreements in the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.

Furnish means "supply and deliver, ready for unloading, unpacking, assembly, installation, and similar operations."

Install describes operations at site including "unloading, unpacking, assembly, erection, anchoring, applying, working to dimension, finishing, protecting, cleaning and similar operations."

Provide means "furnish and install, complete and ready for use."

Installer is an entity engaged by the Contractor, an employee, or subcontractor for performance of a particular activity, including installation, erection, and application. Installers shall be experienced in the operations they perform.

The term "Experienced," when used with "Installer" means having a minimum of 5 previous projects similar in size to this project, and familiar with precautions required, and requirements of the authority having jurisdiction.

Project Site is the space available for construction activities, either exclusively or with others performing other construction on the Project. The extent of the Project Site is shown on the Drawings, and may or may not be identical with the description of the land upon which the Project is to be built.

Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, at the Project Site or elsewhere, and to report on, and, if required, to interpret, results of those inspections or tests.

Language used in the Contract Documents is the abbreviated type. Implied words and meanings will be appropriately interpreted. Singular words will be interpreted as plural and plural words as singular where applicable and the context indicates.

Imperative Language is generally used. Requirements expressed imperatively are to be performed by the Contractor. At certain locations subjective language is used to describe responsibilities which must be fulfilled indirectly by the Contractor, or by others when noted.

Assignment of Specialists: Certain construction activities shall be performed by specialists, recognized experts in operations to be performed. Specialists must be engaged for those activities, and these assignments are requirements over which the Contractor has no option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.

Drawing Symbols: Graphic symbols on Drawings are recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols are defined by "Architectural Graphic Standards", published by John Wiley & Sons, Inc., seventh edition.

Mechanical/Electrical Drawings: Graphic symbols on mechanical and electrical Drawings are aligned with symbols recommended by ASHRAE. Where appropriate, they are supplemented by symbols recommended by technical associations. Refer instances of uncertainty to the Engineer for clarification before proceeding.

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

Referenced standards take precedence over standards that are not referenced but recognized in the industry as applicable.

Unreferenced standards are not applicable, except as a general requirement of whether the Work complies with recognized construction industry standards.

Publication Dates: Where compliance with a standard is required, comply with standard in effect as of date of Contract Documents.

Updated Standards: Submit a Change Order proposal where an applicable standard has been revised and reissued after the date of the Contract Documents and before performance of Work. The Engineer will decide whether to issue a Change Order to proceed with the updated standard.

Conflicting Requirements: Where compliance with two or more standards that establish different or conflicting requirements for minimum quantities or quality levels is specified, the most stringent requirement will be enforced. Refer uncertainties as to which quality level is more stringent to the Engineer for a decision before proceeding.

Minimum Quantities or Quality Levels: The quantity or quality shown or specified is the minimum to be provided or performed. Indicated values are minimum or maximum, as appropriate for the requirements. Refer instances of uncertainty to the Engineer for decision before proceeding.

Copies of Standards: Each entity engaged on the Project shall be familiar with standards applicable to that activity. Copies of applicable standards are not bound with the Contract Documents.

Where copies of standards are required, obtain copies directly from the publication source. Although copies of standards needed for enforcement of requirements may be part of submittals, the Engineer reserves the right to require the submittal of additional copies for enforcement of requirements.

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

Trade Union Jurisdictions: Maintain, complete current information on jurisdictional matters, regulations and pending actions, as applicable to construction activities. The manner in which Contract Documents have been organized and subdivided is not intended to indicate of trade union or jurisdictional agreements.

Discuss new developments at project meetings at the earliest feasible dates. Record relevant information and actions agreed upon.

Assign and subcontract construction activities, and employ tradesmen and laborers, in a manner that will not unduly risk jurisdictional disputes that could result in conflicts, delays, claims and losses.

Permits, Licenses, and Certificates: Submit copies of permits, licenses, certifications, inspection reports, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records in conjunction with compliance with standards and regulations bearing on performance of the Work.

END OF SECTION 01090

SECTION 01200 - PROJECT MEETINGS

Summary: This Section specifies requirements for Project meetings including:

Pre-Construction Conferences
Progress Meetings

Pre-construction Conference: Conduct a pre-construction conference after execution of the Agreement and prior to commencement of construction activities. Review responsibilities and personnel assignments.

Attendees: The Owner, Engineer and their consultants, the Contractor and its superintendent, subcontractors, and other concerned parties shall be represented by persons authorized to conclude matters relating to the Work.

Agenda: Discuss significant items that could affect progress, including the tentative construction schedule, critical sequencing, use of the premises, procedures for processing Change Orders and equipment deliveries.

Pre-installation Conference: Conduct a pre-installation conference before each activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in the installation, and coordination or integration with other materials and installations that have preceded or will follow, shall attend. Advise the Engineer of scheduled meeting dates.

Review progress of other activities and preparations for the activity under consideration at each conference, including time schedules, manufacturer's recommendations, weather limitations, substrate acceptability, compatibility problems and inspection and testing requirements.

Record significant discussions, agreements and disagreements of each conference, along with the approved schedule. Distribute the meeting record to everyone concerned, promptly, including the Owner and Engineer.

Do not proceed if the conference cannot be successfully concluded. Initiate necessary actions to resolve impediments and reconvene the conference at the earliest feasible date.

Progress Meetings: Conduct progress meetings at regular intervals. Notify the Owner and Engineer of scheduled dates. Coordinate meeting dates with preparation of the payment request.

Attendees: The Owner and Engineer, each subcontractor, supplier or other entity concerned with progress or involved in planning, coordination or performance of future activities shall be represented by persons familiar with the Project and authorized to conclude matters relating to progress.

Agenda: Review minutes of the previous progress meeting. Review significant items that could affect progress. Include topics appropriate to the current status of the Project.

Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

Review the present and future needs of each entity present, including such items as:

Time
Sequences
Deliveries
Off-site fabrication problems
Site utilization
Temporary facilities and services
Hazards and risks
Quality and Work standards
Change Orders
Documentation of information for payment requests

Reporting: No later than 5 days after each meeting, distribute copies of minutes of the meeting to each party present and to parties who should have been present. Include a summary, in narrative form, of progress since the previous meeting.

END OF SECTION 01200

SECTION 01230 - ALTERNATE BIDS

Section Includes:

Documentation of changes to Contract Sum/Price

Submission Requirements:

Submit Alternates indicating the amount to be added to or deducted from the Base Bid for the provision of or deletion of all labor, materials and all other Work incorporated and identified by the Specification Sections and Drawings referenced or affected.

Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the sole discretion of the Owner. Accepted Alternates will be identified in the Owner-Contractor Agreement.

Schedule of Alternates:

ALTERNATE BID M-1 (AAON CHILLER)

The base bid includes the installation of a “TRANE CHILLER”. State the amount to be added to, or deducted from the contract to install an “AAON CHILLER” in lieu of the base bid chiller as here-in specified.

ALTERNATE BID M-2 (CARIER CHILLER)

The base bid includes the installation of a “TRANE CHILLER”. State the amount to be added to, or deducted from the contract to install a “CARRIER CHILLER” in lieu of the base bid chiller as here-in specified.

END OF SECTION 01230

SECTION 01300 - SUBMITTALS

Summary: This Section specifies requirements for handling submittals.

General Procedures: Coordinate submittal preparation with performance of construction activities, and with purchasing or fabrication, delivery, other submittals and related activities. Transmit in advance of performance of related activities to avoid delay.

Coordinate transmittal of different submittals for related elements so processing will not be delayed by the need to review concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination until related submittals are received.

Submittal Preparation: Place a label or title block on each submittal for identification. Provide a 4" x 5" space on the label or beside the title block on Shop Drawings to record Contractor's review and approval markings and action taken. Include the following information on the label for processing and recording action taken.

Project name
Date
Name and address of Engineer
Name and address of Contractor
Name and address of subcontractor
Name and address of supplier
Name of manufacturer

Submittal Transmittal: Package submittals appropriately for transmittal and handling. Transmit with a transmittal form. Submittals received from other than the Contractor will be returned without action.

Contractor's Construction Schedule: Submit a fully detailed construction schedule, within 10 days of the date established for Commencement of the Work. Provide a line item for each construction activity. Use the breakdown of units of Work as indicated in the "Schedule of Values".

Secure commitments for performing critical construction operations from parties involved. Coordinate each activity with other activities and show in proper sequence; include minor elements involved in the construction sequence. Indicate sequences necessary for completion of related portions.

Coordinate the Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests and other schedules.

Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the Schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.

Submittal Schedule: Submit the Submittal Schedule within 10 days of the Construction Schedule. Coordinate the Schedule with the list of subcontracts, Schedule of Values and list of products as well as the Construction Schedule.

Prepare the Schedule in chronological order; include submittals. Provide the following information:

Scheduled date for the first submittal
Related Section number
Name of subcontractor
Description of the construction element covered
Scheduled date the Engineer's final release or approval

Distribution of Schedules: Distribute copies of the Construction and Submittal Schedules to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. When revisions are made, distribute to the same parties and post in the same locations.

Updating: Revise each Schedule after each meeting or activity, where revisions have been made. Issue the updated Schedules concurrently with report of each meeting.

Shop Drawings: Submit new information, drawn to accurate scale. Indicate deviations from Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Include the following information:

Dimensions
Identification of products and materials included
Notation of coordination requirements
Notation of dimensions established by field measurement

Sheet Size: Except for templates, patterns and similar full- size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".

Initial Submittal: Submit one correctable translucent print and one blue-line print for review; the reproducible print will be returned.

Final Submittal: Submit 3 blue-line prints; if the Drawing is required for maintenance manuals submit 5 prints. 2 prints will be retained; the remainder will be returned. One of the prints returned shall be maintained as a "Record Document".

Do not use Shop Drawings without a final stamp indicating action taken in connection with construction.

Product Data: Collect Product Data into a single submittal for each element or system. Mark each copy to show applicable choices and options.

Where Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

Manufacturer's printed recommendations
Compliance with recognized trade association standards
Compliance with recognized testing agency standards
Application of testing agency labels and seal
Notation of dimensions verified by field measurement
Notation of coordination requirements

Preliminary Submittal: Submit a preliminary single-copy where selection of options is required.

Submittals: Submit 3 copies of each required submittal; submit 6 copies for maintenance manuals. The Engineer will retain one, and will return the other marked with action taken and corrections or modifications required.

Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

Distribution: Furnish copies of final submittal to installers, and others required for performance of construction activities. Show distribution on transmittal forms. Do not proceed with installation until an applicable copy of Product Data is in the installer's possession.

Do not permit use of unmarked copies of Product Data in connection with construction.

Distribution: Prepare additional sets for subcontractors, manufacturers, fabricators, installers, and others as required for performance. Show distribution on transmittal forms.

Engineer's Action: Except for submittals for record, information or similar purposes, where action and return is required, the Engineer will review each submittal, mark to indicate action taken, and return. Compliance with specified characteristics is the Contractor's responsibility.

Action Stamp: The Engineer will stamp each submittal with a self-explanatory action stamp. The stamp will be appropriately marked to indicate action taken.

END OF SECTION 01300

SECTION 01600 - MATERIALS AND EQUIPMENT

"Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock.

> "Named Products" are items identified by manufacturer's product name, including make or model designation indicated in the manufacturer's product literature.

"Materials" are products that are shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

"Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

> When the Contractor has the option of selecting between two or more products, the product selected shall be compatible with products previously selected.

Nameplates: Except for required labels and operating data, do not attach manufacturer's nameplates or trademarks on surfaces exposed to view in occupied spaces or on the exterior.

> Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an inconspicuous accessible surface. The nameplate shall contain the following information and essential operating data:
>
> > Name of product and manufacturer
> > Model and serial number
> > Capacity
> > Speed
> > Ratings

Product Delivery, Storage, and Handling: Deliver, store and handle products in accordance with manufacturer's recommendations, using methods that will prevent damage, deterioration and loss.

> Schedule delivery to minimize long-term storage and prevent overcrowding construction spaces. Coordinate with installation to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
>
> Deliver products in manufacturer's original sealed container or packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
>
> Inspect products on delivery to ensure compliance with Contract Documents, and to ensure that products are undamaged and properly protected.
>
> Store products to facilitate inspection and measurement of quantity or counting of units. Store heavy materials away from the structure in a manner that will not endanger supporting construction.

Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

Non-Proprietary Specifications: When Specifications list products or manufacturers that are available and may be used, but do not restrict the Contractor to use of these products only, the Contractor may propose any product that complies with Contract requirements. Comply with provisions for "substitutions" to obtain approval for use of an unnamed product.

Descriptive Specification Requirements: Where Specifications describe a product, listing characteristics required, with or without use of a brand name, provide a product that provides the characteristics and otherwise complies with requirements.

Compliance with Standards: Where Specifications require compliance with a standard, select a product that complies with the standard specified.

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

END OF SECTION 01600

SECTION 01700 - PROJECT CLOSEOUT

Substantial Completion: Before requesting inspection for certification of Substantial Completion, complete the following:

In the Application for Payment that coincides with the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed substantially complete.

Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar record information.

Complete start-up testing of systems, and instruction of the Owner's personnel. Remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

Complete final clean up. Touch-up and repair and restore marred exposed finishes.

Inspection Procedures: On receipt of a request for inspection, the Engineer will proceed or advise the Contractor of unfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

The Engineer will repeat inspection when requested and assured that the Work has been substantially completed.

Results of the completed inspection will form the basis of requirements for final acceptance.

Final Acceptance: Before requesting inspection for certification of final acceptance and final payment, complete the following:

Submit final payment request with releases.

Submit a final statement, accounting for changes to the Contract Sum.

Submit a copy of the final inspection list stating that each item has been completed or otherwise resolved for acceptance

Submit consent of surety to final payment.

Submit evidence of continuing insurance coverage complying with insurance requirements.

Reinspection Procedure: The Engineer will reinspect the Work upon receipt of notice that the Work has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

Upon completion of reinspection, the Engineer will prepare a certificate of final acceptance, or advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

If necessary, reinspection will be repeated.

Record Document Submittals: Do not use Record Documents for construction purposes; protect from loss in a secure location; provide access to Record Documents for the Engineer's reference.

Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark-up these drawings to show the actual installation. Mark whichever drawing is most capable of showing conditions accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover.

Record Specifications: Maintain one copy of the Project Manual, including addenda. Mark to show variations in actual Work performed in comparison with the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot be readily discerned later by direct observation. Note related record drawing information and Product Data.

Upon completion of the Work, submit record Specifications to the Engineer for the Owner's records.

Maintenance Manuals: Organize maintenance data into sets of manageable size. Provide the number of copies as specified in section 01300. Bind in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark identification on front and spine of each binder. Include the following information:

Emergency instructions
Spare parts list
Copies of warranties
Wiring diagrams
Recommended "turn around" cycles
Inspection procedures
Shop Drawings and Product Data

Operating and Maintenance Instructions: Arrange for the manufacturer's recognized representative of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Include a detailed review of the following:

Maintenance manuals
Spare parts and materials
Tools
Lubricants
Control sequences
Hazards
Warranties and bonds
Maintenance agreements and similar continuing commitments

As part of instruction for operating equipment, demonstrate the following procedures:

Start-up and shutdown
Emergency operations
Noise and vibration adjustments
Safety procedures

Provide a video of the above demonstrations taped on VHS format to be turned over to the Owner for his use as needed.

Final Cleaning: Employ experienced workers for final cleaning. Clean each surface to the condition expected in a commercial building cleaning and maintenance program. Complete the following before requesting inspection for certification of Substantial Completion:

Remove labels that are not permanent labels.

Clean exposed hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication.

Clean the site of rubbish, litter and other foreign substances. Sweep paved areas; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

Removal of Protection: Remove temporary protection and facilities.

Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Remove waste materials from the site and dispose of in a lawful manner.

END OF SECTION 01700

SECTION 01740 - WARRANTIES AND BONDS

Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

Special Warranties are written warranties required by or incorporated in Contract Documents, to extend time limits provided by standard warranties or to provide greater rights for the Owner.

Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

Requirements for warranties for products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -16.

Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors required to countersign special warranties with the Contractor.

Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

Replacement Cost: On determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through part of its useful service life.

Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

Rejection of Warranties: The Owner reserves the right to reject warranties and limit selections to products with warranties not in conflict with requirements of the Contract Documents.

The Owner reserves the right to refuse to accept Work where a special warranty, or similar commitment is required, until evidence is presented that entities required to countersign commitments are willing to do so.

Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion, submit written warranties on the Engineer's request.

When a designated portion of the Work is completed and occupied or used, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

When a special warranty is to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.

Special warranty forms are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or the Contractor and subcontractor, supplier or manufacturer. Submit a draft to the Owner through the Engineer for approval prior to final execution.

Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

Provide heavy paper dividers with celluloid covered tabs for each warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.

When operating and maintenance manuals are required for warranted construction, provide additional copies of each warranty, as necessary, for inclusion in each required manual.

END OF SECTION 01740

SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, as well as all Divisions-15 sections shall apply in conjunction with work of this section.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division-1:

1. Permits and fees.
2. Submittals.
3. Project schedule
4. Installation accessibility.
5. Acceptable Substitute Manufacturers and Bid Alternates
6. Motor starters
7. Submittals
8. Record documents.
9. Maintenance manuals.

    a. Warranties.
    b. Delivery, storage and handling
    c. Acceptable manufactures.

10. Rough-ins.
11. Mechanical installations.
12. Cutting and patching
13. Firestopping.

1.3 PERMITS AND FEES

A. Refer to Division 1 sections for information relative to permits and fees.

B. Where required by the authority having jurisdiction, any permit and / or fee shall be obtained and paid for by the Contractor. Include in the bid all fees associated with obtaining any required permit. The responsibility for obtaining any necessary permit is the contractors.

1.4 SUBMITTALS

A. General: Refer to individual sections of this specification for any additional shop drawing requirements. Follow the procedures specified in Division-1 Sections. The contractor shall review and approve all shop drawings prior to formal submittal and be totally responsible for their accuracy including quantities. All shop drawings shall be submitted with a title sheet indicating the name of the project, the Architect, the Engineer, the vendor and the contractor. There must be sufficient space on the title sheet to allow the engineer to add the appropriate Stamp and any necessary comments. **Shop drawings not conforming to the above will be returned without review.** Shop drawings shall be submitted in accordance with Division 1 requirements.

1.5 PROJECT SCHEDULE

A. Refer to Division-1 sections for project schedule and phasing information.

1.6 INSTALLATION ACCESSIBILITY

A. The installation of all equipment and materials shall be done so that access is available for necessary maintenance and any servicing.

1.7 ACCEPTABLE SUBSTITUTE MANUFACTURERS AND BID ALTERNATES

A. The design of the mechanical system(s) is based on the equipment manufacturer indicated as the basis for design on the drawings and/or in the specifications. Although individual sections of the specifications list other acceptable substitute manufacturers, these manufacturers are acceptable if, and only if, the following occurs:

1. Performance must be equal to or exceed the design based equipment.
2. Operating characteristics must be comparable to those of the design based equipment.
3. Physical size of the equipment must be such that it can be installed in the available space, maintaining all required clearances for access and maintenance. The contractor shall be responsible for verifying that any and all substituted equipment meets this requirement.
4. All the features, construction, and accessories indicated that the piece of equipment or assembly or system, are specified to have must be provided. Selection of a substitute manufacturer does not relieve the contractor or manufacturer from providing all features, construction and accessories specified.
5. The contractor will be responsible for any and all changes including but not limited to (additional supports, equipment, electrical equipment & wiring, piping changes, ductwork changes, controls changes, etc.) that may be required to accommodate equipment other than that which the design was based on.

B. Bid alternates will be considered valid if, and only if, the following occurs:

1. Performance must be equal to or exceed the design based equipment.
2. Operating characteristics must be comparable to those of the design based equipment.
3. Physical size of the equipment must be such that it can be installed in the available space, maintaining all required clearances for access and maintenance. The contractor shall be responsible for verifying that any and all substituted equipment meets this requirement.
4. All the features, construction, and accessories indicated that the piece of equipment or assembly or system, are specified to have must be provided. Selection of a substitute manufacturer does not relieve the contractor or manufacturer from providing all features, construction and accessories specified.
5. The contractor will be responsible for any and all changes including but not limited to (additional supports, equipment, electrical equipment & wiring, piping changes, ductwork changes, controls changes, etc.) that may be required to accommodate equipment other than that which the design was based on.

C. Pre-bid substitution requests must be submitted in accordance with the Instruction to Bidders. Post contract award substitution requests must be submitted in accordance with the applicable Division 1 section.

NOTE: ULTIMATE AND FINAL APPROVAL OF WHETHER A SUBSTITUTE MANUFACTURER IS ACCEPTABLE OR OF WHETHER AN ALTERNATE IS VALID IS AT THE SOLE DISCRETION OF THE LICENSED PROFESSIONAL ENGINEER FOR THE PROJECT.

1.8 SUBMITTALS

A. General: Follow the procedures specified in Division-1 Section, "Submittals".

1.10 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division-1 Section, "Project Closeout". In addition to the requirements specified in Division-1, indicate the following installed conditions:

1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams complete with valve tag chart, Refer to Division-15 Section, "Mechanical Identification." Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

5. Contract Modifications, actual equipment and materials installed.

1.11 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division-1. In addition to the requirements specified in Division-1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2- through -16 for rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.

3. Coordinate requirements for chases slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements refer conflict to the Engineer.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
10. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division-8 and/or.
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division-1 Section, "Cutting and Patching". In addition to the requirements specified in Division-1, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. In areas of the building where new finishes are being provided, the patching required on a surface which is to receive a new finish will be to bring the underlying surface up to the finish required to receive the final finish. This contractor shall coordinate subsurface finish requirements with the finish trade contractor(s).

F. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

a. Refer to Division-1 Section, "Definitions and Explanations" for definition of "experienced Installer."

3.4 FIRESTOPPING

A. Each contractor is responsible for furnishing and installing their own firestopping. Refer to Division 7 for requirements.

END OF SECTION 15010

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.

1. Piping materials and installation instructions common to most piping systems
2. Dielectric fittings
3. Flexible connectors
4. Field-fabricated metal and wood equipment supports
5. Installation requirements common to equipment specification sections

B. Pipe and pipe fitting materials are specified in Division 15 piping system Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors: Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions: Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants: Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures: Examples include installations within unheated shelters.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support pipes to prevent sagging and bending.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dielectric Unions:

a. Epco Sales Inc.
b. Hart Industries International, Inc.
c. Watts Industries, Inc.; Water Products Div.
d. Zurn Industries, Inc.; Wilkins Div.

2. Dielectric Flanges:

   a. Capitol Manufacturing Co.
   b. Central Plastics Co.
   c. Epco Sales Inc.
   d. Watts Industries, Inc.; Water Products Div.

3. Dielectric-Flange Insulating Kits:

   a. Calpico, Inc.
   b. Central Plastics Co.

4. Dielectric Couplings:

   a. Calpico, Inc.
   b. Lochinvar Corp.

5. Dielectric Nipples:

   a. Grinnell Corp.; Grinnell Supply Sales Co.
   b. Perfection Corp.
   c. Victaulic Co. of America.

6. Metal, Flexible Connectors:

   a. Flexicraft Industries.
   b. Grinnell Corp.; Grinnell Supply Sales Co.
   c. Metraflex Co.
   d. Uniflex, Inc.

7. Rubber, Flexible Connectors:

   a. General Rubber Corp.
   b. Mercer Rubber Co.
   c. Metraflex Co.
   d. Uniflex, Inc.

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1: for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21: nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C). Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.5 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

1. 2-Inch NPS (DN50) and Smaller: Threaded.
2. 2-1/2-Inch NPS (DN65) and Larger: Flanged.
3. Option for 2-1/2-Inch NPS (DN65) and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

E. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig (860-kPa) minimum working-pressure rating at 220 deg F (104 deg C). Units may be straight or elbow type, unless otherwise indicated.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping free of sags and bends.

F. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

G. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

H. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

I. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

J. Install fittings for changes in direction and branch connections.

K. Install couplings according to manufacturer's written instructions.

L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.

M. Verify final equipment locations for roughing-in.

N. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

O. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
    b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
    c. Align threads at point of assembly.
    d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

P. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

END OF SECTION 15050

SECTION 15075 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes mechanical identification materials and devices. The pipe identification shall be required for all piping new and existing located in the mechanical/storage room area.

1.3 QUALITY ASSURANCE

A. Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

1.4 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are for applications referenced in other Division 15 Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Stencils: Standard stencils, prepared with letter sizes conforming to recommendations of ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Material: Fiberboard.
2. Material: Brass.
3. Stencil Paint: Exterior, oil-based, alkyd gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.

4. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

C. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

D. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive, vinyl type with permanent adhesive.

E. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

F. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least 3 times letter height and of length required for label.

G. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

H. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.

I. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

J. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

PART 3 - EXECUTION

3.1 LABELING AND IDENTIFYING PIPING SYSTEMS

A. Install pipe markers on each system. Include arrows showing normal direction of flow. Pipe markers shall be installed on both new and existing piping.

B. Marker Type: Stenciled markers complying with ASME A13.1.

C. Fasten markers on pipes and insulated pipes smaller than 6 inches OD by one of following methods:

1. Snap-on application of pretensioned, semirigid plastic pipe marker.
2. Adhesive lap joint in pipe marker overlap.
3. Laminated or bonded application of pipe marker to pipe or insulation.
4. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 3/4 inch wide, lapped a minimum of 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.

D. Fasten markers on pipes and insulated pipes 6 inches in diameter and larger by one of following methods:

1. Laminated or bonded application of pipe marker to pipe or insulation.
2. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 1-1/2 inches wide, lapped a minimum of 3 inches at both ends of pipe marker, and covering full circumference of pipe.
3. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.

E. Piping in mechanical equipment, machine and boiler rooms shall be painted according to ASME recommended color coding; i.e. Chilled Water - Green, Hot Water - Yellow, etc.

F. Locate pipe markers and color bands where piping is exposed in finished spaces; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations according to the following:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
3. Near penetrations through walls, floors, ceilings, or nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at a maximum of 50-foot intervals along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.2 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

B. Clean faces of identification devices and glass frames of valve charts.

END OF SECTION 15075

SECTION 15083 - HVAC SYSTEM INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes insulation materials and accessories for insulating HVAC system piping.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Provide detailed shop drawings for the exterior duct insulation system. The shop drawings are to be prepared by the manufacturer / certified installer and shall include warranty information.

1.4 QUALITY ASSURANCE

A. Pipe insulation, including adhesives, shall have a flame spread index not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723, using the procedures of ASTM E2231.

B. All insulation values are to meet the requirements of the applicable edition of the International Energy Conservation Code.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature. Store materials providing protection from the elements.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields. Coordinate clearance requirements with the piping.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Mineral-Fiber, Preformed Pipe Insulation:

1. Subject to compliance with requirements, provide Johns Manville Micro-Lok insulation or equal products manufactured by one of the following:

   a. Knauf Insulation; 1000 Pipe Insulation.
   b. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL.

3. Provide High-impact-resistant, UV-resistant PVC jacketed fitting covers complying with ASTM D 1784, Class 16354-C; Flame spread 25 or less; Smoke development 50 or less.

2.2 CEMENTS, ADHESIVES AND MASTICS

A. Provide all required types of cements, adhesives, mastics and other accessories required to install all insulation materials and systems. Prepare surfaces as required by the insulation manufacturers. Install cements, adhesives and mastics per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes per the manufacturer's instruction with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets per manufacturer’s instructions.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.2 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations. Seal penetrations with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

E. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch (150-mm) centers, starting at corners. Install 3/8-inch- (10-mm-) diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism. Fabricate boxes from aluminum, at least 0.050 inch thick. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.3 GENERAL PIPE INSULATION INSTALLATION

A. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Union and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

1. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
2. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
3. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
4. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

5. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
6. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
7. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

B. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.4 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Apply Insulation on Pipe Fittings, Elbows, Valves and Pipe Specialties.

3.5 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes per manufacturer’s instructions. Where vapor barriers are required, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings, Elbows, Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.6 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Chilled-water pump insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft.

C. Chilled-water expansion/compression tank insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Board: 1 inch thick

D. Chilled-water air-separator insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Board: 1 inch thick

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water Piping:

1. All Pipe Sizes: Insulation shall be Flexible Elastomeric: 3/4 inch thick.

B. Make-up Water:

1. All sizes: Insulation shall be Mineral-Fiber, 1 inch thick with vapor barrier.

C. Chilled Water Piping or Dual Temperature Piping:

1. NPS 2 inches and larger, insulation shall be:

a. Mineral-Fiber, 2 inches thick with vapor barrier.

3.9 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water Supply and Return: All Pipe Sizes: Insulation shall be:

1. Mineral-Fiber, Preformed Pipe Insulation, 3 inches thick with vapor barrier and .020 corrugated aluminum jacket.

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed: Corrugated aluminum, 0.020 inch thick.

END OF SECTION 15083

SECTION 15110 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general duty valves common to several mechanical piping systems.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Special purpose valves are specified in Division 15 piping system Sections.
2. Valve tags and charts are specified in Division 15 Section "Mechanical Identification."

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: Comply with the requirements specified in Division 1 Section "Materials and Equipment," under "Source Limitations" Paragraph.

B. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

C. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set globe and gate valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ball Valves:

a. Conbraco Industries, Inc.; Apollo Division.
b. NIBCO Inc.
c. Stockham Valves & Fittings, Inc.
d. Victaulic Company of America.

2. Plug Valves:

a. Grinnell Corp.
b. NIBCO Inc.
c. Stockham Valves & Fittings, Inc.
d. Victaulic Company of America.

3. Globe Valves:

a. Crane Company; Valves and Fitting Division.
b. Milwaukee Valve Company, Inc.
c. NIBCO Inc.
d. Stockham Valves & Fittings, Inc.

4. Butterfly Valves:

a. Crane Company; Valves and Fitting Division.
b. Grinnell Corp.
c. NIBCO Inc.
d. Stockham Valves & Fittings, Inc.
e. Victaulic Company of America.

5. Swing Check Valves:

a. Crane Company; Valves and Fitting Division.
b. Milwaukee Valve Company, Inc.

c. NIBCO Inc.
d. Stockham Valves & Fittings, Inc.
e. Victaulic Company of America.

6. Wafer Check Valves:

a. Milwaukee Valve Company, Inc.
b. NIBCO Inc.
c. Stockham Valves & Fittings, Inc.
d. Tyler Pipe.
e. Victaulic Company of America.

7. Lift Check Valves:

a. Crane Company; Valves and Fitting Division.
b. Milwaukee Valve Company, Inc.
c. NIBCO Inc.
d. Stockham Valves & Fittings, Inc.

2.2 BASIC, COMMON FEATURES

A. Design: Rising stem or rising outside screw and yoke stems, except as specified below.

1. Nonrising stem valves may be used only where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

C. Sizes: Same size as upstream pipe, unless otherwise indicated.

D. Operators: Use specified operators and handwheels, except provide the following special operator features:

1. Handwheels: For valves other than quarter turn.
2. Lever Handles: For quarter-turn valves 6 inches and smaller, except for plug valves, which shall have square heads. Furnish Owner with 1 wrench for every 10 plug valves.
3. Chain-Wheel Operators: For valves 4 inches and larger, installed 96 inches or higher above finished floor elevation.
4. Gear-Drive Operators: For quarter-turn valves 8 inches and larger.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

G. Threads: ASME B1.20.1.

H. Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.

I. Solder Joint: ASME B16.18.

1. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F for gate, globe, and check valves; below 421 deg F for ball valves.

2.3 GATE VALVES

A. Gate Valves, 2-1/2 Inches and Smaller: MSS SP-80; Class 125, 200-psi cold working pressure (CWP), or Class 150, 300-psi CWP; ASTM B 62 cast-bronze body and bonnet, solid-bronze wedge, copper-silicon alloy rising stem, teflon-impregnated packing with bronze packing nut, threaded or soldered end connections; and with aluminum or malleable-iron handwheel.

B. Gate Valves, 3 Inches and Larger: MSS SP-70, Class 125, 200-psi CWP, ASTM A 126 cast-iron body and bonnet, solid cast-iron wedge, brass-alloy stem, outside screw and yoke, teflon-impregnated packing with 2-piece packing gland assembly, flanged end connections; and with cast-iron handwheel.

2.4 BALL VALVES

A. Ball Valves, 4 Inches and Smaller: MSS SP-110, Class 150, 600-psi CWP, ASTM B 584 bronze body and bonnet, 2-piece construction; chrome-plated brass ball, standard port for ½-inch valves and smaller and conventional port for 3/4-inch valves and larger; blowout proof; bronze or brass stem; teflon seats and seals; threaded or soldered end connections:

1. Operator: Lever operators with lock.
2. Stem Extension: For valves installed in insulated piping.
3. Memory Stop: For operator handles.

2.5 PLUG VALVES

A. Plug Valves: MSS SP-78, 175-psi CWP, ASTM A 126 cast-iron body and bonnet, cast-iron plug, Buna N, Viton, or teflon packing, flanged or grooved end connections:

1. Operator: Lever.
2. Operator: Worm and gear with handwheel, sizes 6 inches and larger.

2.6 GLOBE VALVES

A. Globe Valves, 2-1/2 Inches and Smaller: MSS SP-80; Class 125, 200-psi CWP, or Class 150, 300-psi CWP; ASTM B 62 cast-bronze body and screwed bonnet, rubber, bronze, or teflon disc, silicon bronze-alloy stem, teflon-impregnated packing with bronze nut, threaded or soldered end connections; and with aluminum or malleable-iron handwheel.

B. Globe Valves, 3 Inches and Larger: MSS SP-85, Class 125, 200-psi CWP, ASTM A 126 cast-iron body and bolted bonnet with bronze fittings, renewable bronze seat and disc, brass-alloy stem, outside screw and yoke, teflon-impregnated packing with cast-iron follower, flanged end connections; and with cast-iron handwheel.

2.7 BUTTERFLY VALVES

A. Butterfly Valves: MSS SP-67, 200-psi CWP, 150-psi maximum pressure differential, ASTM A 126 cast-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals, wafer, lug, or grooved style:

1. Disc Type: Elastomer-coated ductile iron.
2. Operator for Sizes 2 Inches to 6 Inches: Lever handle with latch lock.
3. Operator for Sizes 8 Inches to 24 Inches: Gear operator with position indicator.

4. Operator for Sizes 8 Inches and Larger, 96 Inches or Higher above Floor: Chain-wheel operator.

2.8 CHECK VALVES

A. Swing Check Valves, 2-1/2 Inches and Smaller: MSS SP-80; Class 125, 200-psi CWP, or Class 150, 300-psi CWP; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body and cap, rotating bronze disc with rubber seat or composition seat, threaded or soldered end connections:

B. Swing Check Valves, 3 Inches and Larger: MSS SP-71, Class 125, 200-psi CWP, ASTM A 126 cast-iron body and bolted cap, horizontal-swing bronze disc, flanged or grooved end connections.

C. Wafer Check Valves: Class 125, 200-psi CWP, ASTM A 126 cast-iron body, bronze disc/plates, stainless-steel pins and springs, Buna N seals, installed between flanges.

D. Lift Check Valves: Class 125, ASTM B 62 bronze body and cap (main components), horizontal or vertical pattern, lift-type, bronze disc or Buna N rubber disc with stainless-steel holder threaded or soldered end connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

A. Install valves as indicated, according to manufacturer's written instructions.

B. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Install valves in a position to allow full stem movement.

G. For chain-wheel operators, extend chains to 60 inches above finished floor elevation.

H. Installation of Check Valves: Install for proper direction of flow as follows:

1. Swing Check Valves: Horizontal position with hinge pin level.
2. Wafer Check Valves: Horizontal or vertical position, between flanges.
3. Lift Check Valve: With stem upright and plumb.

3.3 SOLDERED CONNECTIONS

A. Cut tube square and to exact lengths.

B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket.

C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

D. Open gate and globe valves to fully open position.

E. Remove the cap and disc holder of swing check valves having composition discs.

F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

G. Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.4 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.5 FLANGED CONNECTIONS

A. Align flange surfaces parallel.

B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.6 VALVE END SELECTION

A. Select valves with the following ends or types of pipe/tube connections:

1. Copper Tube Size, 2-1/2 Inches and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
2. Steel Pipe Sizes, 2-1/2 Inches and Smaller: Threaded or grooved end.
3. Steel Pipe Sizes, 3 Inches and Larger: Grooved end or flanged.

3.7 APPLICATION SCHEDULE

A. General Application: Use, ball, and butterfly valves for shutoff duty; ball or butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

B. Domestic Water Systems: Use the following valve types:

1. Ball Valves: Class 150, 600-psi CWP, with stem extension.
2. Bronze Swing Check: Class 125, with rubber seat.
3. Check Valves: Class 125, swing or wafer type as indicated.

C. Chilled Water Systems: Use the following valve types:

1. Ball Valves: Class 150, 600-psi CWP, with stem extension and memory stop.
2. Bronze Swing Check: Class 150, with composition seat.
3. Check Valves: Iron swing, wafer, or lift type, as indicated. Swing check shall be Class 150 with bronze seat ring.
4. Butterfly valve, NPS 2-1/2 (DN 65) and Larger: MSS SP-67, 200-psi CWP, 150-psi maximum pressure differential.

3.8 ADJUSTING

A. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION 15110

SECTION 15122 - METERS AND GAGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes meters and gages for mechanical systems.

B. Related Sections include the following:

1. Mechanical equipment Sections that specify meters and gages as part of the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Liquid-in-Glass Thermometers:

a. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
b. Ernst Gage Co.
c. Trerice: H. O. Trerice Co.
d. Weiss Instruments, Inc.

2. Pressure Gages (Glycerin Filled):

a. Enerpac

3. Test Plugs:

a. Flow Design, Inc.
b. National Meter.
c. Trerice: H. O. Trerice Co.
d. Watts Industries, Inc.; Water Products Div.

2.2 THERMOMETERS, GENERAL

A. Scale Range: Temperature ranges for services listed are as follows:

1. Domestic Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.
3. Hot Water: 30 to 300 deg F, with 2-degree scale divisions.
4. Steam and Condensate: 50 to 400 deg F, with 5-degree scale divisions.

B. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Description: ASTM E 1.

B. Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches long.

C. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

D. Tube: Red or blue reading, organic-liquid filled with magnifying lens.

E. Scale: Satin-faced nonreflective aluminum with permanently etched markings.

F. Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.

2.4 THERMOMETER WELLS

A. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.

1. Material: Brass, for use in copper piping.
2. Material: Stainless steel, for use in steel piping.
3. Material: Steel, for use in steel piping.
4. Extension-Neck Length: Nominal thickness of 2 inches, but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
5. Insertion Length: To extend to center of pipe.
6. Cap: Threaded, with chain permanently fastened to socket.
7. Heat-Transfer Fluid: Oil or graphite.

2.5 PRESSURE GAGES

A. Enerpac model G2553L with GA-2 Gauge adapter.

2.6 PRESSURE-GAGE FITTINGS

A. Valves: NPS 1/4 brass or stainless-steel needle type.

B. Syphons: NPS 1/4 coil of brass tubing with threaded ends.

C. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.7 TEST PLUGS

A. Description: Nickel-plated, brass-body test plug in NPS 1/4 fitting.

B. Body: Length as required to extend beyond insulation.

C. Pressure Rating: 500 psi minimum.

D. Core Inserts: Two self-sealing valves, suitable for inserting 1/8-inch OD probe from dial-type thermometer or pressure gage.

E. Core Material for Air, Water, Oil, and Gas: 20 to 200 deg F, chlorosulfonated polyethylene synthetic rubber.

F. Core Material for Air and Water: Minus 30 to plus 275 deg F, ethylene-propylene-diene terpolymer rubber.

G. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.

H. Test Kit: Pressure gage and adapter with probe, two bimetal dial thermometers, and carrying case.

1. Pressure Gage and Thermometer Ranges: Approximately two times the system's operating conditions.

PART 3 - EXECUTION

3.1 METER AND GAGE INSTALLATION, GENERAL

A. Install meters, gages, and accessories according to manufacturer's written instructions for applications where used.

3.2 THERMOMETER INSTALLATION

A. Install thermometers and adjust vertical and tilted positions.

B. Install thermometers where indicated on the drawings.

C. Install separable sockets in vertical position in piping tees where fixed thermometers are indicated.

1. Install with socket extending to center of pipe.
2. Fill sockets with oil or graphite and secure caps.

D. Install thermometer wells in vertical position in piping tees where test thermometers are indicated.

1. Install with stem extending to center of pipe.
2. Fill wells with oil or graphite and secure caps.

3.3 PRESSURE-GAGE INSTALLATION

A. Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.

B. Install pressure gauges where indicated on the drawings.

C. Install pressure-gage needle valve and snubber in piping to pressure gages.

1. Exception: Install syphon instead of snubber in piping to steam pressure gages.

3.4 ADJUSTING AND CLEANING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gages to proper angle for best visibility.

C. Clean windows of meters and gages and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION 15122

SECTION 15181 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the piping systems.

1.3 SUBMITTALS

A. Product Data: For each type of the following:

1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air control devices.
3. Hydronic specialties.
4. Grooved joint pipe couplings and fitting.

B. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. The installation is to conform to the requirements of the 2009 International Mechanical Code and any applicable local codes. Verify local code requirements with the Authority Having Jurisdiction.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. 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 ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

D. All grooved joint couplings, fittings, valves and other specialties shall be provided from a single manufacturer. Grooving tools shall be from the same manufacturer as the grooved components. All castings used for coupling housings, valve bodies, fittings, etc. shall be date stamped for traceability and quality control.

1.5 EXTRA MATERIALS

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

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. 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.

H. Grooved Mechanical-Joint Piping Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by Victaulic Company of America or Anvil International.
2. Steel Pipe: ASTM A 53, carbon steel, schedule 40, roll or cut grooved ends.
3. Fittings: ASTM A 395, grade 65-45-12 ductile iron; ASTM A 536, grade 65-45-12 wrought steel conforming to ASTM A-235/A 53M, Type F, E, or S, Grade B factory fabricated steel; or ASTM A 234, Grade WPB steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, to secure grooved pipe and fittings.
4. Couplings: Ductile iron conforming to ASTM A-536, Grade 65-45-12.

    a. NPS 2 through NPS 8; rigid coupling with high temperature range (-30 degrees F to 230 or 250 degrees F; see Part 3) Grade EHP gasket.
    b. NPS 10 through NPS 12; rigid coupling with Grade EHP gasket (-30 degrees F to 230 degrees F).
    c. NPS 2 through NPS 12: flexible coupling for use in locations where vibration attenuation and stress relief is required. Three flexible couplings may be used in lieu of a flexible connector.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Grooved Joint Lubricants: lubricate gaskets using a lubricant supplied by the coupling manufacturer. Lubricant shall be suitable for the gasket elastomer and fluid media.

1. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.3 EXPANSION FITTINGS AND COMPENSATORS

A. Grooved Mechanical-Joint Piping Systems: Provide Victaulic Style 150 Mover slip type expansion joint, ductile iron ASTM A-395 and ASTM A-536 schedule 40 carbon steel.

B. Welded, Screwed, or Soldered Joint Piping Systems: Provide Expansion Compensators manufactured by Hyspan Precision Products or Metraflex Inc. Compensators to have a fully enclosed externally pressurized multiply stainless steel bellows and rated for 200 psig.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

D. Dielectric Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Calpico, Inc.
   b. Lochinvar Corporation.

2. Galvanized-steel coupling with inert and non-corrosive thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Perfection Corporation; a subsidiary of American Meter Company.
   b. Victaulic Company of America.

2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.5 VALVES AND SPECIALTIES

A. Safety Relief Valves (Diaphragm-Operated):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump; a division of ITT Industries.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: for NPT ¾" and 1", Bronze with 125 PSIG maximum working pressure and 250 degree F. maximum operating temperature.
3. Body: for NPT 1 ½" and 2", Cast Iron with 50 PSIG maximum working pressure and 250 degree F. maximum operating temperature.
4. Diaphragm and Seat: EPDM.
5. Wetted, Internal Work Parts: Brass.
6. Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

2.6 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Bell & Gossett Domestic Pump; a division of ITT Industries.
3. Taco.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. CWP Rating: 150 psig (1035 kPa).
4. Maximum Operating Temperature: 225 deg F (107 deg C).

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.

3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/4 (DN 8).
6. CWP Rating: 150 psig (1035 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

D. Expansion Tanks/Diaphragm Bladder-:

1. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 240 deg F (191 deg C) maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Diaphragm/Bladder: Heavy duty Butyl Rubber, securely sealed into tank to separate air charge from system water to maintain required expansion capacity.

E. Centrifugal Type Air Separators:

1. The air separator must be designed, constructed and stamped for 125 psig @ 350ºF (862 kPa @ 177ºC) in accordance with Section VII, Division I of the ASME Boiler and Pressure Vessel Code, and registered with the National Board of Boiler and Pressure Vessel Inspectors. The air separator(s) shall be painted with one shop coat of light gray air dry enamel.
2. The unit shall have flanged inlet and outlet connections tangential to the vessel shell. The unit shall have the capability to direct accumulated air to the compression tank (air control system) or air vent (air elimination system) via an NPT vent connection at top of unit. A blowdown connection shall be provided to facilitate routine cleaning.

F. In-Line Air Separators:

1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
2. Maximum Working Pressure: Up to 175 psig (1207 kPa).
3. Maximum Operating Temperature: Up to 300 deg F (149 deg C).

G. Air Purgers:

1. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
2. Maximum Working Pressure: 150 psig (1035 kPa).
3. Maximum Operating Temperature: 250 deg F (121 deg C).

2.7 CHEMICAL TREATMENT

A. Bypass Chemical Feeder/Filter: Provide the quantity and capacity of bypass feeder(s) as shown on the drawings, manufactured by Neptune Chemical Pump Company or equal. The bypass feeder shell shall be constructed of 11 gauge steel minimum for 2 gallon units and 10 gauge steel minimum for 5 gallon and larger units. Tank heads shall be a minimum of 11 gauge steel for 2 gallon units and a minimum 9 gauge steel for 5 gallon units. The bypass feeder shall be rated at 300 psi and to 200 degrees F. The tank shall have a wide mouth, 3-1/2" opening so that chemical addition can be performed without the need of a funnel. The bypass feeder shall have a continuous threaded closure requiring 2-1/2 turns to close and seal. Closures using partial threads or lugs shall not be considered. Closures rated less than 300 psi shall not be considered equal. The cap shall be constructed of cast iron with an epoxy-coated underside to prevent corrosion and shall use a square ring gasket seal. The ring gasket shall not be glued or restrained from movement. Closures using "o" rings or gaskets which are glued or restrained from free movement by snap rings shall not be considered equal. The bypass feeder shall be provided with legs to elevate the feeder off the floor. The legs shall have holes to allow mounting by anchor bolts. The bypass feeder shall be provided with a 5 micron cartridge filter for simultaneous side stream filtering.

B. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

2.8 HYDRONIC PIPING SPECIALTIES

A. Suction Diffusers:

1. Angle pattern flow straightening fitting equipped with a combination diffuser strainer- orifice cylinder, flow straightening vanes, start-up strainer and filed supplied adjustable support foot. The combination diffuser-strainer-orifice cylinder shall be designed to withstand pressure differential equal to the system pump shutoff head and shall have a free area equal to five times the cross section area of the pump suction opening. The length of the flow straightening vanes shall be no less than 21/2 times the diameter of the system pump suction connection.
2. Provide cast iron NPT and flanged models rated for a maximum working pressure of 175 PSIG. The flow straightening fitting shall be of cast iron construction with Stainless steel combination diffuser-strainer-orifice cylinder with 3/16" diameter perforations to protect the system pump. Provide start-up strainer of 16 mesh bronze. All internal components shall be replaceable.

B. Y-Pattern Strainers: Subject to compliance with requirements, provide products by Metraflex, Hoffman Specialty, Armstrong or equal:

1. Body: ASTM A 536, Grade 65-45-12 ductile iron with coupled cover; ASTM A 126, Class B, cast iron with blowoff plug for NPS 2" and smaller and bolted cover for NPS 2 ½" and larger.

2. End Connections: Threaded for NPS 2 and smaller: grooved or flanged for NPS 2-1/2 and larger.
3. Strainer Screen: perforated stainless steel with 50 percent total free area.
4. CWP Rating: 300 psig (2065 kPa).

C. T-Pattern Strainers:

1. Body: ASTM A 536, grade 65-45-12 ductile iron with coupled cover: ASTM A 53, Grade B factory fabricated steel with T-bolt hinged closure and bottom drain connection.
2. End Connections: Grooved ends.
3. Strainer Screen: perforated stainless-steel basket with 50 percent total free area.
4. CWP Rating: 300 psig (2065 kPa).

D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch (20-mm) misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).
6. Three Victaulic Style 77 couplings may be used in lieu of a flexible for vibration attenuation and stress relief at equipment connections. The couplings shall be in close proximity to the vibration source.

E. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating, chilled water piping and dual temperature system piping, aboveground, NPS 2-1/2 and larger, shall be:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
    a. Provide high temperature couplings at all connections to boilers and heat exchangers and on all heating system piping located within the boiler room.
    b. Provide flexible couplings at connections to all pumps.

B. Condenser-water piping, aboveground, NPS 2 and smaller**,** shall be one of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

C. Makeup-water piping installed aboveground shall be:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

D. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K (A), annealed-temper copper tubing with soldered or flared joints.

E. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install check valves at each pump discharge and elsewhere as required to control flow direction.

C. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install fittings for changes in direction and branch connections. Install piping to allow application of insulation.

G. Select system components with pressure rating equal to or greater than system operating pressure.

H. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

I. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

J. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

K. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

L. Install unions in piping**,** NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated. Unions and flanges are not required in grooved system installations as the couplings serve as disconnection points.

M. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple, ball valve and hose connection in blowdown connection of strainers. Match size of strainer blowoff connection for strainers smaller than NPS 2.

N. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

A. Support all HVAC system piping to conform to ASME B31.9. Provide adjustable clevis hangers for all horizontal piping. Each hanger shall allow for adjustment, after installation, while supporting the pipe. Attach hangers to structural steel in accordance with MSS SP-69 and MSS SP-89. Install piping hangers and supports to provide the indicated pipe slopes.

B. Provide a 12” long 18 gage protective saddle for all clevis hangers that support insulated piping.

C. Use carbon-steel pipe hangers and supports and attachments for general service applications.

D. Use stainless-steel pipe hangers or fiberglass pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

E. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

F. Install hangers for steel piping with the following maximum spacing:

1. NPS 3/4 to NPS 2: 8 feet maximum horizontal spacing.
2. NPS 2 and larger: 12 feet maximum horizontal spacing.
3. Vertical supports at roof, at each floor, and at 10 foot maximum intervals.

G. Install hangers for drawn-temper copper tubing with the following maximum spacing: a

1. NPS 1-1/4 and smaller: 6 feet maximum horizontal spacing.
2. NPS 1-1/2 and larger: 10 feet maximum horizontal spacing.
3. Vertical supports at roof, at each floor, and at 10-foot maximum intervals.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

B. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

C. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

D. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts in accordance with the manufacturer's written instructions. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings of the same manufacturer.

1. The grooved couplings factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and the installation of grooved joints.
2. The representative shall visit the job site periodically to review the installation and verify the system is being installed per the manufacturer's recommendations.
3. A direct employee of the grooved piping system manufacturer must conduct the training and site visits. A distributor representative is not acceptable.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install automatic air vents at high points of system piping in mechanical equipment rooms only.

B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

C. Where indicated install air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.

D. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches (1200 mm) above the floor. Install feeder in minimum NPS 3/4 (DN 20) bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 (DN 20) pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

E. Install expansion tanks on the floor or properly suspended from the structure. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system project requirements. Provide ASME relief valves and pressure gauges on all expansion tanks per PA Labor and Industry requirements.

3.7 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the proper water characteristics.

B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

C. Prior to start-up of any HVAC equipment, provide the required type of water treatment for all closed loop and open systems including but not limited to; the closed loop boiler system, the closed loop chilled water system, the pool heater system and the snow melt systems.

D. Provide initial chemical treatment of all systems and maintain the required water quality within the proper ranges for a period of one year after the date of substantial completion. If the project has multiple construction phases, the date of substantial completion for the final phase of construction shall be used to begin the time period for water treatment.

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace all strainer screens. If the project has multiple construction phases provide the necessary labor and materials for flushing and cleaning of the hydronic system for each phase.
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 air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working 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 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in 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.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect 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. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 15181

SECTION 15185 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following categories of hydronic pumps for hydronic system:

1. End-suction pumps.

1.3 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities; shipping, installed, and operating weights; furnished specialties; final impeller dimensions; and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: Show pump layout and connections. Include Setting Drawings with templates for installing foundation and anchor bolts and other anchorages.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For pumps to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.

B. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on the specific types and models indicated. Other manufacturers' pumps with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

C. Regulatory Requirements: Fabricate and test steam condensate pumps to comply with HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation," and HI 1.6, "Centrifugal Pump Tests."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Pump size must sit on the existing concrete base. It the pumps submitted do not fit on the existing concrete base, they will be rejected.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: One mechanical seal for each pump.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexible-Coupled, End-Suction Pumps:

a. Amtrol, Inc.
b. Bell & Gossett ITT; Div. of ITT Fluid Technology Corp.
c. Goulds Pumps, Inc.
d. PACO Pumps.

e. Taco; Fabricated Products Div.
f. Aurora Pump.

2.2 GENERAL PUMP REQUIREMENTS

A. Pump Units: Factory assembled and tested.

B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be nonoverloading over full range of pump performance curve.

C. Motors Indicated to Be Energy Efficient: Minimum efficiency as indicated according to IEEE 112, Test Method B. Include motors with higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B, if efficiency is not indicated.

2.3 FLEXIBLE-COUPLED, END-SUCTION PUMPS

A. Description: Base-mounted, centrifugal, flexible-coupled, end-suction, single-stage, bronze-fitted, back-pull-out, radially split case design; rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

1. Casing: Cast iron, with flanged piping connections, drain plug at low point of volute, and threaded gage tappings at inlet and outlet connections.
2. Casing: Cast iron, with flanged piping connections, drain plug at low point of volute, threaded gage tappings at inlet and outlet connections, and integral feet or other means on volute to support weight of casing and attached piping. Casing shall allow removal and replacement of impeller without disconnecting piping.
3. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, keyed to shaft, and secured by locking cap screw.
4. Wear Rings: Replaceable, bronze casing ring.
5. Shaft and Sleeve: Steel shaft with bronze sleeve.
6. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
7. Seals: Stuffing box, with at least four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
8. Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
9. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment; with flange and sleeve section that can be disassembled and removed without removing pump or motor.
10. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment for motor sizes of 100 hp and smaller; with flange and sleeve section that can be disassembled and removed without removing pump or motor, for sizes larger than 100 hp.
11. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment; with flange and sleeve section that can be disassembled and removed without removing pump or motor.
12. Coupling Guard: Steel, removable, and attached to mounting frame.

13. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate for mounting pump casing, coupling guard, and motor. Field-drill motor-mounting holes for field-installed motors.

    a. Option: Cast-iron frames are acceptable.

14. Motor: Secured to mounting frame, with adjustable alignment.

2.4 PUMP SPECIALTY FITTINGS

A. Suction Diffuser: Angle or straight pattern, 175-psig pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory- or field-fabricated support.

B. Triple-Duty Valve: Angle or straight pattern, 175-psig pressure rating, cast-iron body, pump-discharge fitting; with drain plug and bronze-fitted shutoff, balancing, and check valve features.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation.

1. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
2. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Install pumps according to manufacturer's written instructions.

1. Install pumps according to HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

B. Install pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.

C. Support pumps and piping separately so piping is not supported by pumps.

D. Set base-mounted pumps on concrete foundation. Disconnect coupling halves before setting. Do not reconnect couplings until alignment operations have been completed.

1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.
2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

3.3 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting them on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made.

B. Comply with pump and coupling manufacturers' written instructions.

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install suction diffuser and shutoff valve on suction side of base-mounted pumps.

F. Install triple-duty valve on discharge side of base-mounted pumps.

G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

H. Install pressure gages on pump suction and discharge. Install at integral pressure-gage tappings where provided.

I. Install temperature and pressure-gage connector plugs in suction and discharge piping around each pump.

J. Install check valve and gate or ball valve on each condensate pump unit discharge.

K. Install electrical connections for power, controls, and devices.

L. Electrical power and control wiring and connections are specified in Division 16 Sections.

M. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 COMMISSIONING

A. Verify that pumps are installed and connected according to the Contract Documents.

B. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents.

C. Perform the following preventive maintenance operations and checks before starting:

1. Lubricate bearings.
2. Remove grease-lubricated bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
3. Disconnect coupling and check motor for proper rotation that matches direction marked on pump casing.
4. Verify that pumps are free to rotate by hand and that pumps for handling hot liquids are free to rotate with pumps hot and cold. Do not operate pumps if they are bound or drag, until cause of trouble is determined and corrected.
5. Check suction piping connections for tightness to avoid drawing air into pumps.
6. Clean strainers.
7. Verify that pump controls are correct for required application.

D. Starting procedure for pumps with shutoff power not exceeding safe motor power is as follows:

1. Prime pumps by opening suction valves and closing drains, and prepare pumps for operation.
2. Open cooling water-supply valves in cooling water supply to bearings, where applicable.
3. Open cooling water-supply valves if stuffing boxes are water cooled.
4. Open sealing liquid-supply valves if pumps are so fitted.

5. Open warm-up valves of pumps handling hot liquids if pumps are not normally kept at operating temperature.
6. Open circulating line valves if pumps should not be operated against dead shutoff.
7. Start motors.
8. Open discharge valves slowly.
9. Observe leakage from stuffing boxes and adjust sealing liquid valve for proper flow to ensure lubrication of packing. Let packing "run in" before reducing leakage through stuffing boxes; then tighten glands.
10. Check general mechanical operation of pumps and motors.
11. Close circulating line valves once there is sufficient flow through pumps to prevent overheating.

E. When pumps are to be started against closed check valves with discharge shutoff valves open, steps are the same, except open discharge valves before starting motors.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 15185

SECTION 15430 - AIR-COOLED SCROLL CHILLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, as well as all Divisions-15 sections shall apply in conjunction with work of this section.

1.2 SUMMARY

A. This Section includes air-cooled scroll chiller and related accessories.

1.3 SUBMITTALS

A. Submit drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate accessories where required for complete system.

B. Submit product data indicating rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

C. Submit manufacturer's installation instructions, including refrigerant piping diagrams per manufacturer’s recommendations. The manufacturer shall include with the chiller submittal a detailed job specific drawing of the required refrigerant piping necessary for the chiller(s) being offered for this project. The drawing shall include pipe sizes, dimensions, quantity and routing of the refrigerant lines necessary for this application.

D. Wiring diagrams detailing wiring for power and controls and differentiating between manufacturer-installed wiring and field-installed wiring.

E. Operation and Maintenance Data.

F. Warranty information indicating the manufacturer will provide a warranty conforming to the requirements of the specification section.

1.4 QUALITY ASSURANCE

A. ANSI/ARI 550/590-98 - Standard for Water Chilling Packages using the Vapor Compression Cycle.

B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. ANSI/ASHRAE 90.1 - Energy Efficient Design of New Buildings.

D. AHRI 370 Standard for sound rating.

E. ANSI/NEMA MG 1 - Motors and Generators.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units. Protect units from physical damage. Factory coil shipping covers shall be kept in place until installation.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases, where applicable, with actual equipment provided. Cast anchor-bolt inserts into bases.

B. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.

C. Coordinate sizes and locations of roof equipment supports, and roof penetrations with actual equipment provided.

1.7 EXTENDED SERVICE AND WARRANTY

A. The In addition to the manufactures (5) five year compressors warranty, provide an all inclusive (2) two year parts and labor warranty. Warranty shall include all necessary parts and labor for any defects for a two year period beyond substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, the BASE BID shall be by Trane. Subject to review, equipment meeting the full requirements of the specifications and project installation limitations (i.e. size and weight), provide the following alternate bids as identified in division 1 of the specifications.

1. Alternate Bid M-1 (Aaon Chiller).
2. Alternate Bid M-2 (Carrier Chiller)

B. Manufactures other the basis of design manufacturer shall carefully review the contract drawings, prior to bidding, to verify the equipment will meet all requirements including installation clearances. When necessary, the contractor shall provide additional steel supports to adequately support the chiller, regardless of the manufacturer.

C. Chillers are required to meet the following:

1. Minimum chiller EER to be as indicated on the drawings.
2. Electrical components and wiring requirements are to be compatible with the basis of design manufacturer.
3. Sound criteria listed on the contract drawings.

2.2 GENERAL UNIT DESCRIPTION

A. Factory assembled, single-piece chassis, air-cooled liquid chiller. Contained within the package shall be all factory wiring, piping, controls, and refrigerant charge (HFC-410A).

2.3 CABINET

A. Frame shall be heavy-gage, with a powder coated paint finish for both aesthetic appeal and to offer more resistance to corrosion.

B. Units shall be constructed of a galvanized steel frame with galvanized steel panels and access doors. Component surfaces shall be finished with a powder-coated paint. The coating or paint system shall withstand a 1000-consecutive-hour salt spray application in accordance with standard ASTMB117.

2.4 COMPRESSORS

A. Fully hermetic scroll type compressors with R410A optimized and dedicated scroll profile.

B. Direct drive motor cooled by suction gas with only three major moving parts and a completely enclosed compression chamber which leads to increased efficiency.

C. Each compressor shall have overload protection internal to the compressor.

D. Each compressor shall include: centrifugal oil pump, oil level sight glass and oil charging valve

E. Each compressor will have crankcase heaters installed and properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

2.5 EVAPORATOR

A. The evaporator shall be a high efficiency, brazed plate-to-plate type heat exchanger consisting of parallel plates. Braze plates shall be stainless steel with copper braze material.

B. The evaporator shall be protected with an etched foil heater and insulated with 1.5 inch insulation. This combination shall provide freeze protection down to -20F ambient temperatures while the heater is powered. Contractor shall provide separate power to energize heater and protect evaporator while chiller is disconnected.

C. The water side working pressure shall be rated at 150 psig and tested at 1.5 times maximum allowable water side working pressure.

D. The refrigerant side working pressure shall be rated at 460 psig (29.6 bars) and tested at 1.1 maximum allowable refrigerant side working pressure.

2.6 CONDENSER

A. The condenser coils shall consist of copper tubes mechanically bonded into plate-type aluminum fins. A subcooling coil shall be an integral part of the main condenser coil.

B. The maximum allowable working pressure of the condenser shall be 650 psig (44.8 bars). The condensers shall be factory proof and leak tested at 715 psig (49.3 bars).

C. Low Sound Fans shall be dynamically and statically balanced, direct drive, corrosion resistant glass fiber reinforced composite blades molded into a low noise fan blade.

D. Low speed fan motors shall be three-phase with permanently lubricated ball bearings and individually protected by circuit breakers.

E. Unit shall be capable of starting and running at outdoor ambient temperatures from 32F to 125F (0C - 52C) for all sizes.

F. Provide factory-mounted, louvered, "architecturally pleasing" panels. Panel louvers shall cover the condenser coils and protect from hail.

2.7 ENCLOSURES

A. Mount starters in a UL1995 rated panel for outdoor use.

B. The starter shall be across-the-line configuration, factory-mounted and fully pre-wired to the compressor motor(s) and control panel.

C. Unit shall have a single point power connection.

D. A control power transformer shall be factory-installed and factory-wired to provide unit control power.

E. Control panel shall be dead front construction for enhanced service technician safety.

F. Power line connection type shall be standard with a terminal block.

G. Unit wiring shall run in liquid-tight conduit.

2.8 REFRIGERATION COMPONENTS

A. Each refrigerant circuit shall include a filter drier, electronic expansion valve with site glass, liquid line service valves and a complete operating charge of both refrigerant HFC-410A and compressor oil.

B. Each refrigerant circuit shall include a discharge line service valve to allow the refrigerant to be isolated in the condenser.

2.9 CONTROLS, SAFETIES AND DIAGNOSTICS

A. The microprocessor-based unit controller shall be factory-installed and factory-tested.

B. The unit display shall provide the following data:

1. Water and air temperatures
2. Refrigerant levels and temperatures
3. Flow switch status
4. Compressor starts and run times
5. Display diagnostics.

C. The unit controller shall provide chilled water reset based on return water as an energy saving option.

D. Chilled water temperature control shall be microprocessor-based, proportional and integral controller to show water and refrigerant temperature, refrigerant pressure, and diagnostics. This microprocessor-based controller is to be supplied with each chiller by the chiller manufacturer. Controls shall include the following readouts and diagnostics:

1. Low evaporator refrigerant temperature and/or pressure
2. High condenser refrigerant pressure
3. Low oil flow
4. Motor current overload
5. High compressor discharge temperature
6. Electronic distribution faults: phase loss, phase imbalance, or phase reversal

E. Unit shall be shipped with factory control and power wiring installed.

F. On chiller, mount weatherproof control panel, containing starters, power and control wiring, factory wired with terminal block power connection. Provide primary and secondary fused control power transformer and a single 115 volt 60 Hz single phase connection for evaporator freeze protection heaters.

G. The unit controller shall utilize the following components to automatically take action to prevent unit shutdown due to abnormal operating conditions which will perform as follows:

1. High pressure switch that is set 20 PSIG lower to automatically shut off a compressor to help prevent a high pressure condenser control trip. One switch is required for each compressor and indicating light shall also be provided.
2. Motor surge protector that is set at 95% of compressor RLA that will automatically shut off a compressor to help prevent an over current trip. One protector is required for each compressor and indicating light shall also be provided.
3. Low pressure switch that is set at 5 PSIG above the factory low pressure switch that will automatically shut off a compressor to help prevent a low evaporator temperature trip. One switch is required for each compressor and indicating light shall also be provided.

H. Provide the following safety controls with indicating lights or diagnostic readouts.

1. Low chilled water temperature protection.
2. High refrigerant pressure.
3. Low oil flow protection.
4. Loss of chilled water flow.
5. Contact for remote emergency shutdown.
6. Motor current overload.
7. Phase reversal/unbalance/single phasing.
8. Over/under voltage.
9. Failure of water temperature sensor used by controller.
10. Compressor status (on or off).

I. Provide the following operating controls:

1. Chilled water pump output relay that closes when the chiller is given a signal to start.
2. High ambient pressure controller that shuts off a compressor to keep head pressure under control and help prevent high pressure nuisance trip outs on days when outside ambient is above design.
3. Compressor current sensing limit that shuts off a compressor to help prevent current overload nuisance trips.
4. Auto lead-lag functions that constantly even out run hours and compressor starts automatically. If contractor cannot provide this function then cycle counter and hour meter shall be provided for each compressor so owner can be instructed by the contractor on how to manually change lead-lag on compressors and even out compressor starts and running hours.
5. Low ambient lockout control with adjustable setpoint.

J. Provide user interface on the front of the panel. If display is on the inside of the panel, then a control display access door shall be provided to allow access to the display without removal of panels. Provide user interface with a minimum of the following features:

1. Leaving chilled water setpoint adjustment from LCD input
2. Entering and leaving chilled water temperature output
3. Percent RLA output for each compressor
4. Pressure output of condenser for circuits one and two
5. Pressure output of evaporator for circuits one and two
6. Ambient temperature output
7. Voltage output
8. Current limit setpoint adjustment from LCD input.
9. Remote leaving water temperature setpoint.
10. Alarm indicating light and relay.

K. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.

L. The chiller control panel shall provide an alarm relay output that shall energize whenever a fault requiring manual reset is detected by the panel. Provide programmable relays.

M. The chiller control panel shall provide input for leaving chilled water temperature setpoint based upon a 2-10VDC or 4-20mA signal from a building automation system.

N. The chiller control panel shall provide input for chiller current limit setpoint based upon a 2-10VDC or 4-20mA signal from a building automation system.

O. The chiller control panel shall provide an output for chiller Percent Capacity via a 2-10VDC or 4-20mA signal to a building automation system.

P. The Chiller control panel shall provide an input for chiller enable signal from the BAS.

2.10 CHILLED FLUID CIRCUIT

A. Chilled fluid circuit shall be rated for 150 psig (1034 kPa) working pressure.

B. Proof of flow switch shall be factory mounted and installed.

C. Flow switch shall be IFM flow monitor type.

D. Units with brazed plate evaporators shall have a water strainer that is factory provided. It shall be installed with a blowdown valve to facilitate periodic cleaning of the strainer to prevent it from becoming clogged.

E. Water pipe extensions with insulation shall be factory installed from the evaporator to the edge of the unit.

F. All major serviceable components shall be located at least 18-inches from edge of chiller. Service shutoff valves and water strainer are conveniently located to enable each service.

2.11 ACCESSORIES AND OPTIONS

A. Sound Reduction: Provide the following options:

1. Provide Sound Blankets covering all compressors, oil separators, and suction / discharge lines.

B. Provide factory mounted suction service shut-off valve for each compressor.

C. Provide vibration isolators, selected by the chiller manufacturer, to completely eliminate any vibrations to the structural steel supports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine chillers before installation. Reject chillers that are damaged. Install chillers in accordance with manufacturer’s instructions.

B. Examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting chiller performance, maintenance, and operations before equipment installation. Final chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

3.2 CHILLER INSTALLATION

A. Install in accordance with manufacturer's instructions. Install piping adjacent to chiller to allow service and maintenance.

B. Install chillers on structure steel and equipment curbs as noted and/or indicated. Install units on vibration isolators, selected by the chiller manufacturer, to totally eliminate vibration through the supporting structure. Where required provide supplementary structural steel for chiller support. Supplementary steel shall be primed and painted.

C. When remote mounted evaporator(s) are required provide a welded and painted structural steel base to mount the evaporator(s), 30” above finished floor, in the area indicated.

D. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.

3.3 STARTUP SERVICE/COMMISSIONING

A. Engage a factory-authorized service representative to perform startup service and commissioning. Complete installation and startup checks according to manufacturer's written instructions. Verify that refrigerant charge is sufficient and chiller has been leak tested. Verify that pumps are installed and functional. Verify that thermometers and gages are installed. Operate chiller for run-in period. Check bearing lubrication and oil levels. Verify proper motor rotation. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown. Verify and record performance of chiller protection devices. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

B. The HVAC Contractor shall provide the owner with written verification when all Chillers are completely installed, verified by a factory authorized representative the and fully operational.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chillers. Review maintenance procedures. Schedule training with the owner.

END OF SECTION 15430

SECTION 15900 - HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SYSTEM DESCRIPTION

A. The existing system is an existing Novar control system. This shall remain intact with minor modification to accommodate this project. The contractor will install temperature wells in the supply and return piping. The control devices will be provided by the controls sub contractor. The HVAC contractor will remove the existing sensors and wells with care. The contractor will turn the control sensors and wells over to the controls sub-contractor.

B. The contractor shall use the districts approved control installation subcontractor.

ABR Controls
Mr. George Miller
Cell # 484-769-8197

1.3 SEQUENCE OF OPERATION

A. Chiller – The chiller is equipped with a chiller control panel. The BAS based on input from the chiller supply water and return water temperature sensors shall sent a signal to enable the chiller. The BAS shall provide chiller water reset based on outdoor air temperature. The BAS will connect to the chiller control panel and associated relays for compressor status (4 Stages). The BAS will connect to the chiller control panel and the programmable relays for alarm notification.

B. Chiller Water Pumps – The BAS shall connect to the new pump starter and shall operate index the pump to operate during the occupied mode of operation whenever the outdoor air temperature is above 60 degrees (adjustable). Only one pump will need to run at a time. The BAS shall start lag pump on a failure of the lead pump. BAS shall provide lead pump rotation for equal run time. The BAS shall use current transducer for pump status.

1.4 QUALITY ASSURANCE

A. The controls for this project consist of minor modifications to the existing Novar control system. The only acceptable control subcontractor shall be the districts authorized Novar control subcontractor.

1.5 COORDINATION AND VERIFICATION

A. Coordinate the new installation with all the existing controls. Contractor must verify the operation of the new controls being installed as well as the existing controls remaining which effects the modifications being made as part of this project.

1.6 FIELD QUALITY CONTROL, TRAINING AND GRAPHICS

A. This contractor shall confirm and verify that all new and existing controls function to meet the sequence of operation described above.

B. Provide 8 hours of onsite training to instruct owner’s personnel on the system operation.

C. Provide modifications to the graphical system representations on the site network computer as required.

END OF SECTION 15900

SECTION 15990 –TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

Section Includes Testing, Adjusting and Balancing (TAB) of the following air and water systems:

1. Constant-flow hydronic systems. New Pump Set up and report.

1.3 SUBMITTALS

A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified herein.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB in the testing, adjusting and balancing of both air and water systems. The NEBB certified firm guarantees that all work will be performed in accordance with the applicable NEBB standards and procedures, and evidence of the firm's certification shall be provided for the engineer or designated owner's representative. In addition to the NEBB certified firm's guarantee, the NEBB certified firm shall provide to the engineer or designated owner's representative, a NEBB Certificate of Conformance Certification (issued by the NEBB National office) for work on the project specified. The Certificate of Conformance Certification provides written assurance that the NEBB Certified Firm will perform its contracted services in accordance with the following:

1. Applicable NEBB standards and procedures.
2. Provisions of the NEBB Quality Assurance Program which is described in the NEBB Operational Procedures

B. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

B. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Verify all systems are complete, including controls, before starting the TAB work.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

3.4 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set system controls so automatic valves are wide open to heat exchangers.
6. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

7. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.5 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved. Monitor motor performance during procedures and do not operate motors in overload conditions.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 10 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

D. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

E. Check settings and operation of each safety valve. Record settings.

3.6 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer. Include a list of instruments used for procedures, along with proof of calibration.

B. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.

b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm (L/s).
g. Water pressure differential in feet of head or psig (kPa).
h. Required net positive suction head in feet of head or psig (kPa).
i. Pump rpm.
j. Impeller diameter in inches (mm).
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig (kPa).
b. Pump shutoff pressure in feet of head or psig (kPa).
c. Actual impeller size in inches (mm).
d. Full-open flow rate in gpm (L/s).
e. Full-open pressure in feet of head or psig (kPa).
f. Final discharge pressure in feet of head or psig (kPa).
g. Final suction pressure in feet of head or psig (kPa).
h. Final total pressure in feet of head or psig (kPa).
i. Final water flow rate in gpm (L/s).
j. Voltage at each connection.
k. Amperage for each phase.

C. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

END OF SECTION 15990

SECTION 16010 – BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division-1:

1. Submittals.
2. Coordination Drawings.
3. Record documents.
4. Maintenance manuals.
5. Rough-ins.
6. Electrical installations.
7. Cutting and patching.

1.2 RELATED SECTIONS

A. The following sections contain requirements that relate to this section:

1. Division-1 Section, “General Requirements”.

1.3 SUBMITTALS

A. Follow the procedures specified in Division-1.

B. Submit a minimum of eight (8) copies of electrical related Shop Drawings, Product Data, and Samples submitted, to allow for required distribution of each submittal required, which will be retained by the Electrical Consulting Engineer.

1.4 PRODUCT REVIEWS AND SUBSTITUTIONS

A. No Manufacturer’s products will be reviewed as an equivalent to the specified products unless submitted by a Bidding Contractor for review ten (10) calendar days prior to bid due date. No products will be reviewed after that time. Product review requests must be submitted in accordance with Division 1 and Section 16010. An addendum will be issued to all Bidding Contractors listing any Manufacturers whose products have been added to the Contract Documents as equivalents to the specified products.

B. No substitutions will be reviewed by the Engineer after the Bid Due Date unless specifically requested by the Owner in writing with an associated credit with the substitution.

1.5 SHOP DRAWINGS

A. Refer to the Conditions of the Contract (General and Supplementary) and Division-1 Section, “Shop Drawings,” “Product Data,” and “Samples” for submittal definitions, requirements, and procedures.

B. Submittal of Shop Drawings, Product Data, and Samples will be reviewed only when submitted by the Prime Contractor. Submittals from sub-Contractors and material suppliers directly to the Engineer will not be reviewed. No equipment/materials shall be installed until the Shop Drawings have been stamped with “No Exceptions Taken” or “Make Corrections Noted” by the Engineer.

C. Submit Shop Drawings as listed in each specification section. Following is a list of shop drawings to assist the contractor; however, the contractor shall supply all shop drawings as listed in each individual section whether listed below or not.

1. Panelboards.
2. Disconnect Switches.
3. Combination Motor Starter/Disconnect Switches.
4. Thermal Overload Switches.

D. The Contractor shall provide certificates of approval, in triplicate, for service equipment, building rough wiring, and building finished wiring.

E. Inspection certificates shall be submitted to the Engineer within 30 days after the inspections are made. Contractor shall use an independent NEC Certified Inspection Agency as the approved agency. Contractor must verify that the Certified Inspection Agency is approved by the local municipality and the Owner to inspect electrical installations in the project locality. All inspection certificates must be received before final payment can be made.

F. Refer to General Conditions for additional information.

1.6 MANUFACTURER'S REQUIREMENTS

A. All material shall be new, of the best respective kinds, manufactured by the company or companies mentioned and shall be of domestic manufacture unless specified otherwise.

B. All equipment, material or apparatus of any one system must be the product of one Manufacturer, or system tested products.

C. Manufacturers not listed in the Contract Documents must submit to the Engineer via a Bidding Contractor all product information for review no less than ten (10) calendar days prior to bid due date.

1.7 NAMEPLATE DATA

A. Each item of power operated equipment shall be provided with a permanent operational data nameplate on indicating Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliance, and similar essential data. Nameplates shall be located in an accessible location.

1.8 FAMILIARITY WITH PROPOSED WORK

A. All Contracts are with the understanding that the Contractor, prior to submission of his bid, acquainted himself with the requirements of the Drawings and Specifications, including "Conditions of the Contract," conditions of the site, its terrain, soil conditions, all other requirements of the Contract, and that he obtained all information necessary for completion of the work on or before the date specified for receiving of bids.

B. In all cases where a device or part of the equipment is herein referred to in the singular, such reference shall apply to as many such items as are required to complete the installation.

C. "Existing" information does not necessarily represent "as-built" conditions. The Contractor shall verify all existing conditions. If discrepancies are found the Contractor shall notify the Engineer for a resolution before proceeding.

1.9 DEFINITIONS

A. The term "Provide," when used separately, shall mean to "Furnish and Install."

B. The term "Furnish," when used separately, shall mean to obtain and deliver on the job for installation by other trades.

C. The term "Install," when used separately, shall mean to mount in place, connect and make operable.

1.10 WIRING LAYOUTS

A. Should it become necessary to rearrange any of the circuit or feeder wiring, approval to do so shall first be obtained from the Engineer. The Contractor will be supplied with a spare set of Drawings on which all such approved changes shall be noted. Upon completion of all work under this Contract, these Drawings shall be returned to the Engineer, who will issue a receipt for same.

1.11 FIELD MEASUREMENTS

A. Before ordering any materials or doing any work, Contractor shall verify all measurements at the building site, and shall be responsible for correctness of same. At no time shall the Contractor scale drawings for the purpose of installation.

B. No extra compensation will be allowed on account of differences between actual dimensions and those indicated on the Drawings. Any difference which may be found shall be submitted to the Engineer for consideration before proceeding with the work.

1.12 COORDINATION

A. The Contractor shall cooperate with the other Contractors and shall arrange to eliminate conflicts with the equipment and work of the Contractors.

1.13 CHASES AND OPENINGS

A. The Contractor shall determine, in advance, the locations and sizes of all chases and openings necessary for the proper installation of his work and have same provided during construction. Any chase or opening not made during construction, due to the Contractor's failure to determine same in advance, shall be done by the Contractor at his own expense. Any unnecessary cutting shall be repaired to match the original conditions of the area disturbed at the Contractor's expense.

1.14 WARRANTIES

A. Refer to individual sections for warranty requirements beyond those as specified in Division -1

1.15 TEST AND ADJUST

A. All systems installed under this Contract shall be tested and adjusted to insure that all equipment and systems meet or exceed the specified requirements.

1.16 PHASE LOAD BALANCE

A. A reasonable balance shall be secured on the phases of all main distribution feeders and bus bars.

B. Following installation and with the system in operation, the Electrical Contractor shall check the balance and rearrange connections so that the ampacity on any of the two single-phase phases of the main bus shall not vary more than 10% of each other.

1.17 PAINTING

A. Refer to the Division-1 Section for general requirements.

B. No painting will be performed under this Contract except any “touch-up” required to restore “factory-finished” equipment and material to its original new condition, unless noted otherwise in the specifications or on the drawings.

C. The Electrical Contractor shall be responsible for all touch up painting on this project for electrical work.

1.18 CLEANING

A. Refer to Division-1 Section, “Project Closeout” or “Final Cleaning” for general requirements for final cleaning.

B. The Contractor shall keep the building free of rubbish and material during the course of construction insofar as the work under this Contract is concerned.

C. Upon completion of the project, the Contractor shall remove all rubbish, surplus equipment and shipping labels and have all areas broom clean. The Contractor shall thoroughly clean all fixtures, and other electrical equipment, leaving same in first-class working condition.

1.19 INSTRUCTION OF OWNER'S PERSONNEL

A. The Contractor shall provide the services of competent personnel and/or Manufacturer trained personnel to instruct employees designated by the Owner in the proper operation, care and maintenance of the equipment and system installed under the Contract.

1.20 SCAFFOLDING AND HOISTING

A. The Contractor shall provide all lumber and other material required for the erection of all staging, scaffolding, shoring, protective platforms, railings and ladders. Scaffolding shall be removed at the completion of the work.

B. The Contractor shall protect any flooring that is to remain. The Contractor shall inspect the flooring before the scaffolding is installed and report any damage that exists before the stat of the construction. The Contractor shall be responsible to repair any damage to the flooring after the scaffolding is removed to the acceptance of the owner at no additional cost to the owner.

1.21 PERMITS AND FEES

A. Unless noted otherwise, all permits, certificates, tests, and inspection fees required for the work provided under this contract shall be paid by the Contractor. Refer to General Conditions for additional information.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment Specifications in Divisions-2 through -16 for rough-in requirements.

3.2 CUTTING AND PATCHING

A. Perform cutting and patching in accordance with Division-1. In addition to the requirements specified in Division-1, the following requirements apply. The Electrical Contractor shall be responsible for providing all cutting and patching required to perform his work unless noted otherwise. All roof cutting and patching shall be provided by the owners roof warranty contractor. The cost to cut and patch the roof shall be incorporated into the bid price.

B. Perform cutting, fitting, and patching of electrical equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Install equipment and materials in existing structures.

C. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.3 ELECTRICAL INSTALLATION

A. Coordinate electrical equipment and materials installation with other building components. Verify all dimensions by field measurements. If no dimensions are given, Contractor shall verify with Engineer before starting work. At no time shall the Contractor scale Drawings for the purpose of locating items.

B. Provide for chases, slots, and openings in other building components to allow for electrical installations. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

C. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

D. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible, or to meet current local and national codes.

E. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

F. Install systems, materials, and equipment to conform with submittal data, including Coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.

G. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

H. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

3.4 ELECTRICAL DEMOLITION

A. The Electrical Contractor shall be responsible for all electrical demolition.

B. Where fastened equipment is removed, the contractor shall be responsible to remove the associated lags or bolts that fastened the equipment down. Grind lags or bolts to below exiting surface and patch surface to match existing condition.

3.5 SALVAGE

A. The Owner reserves the right to salvage any electrical equipment prior to the start of construction.

3.6 CEILING TILE REMOVAL

A. The Contractor shall be responsible to remove and replace all ceiling tiles and any insulation found above to perform his work. The contractor shall be responsible to replace any tiles that he damages.

END OF SECTION 16010

SECTION 16110 - RACEWAYS

PART 1 - GENERAL

1.1 REFERENCE

A. Requirements of Drawings and General Conditions of the Contract, Supplementary Conditions and Division-1, General Requirements are hereby made a part of this section as fully as if repeated herein.

B. Division-16 Section, "Basic Electrical Requirements" apply to work specified in this section.

1.2 DESCRIPTION OF WORK

A. The extent of the raceway and work required by this section is indicated by drawings and requirements of other sections of this specification.

B. Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated on plans. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements and comply with applicable portions of NEC for raceways.

C. It is the intent of these Specifications and Drawings that all branch circuits and feeder wiring be run in a continuous conduit system. Type MC cables are not permitted.

1.3 CODES AND STANDARDS

A. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.

B. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to electrical raceway systems; provide products and components which have been UL-listed and labeled.

C. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of raceway systems.

PART 2 - PRODUCTS

2.1 CONDUITS

A. Rigid Steel Conduit: Provide rigid steel, zinc-coated, threaded type conforming to FS WW-C-581, ANSI C80.1 and UL 6. Provide zinc-coating fused to inside and outside walls.

B. Rigid Aluminum Conduit: Provide rigid aluminum, threaded type conforming to ANSI and UL standards.

C. Intermediate Steel Conduit: Provide rigid intermediate grade (IMC) hot-dip galvanized threaded conforming to FS WW-C-581 and UL 1242.

D. Electrical Metallic Tubing (EMT): FSW-C-563, ANSI C80.3, and UL 797.

E. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).

F. Flexible Metal Conduit: FS WW-C-566 and UL 1. Formed from continuous length of spirally wound, interlocked zinc-coated strip steel.

2.2 CONDUIT FITTINGS

A. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.

B. Straight Terminal Connectors: Contractor shall provide one-piece body, with female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

C. 45-Deg or 90-Deg Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

D. Rigid Metal Conduit Fittings: Cast-malleable-iron, galvanized or cadmium plated, conforming to FS W-F-408. Use Type 1 fittings for raintight connections, Type 2 fittings for concrete tight connections, and Type 3 fittings for other miscellaneous connections.

E. Rigid Aluminum Conduit Fittings: Provide cast-aluminum conduit fittings and mounting hardware conforming to ANSI and UL standards of types required for the application.

F. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G. Provide cadmium-plated, malleable-iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.

G. EMT Fittings: All couplings and connectors shall be of the set-screw type.

H. Conduit and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.

I. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types, shapes, and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded-conduit entrance ends, removable covers, either cast or galvanized steel, and corrosion-resistant screws.

2.3 WIREWAYS

A. General: Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other components and accessories as required for complete system.

B. Lay-In Wireways: Provide lay-in wireways with hinged covers, in accordance with UL 870 and with components UL-listed, including lengths, connectors and fittings. Design units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireways with knockouts.

C. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached that removal is not necessary to utilize the lay-in feature.

D. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.

E. Raintight Troughs: Construct in accordance with UL 870, with components UL listed.

F. Construction: 16-ga galvanized sheet metal parts for 4" x 4" to 6" x 6" sections, and 14-ga parts for 8" x 8" and larger sections. Provide knockouts only in bottom of troughs, with suitable adapters to facilitate or tear during installation, or would compromise raintight capability of the trough. Do not use cover screws that will protrude into the trough area and damage wire insulation.

G. Finish: Provide 14-ga and 16-ga galvanized sheet metal parts with corrosion-resistant phosphate primer and baked enamel finish. Plate hardware to prevent corrosion.

2.4 DEMOLITION OF EXISTING CONDUIT

A. The electrical contractor shall be responsible for removing all existing conduit where wiring has been removed from the raceway or conduit.

B. The Contractor may reuse existing conduits that are in good condition and are located correctly for new construction. However, the bid amount shall be based upon providing new conduits. If existing conduits are reused, it is the Electrical Contractor's responsibility to assure that the reused conduit is of proper size and is supported in accordance with the National Electrical Code.

C. Unless noted otherwise, where an electrical device or electrical equipment is indicated to be removed, its associated wiring and conduit shall also be removed.

D. All abandoned conduit and wiring shall be removed.

PART 3 - EXECUTION

3.1 GENERAL

A. All wiring shall be installed in concealed conduits throughout new construction work, either in walls, under slabs, or above ceilings. Run conduits concealed in existing work, cut and patch as required. Type MC cables are permitted only where specified in Section 16120.

B. Use rigid aluminum conduit where installed exposed outdoors.

C. Use EMT conduit in mechanical equipment rooms, electrical equipment rooms, penthouses, crawl spaces, walls, and areas above ceiling.

D. Use flexible metal conduit in moveable partitions and from outlet boxes to recessed lighting fixtures, and final 24" of connection to motors, or control items subject to movement or vibration.

E. **Use liquid-tight flexible metal conduit for final 3' connection of motors in boiler room**.

F. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.

G. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameters.

H. Size conduits to meet NEC, except no conduit shall be smaller than 3/4".

I. Fasten conduit terminations in sheet metal enclosures by two locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.

J. Conduits are not to cross pipe shafts or ventilating duct openings.

K. Keep conduits a minimum distance of 6" from parallel runs of hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.

L. Support riser conduit at each floor level with clamp hangers.

M. Use of running threads at conduit joints and terminations is prohibited.

N. Where required, use 3-piece union or split coupling.

O. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

P. Install conduits so as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.

Q. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings, and in crawl spaces.

R. Conduits shall not be installed against roof deck. Allow 3” of space between conduit and roof deck for the possible penetration of roof nails to protrude without damaging conduit.

S. Provide fish wire or pull string in all spare conduits.

T. Cap all spare conduits installed for future use.

3.2 EXPOSED CONDUITS

A. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.

B. Install exposed conduit work as not to interfere with ceiling inserts, lights, or ventilation ducts or outlets.

C. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed following: Up to 1": 6'-0"; 1-1/4" and over: 8'-0".

D. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.

3.3 CONDUIT FITTINGS

A. Construct locknuts for securing conduit to metal enclosure with sharp edges for digging into metal, and ridged outside circumference for proper fastening.

B. Bushings for terminating conduits smaller than 1-1/4" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.

C. Install insulated type bushings for terminating conduits 1-1/4" and larger.

D. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.

E. Bushing of standard or insulated type to have screw type grounding terminal.

F. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs to be specifically designed for their particular application.

3.4 RACEWAYS AND WIREWAYS

A. Avoid use of dissimilar metals through system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.

B. Install expansion fittings in all raceways/wireways wherever structural expansion joints are crossed.

C. Make changes in direction to raceway/wireway run with proper fittings, supplied by raceway manufacturer. No field bends of raceway/wireway sections will be permitted.

D. Properly support and anchor raceways/wireways for their entire length by structural materials. Raceways are not to span any space unsupported.

E. Use boxes as supplied by manufacturer wherever junction, pull or device boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface installations.

END OF SECTION 16110

SECTION 16120 - WIRES AND CABLES - 600V AND BELOW

PART 1 - GENERAL

1.1 REFERENCE

A. Requirements of Drawings and General Conditions of the Contract, Supplementary Conditions and Division-1, General Requirements are hereby made a part of this section as fully as if repeated herein.

B. Division-16 Section, "Basic Electrical Requirements" apply to work specified in this section.

1.2 DESCRIPTION OF WORK

A. The extent of the wire and cable work is indicated by drawings and by requirements or other sections of this specifications for cables used for power, lighting, control and related system rated 600 volts or less.

1.3 CODES AND STANDARDS

A. NEC Compliance: Comply with applicable requirements of NEC for construction and installation of wires/cables and connectors.

B. UL Compliance: Comply with UL Stds 83 and 486A. Provide wiring/cabling and connector products which are UL-listed and labeled consistent with their uses.

C. ICEA Compliance: Insulated Cable Engineers Association Inc., Standard WC-5-86.

D. IEEE Compliance: Institute of Electrical and Electronic Engineers, Standard 82-83.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all wires and cables of sizes indicated on the drawings and suitable for the temperature, conditions and location where installed. Install all wire in raceway.

2.2 CONDUCTOR MATERIAL

A. Use copper conductors of 98% conductivity and rated at 600V for all wires and cables.

2.3 INSULATION

A. No conductors smaller than No. 12 AWG shall be used unless noted elsewhere. All wires No. 8 AWG or larger shall be stranded. Wire sizes No. 12 and No. 10 AWG shall be solid copper. For all sizes provide THHN/THWN insulation as appropriate for the locations where installed or as noted elsewhere.

2.4 CABLES

A. Provide the following in NEC approved locations and project applications where indicated.

B. Type MC Cable: Provide metallic cable wiring utilizing separate ground wire. Metallic cable may be used on this project only for connection to motors (3 feet maximum). **Use liquid tight in boiler room.**

C. The Contractor shall bear all costs related for removing metallic cable not pre-approved. Type MC cable must be supported within 12" of every fitting, junction box or outlet box that the cable enters.

D. **All other wiring shall be installed in EMT or rigid metal conduit unless approved otherwise by the Engineer prior to installation.**

E. **All feeder wiring shall be run in conduit.**

F. **All branch circuit wiring shall be run in conduit from the panel to the room served by the branch circuit.**

2.5 CONNECTORS FOR CONDUCTORS

A. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

2.6 DEMOLITION OF EXISTING WIRING

A. The electrical contractor shall be responsible for removing all existing wiring which will be disconnected. All wiring shall be removed from the site. No existing wiring shall be abandoned in place.

PART 3 - EXECUTION

3.1 WIRES AND CABLES

A. General: Install electrical cables, wires, and connectors in compliance with NEC. Coordinate cable installation with other work. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.

B. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.

C. Conceal all cable in finished spaces. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible. Keep conductor splices to minimum.

D. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors which are compatible with conductor material.

E. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal. Provide wire ties and neatly train and rack wires in all boxes, panels, and other areas as required.

F. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.2 FIELD QUALITY CONTROL

A. Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels to assure requirements are fulfilled.

B. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.

C. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

D. Table 1 - Color-Coding for Phase Identification:

1. Match existing if present. Color-code secondary service, feeder, and branch circuit conductors with factory-applied color as follows:

120/208 Volts	Phase	277/480 Volts
Black	A	Yellow
Red	B	Brown
Blue	C	Orange
White	Neutral	Grey
Green	Ground	Green

2. Provide visible colored taped as listed above at all termination points for No. 8 and larger wires.

END OF SECTION 16120

SECTION 16135 - ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 REFERENCE

A. Division-16, "Basic Electrical Requirements" sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK

A. The extent of electrical boxes and associated fittings work is indicated by drawings.

1.3 CODES AND STANDARDS

A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.

B. UL Compliance: Comply with UL Std No.'s 50, 514-series and 886. Provide electrical boxes and fittings which are UL-listed and labeled.

C. NEMA Compliance: Comply with applicable requirements of NEMA Stds/Pub No.'s OS1, OS2 and Pub 250.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS

A. Outlet Boxes: Provide galvanized coated flat-rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated (or as required), suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding. Flush boxes must be mounted flush with finished wall surface.

B. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code - compliance option.

C. Device Boxes: Provide galvanized coated flat-rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated (or as required), suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cables clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding. Flush boxes must be mounted flush with finished wall plate.

D. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's codes-compliance option.

E. Surface-Mounted Device and Outlet Boxes: Provide a minimum depth galvanized-coated steel box where indicated on the drawings without prepunched knockouts.

F. Raintight Outlet Boxes: Provide corrosion-resistant cast-metal raintight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, including face plate gaskets and corrosion-resistant plugs and fasteners.

G. Junction and Pull Boxes: Provide galvanized code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers. Provide handles on covers over 4 square feet.

PART 3 - INSTALLATION

3.1 GENERAL

A. Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

C. Provide weathertight outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

D. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.

F. Avoid installing boxes back-to-back in walls. Provide not less than 6" (150mm) separation or separate stud spaces.

G. Avoid installing aluminum products in concrete.

H. Position recessed outlet boxes accurately to allow for surface finish thickness.

I. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surfaces.

J. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

K. Provide electrical connections for installed boxes.

L. Provide cable racks in large boxes.

M. Subsequent to installation of boxes, protect boxes from construction debris and damage.

N. Ground electrical boxes properly upon completion of installation work and demonstrate compliance with requirements.

END OF SECTION 16135

SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 REFERENCE

A. Requirements of Drawings and General Conditions of the Contract, Supplementary Conditions and Division-1, General Requirements are hereby made a part of this section as fully as if repeated herein.

B. Division-16, "Basic Electrical Requirements" sections apply to work of this section.

1.2 CODES AND STANDARDS

A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical supporting devices.

B. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

C. UL Compliance: Provide electrical components and devices which are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide supporting devices which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one (1) type of device fulfills indicated requirements, selection is Installer's option.

2.2 SUPPORTS

A. Provide supporting devices of types, sizes and materials indicated; and having the following construction features:

B. Clevis Hangers: For supporting up to 2" rigid metal conduit; galvanized steel; with ½" diameter hole for round steel rod; approximately 54 pounds per 100 units.

C. Riser Clamps: For supporting up to 5" rigid metal conduit; black steel; with 2 bolts and nuts, and 4" ears; approximately 510 pounds per 100 units.

D. Reducing Couplings: Steel rod reducing coupling, ½" x 5/8", black steel; approximately 16 pounds per 100 units.

E. C-Clamps: Black malleable iron; ½" rod size; approximately 70 pounds per 100 units.

F. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flanges width 2"; approximately 52 pounds per 100 units.

G. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.

H. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.

I. Hexagon Nuts: For ½" rod size; galvanized steel; approximately 4 pounds per 100 units.

J. Round Steel Rod: Black steel; ½" diameter; approximately 67 pounds per 100 feet.

K. Offset conduit clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.

2.3 ANCHORS

A. Provide anchors of types, sizes and materials indicated; and having the following construction features:

B. Lead Expansion Anchors: ½"; approximately 38 pounds per 100 units.

C. Toggle Bolts: Spring head; 3/16" x 4"; approximately 5 pounds per 100 units.

D. Manufacturers: Provide anchors of one of the following (for each type of anchor):

1. Ackerman Johnson Fastening Systems, Inc.
2. Ideal Industries, Inc.
3. Joslyn Manufacturing and Supply Co.
4. McGraw Edison Co.

2.4 SLEEVES AND SEALS

A. Provide sleeves and seals, including armored cable seals, of types, sizes, and materials indicated, with the following construction features:

B. Sleeve Seals: Provide sleeves for piping which penetrate foundation walls below grade, or exterior walls. Caulk between sleeve and pipe with non-toxic, UL-classified caulking material to ensure watertight seal.

C. Wall and Floor Seals: Provide watertight wall and floor seals, or types and sizes indicated; suitable for sealing around conduit, pipe, of tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

D. Fire-Rated Walls and Floors: At all locations where conduits, cables, or ducts penetrate a fire-rated wall or floor, a special fire-retardant caulking compound shall be used, similar to Dow-Corning RTV foam.

2.5 CONDUIT CABLE SUPPORTS

A. Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers; construct for 2" rigid metal conduit; 3-wires, type wire as indicated; construct body of malleable-iron casting with hot-dip galvanized finish.

2.6 U-CHANNEL STRUT SYSTEMS

A. Provide U-channel strut system for supporting equipment supplied under this contract, 12-ga hot-dip galvanized steel, or types and sizes indicated; construct with 9/16" diameter holes, 8" on center on top surface, with standard green finish, and with the fittings which mate and match with U-channel.

B. Auxiliary Steel Supports: Provide all required auxiliary steel to install any equipment supplied under this contract. The design and gauge of steel used shall be as required by the manufacturer's specifications.

C. Manufacturers: Provide U-channel strut systems of one of the following (for each type system):

1. Allied Tube and Conduit Corp.
2. Midland-Ross Corp.
3. OZ/Gedney Div; General Signal Corp.
4. Power-Strut Div; Van Huffel Tube Corp.
5. Unistrut Div; GTE Products Corp.

PART 3 - EXECUTION

3.1 GENERAL

A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices. Comply with installation requirements of NECA and NEC pertaining to supporting devices.

B. Coordinate with other mechanical and electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

END OF SECTION 16190

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 REFERENCE

A. Requirements of Drawings and General Conditions of the Contract, Supplementary Conditions and Division-1, General Requirements are hereby made a part of this section as fully as if repeated herein.

1.2 CODES AND STANDARDS

A. UL Compliance: Comply with UL Std 969.

B. NEC and NEMA Compliances: Comply with NEC and NEMA WC-1 and WC-2.

C. ANSI Compliance: Comply with ANSI Std A13.1.

PART 2 - PRODUCTS

2.1 GENERAL

A. Except as otherwise indicated; provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer’s option, but provides single selection for each application.

2.2 CABLE/CONDUCTOR IDENTIFICATION BANDS

A. Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type; either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.

2.3 SELF-ADHESIVE PLASTIC SIGNS

A. Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application areas and adequate for visibility, with proper wording for each application, e.g., 208V EXHAUST FAN.

B. Colors: Unless otherwise indicated, or required by governing regulations, provide white signs with black lettering.

2.4 ENGRAVED PLASTIC-LAMINATE SIGNS

A. Provide engraving stock melamine plastic laminate with black face and white core plies (letter color), complying with FS L-P-387, in sizes and thicknesses indicated. Engrave laminate with engraver's standard letter style of sizes and wording indicated, and punch for mechanical fastening except where adhesive mounting is necessary because of substrates.

B. Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.5 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

2.6 MANUFACTURER

A. Provide electrical identification products of one of the following (for each type marker):

1. Ideal Industries, Inc.
2. LEM Products, Inc.
3. Markal Company
4. National Band and Tag Co.

PART 3 - EXECUTION

3.1 GENERAL

A. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.

3.2 COORDINATION

A. Where identification is to be applied to surfaces which require finish, install identification after completion of painting.

3.3 REGULATIONS

A. Comply with governing regulations and requests of governing authorities for identification of electrical work.

3.4 CABLE/CONDUCTOR IDENTIFICATION

A. Apply cable-conductor identification where wires of communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

3.5 DANGER SIGNS

A. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.

B. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.

C. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

3.6 EQUIPMENT/SYSTEM IDENTIFICATION

A. Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, ½" high lettering on 1-1/2" high sign (2" high where 2 lines are required), black lettering in white field. Provide text matching terminology and numbering of the contract documents and shop drawings.

B. Provide signs for each unit of the following categories of electrical work.

1. Disconnect Switches.
2. Panelboard Identification.
3. Enclosed Motor Controllers.

C. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment.

D. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

3.7 PANELBOARD DIRECTORY

A. Update existing panelboard directories to reflect work performed under this contract.

B. Provide typed panelboard directory in new panel indicating equipment controlled by each circuit.

END OF SECTION 16195

SECTION 16442 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600V and less for the following types:

1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

D. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 WARRANTY

A. All equipment and labor provided under this specification section shall be warranted for a period of one year after project completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D Company

B. Siemens

C. Cutler Hammer

D. General Electric

2.2 FABRICATION AND FEATURES

A. Enclosures: Flush and surface mounted cabinets. Refer to panel schedules on drawings to determine flush or surface. NEMA PB 1, Type 1.

B. Hinged Front Cover: **Entire front trim hinged to box and with standard door within hinged trim cover.** For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

C. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

D. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

E. Bus: Hard-drawn copper, 98 percent conductivity.

F. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.

G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

H. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches. Provide when indicated on the panel schedules.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Refer to Section 16195 for more information.

E. Install filler plates in unused spaces.

F. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

A. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Test continuity of each circuit.

B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 10 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442

SECTION 16452 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Division-16, "Basic Electrical Requirements" sections apply to work of this section.

1.2 SUMMARY

A. Extend the existing grounding system. Extension of electrical grounding and bonding work is indicated by drawings and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

1.3 CODES AND STANDARDS

A. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.

B. UL Compliance: Comply with applicable requirements of UL 467, 486A, and 869, pertaining to grounding and bonding of systems, circuits and equipment. Provide grounding and bonding products which are UL-listed and labeled for their intended usage.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General: Except as otherwise indicated, provide electrical grounding and bonding system assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, and additional accessories necessary to extend the existing system. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sizes according to NEC.

C. Bonding Plates, connectors, Terminals, and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.

D. Electrical Grounding connection Accessories: Provide electrical insulating tape, heat shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Engineer in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEM

A. General: Install electrical grounding and bonding system as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

C. Branch Circuits: Install a minimum 12 AWG ground wire in each 20A circuit and connect to each device. Size larger circuit ground wires as per NEC Table 250-122.

D. Bond ground system to equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables.

E. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.

F. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torqueing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

G. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible to minimize transient voltage rises.

H. Install clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 25 ohms, notify Engineer and Owner for additional instruction.

END OF SECTION 16452

SECTION 16470 – DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Disconnect switches.

B. Enclosures.

1.2 REFERENCES

A. FS W F 870 Fuseholders (For Enclosed Cartridge Fuses).

B. FS W S 865 Switch, Box, (Enclosed), Surface Mounted.

C. NEMA KS 1 Enclosed Switches.

1.3 SUBMITTALS

A. Submit product data under provisions of Section 16010.

B. Include outline Drawings with dimensions, and equipment ratings for voltage, capacity, horsepower, and short circuit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D Company.

B. Siemens.

C. Eaton (Cutler Hammer).

D. General Electric.

E. No Other Manufacturers will be considered.

2.2 HEAVY DUTY TYPE

A. All switches shall have switch blades which are visible when the switch is OFF and the cover is open.

B. Lugs shall be front removable and UL listed for 60°C or 75°C conductors in switches rated 30 100 ampere, 75°C conductors in switches rated 200 1200 ampere, copper conductors.

C. All current carrying parts shall be plated to resist corrosion.

D. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.

E. Switches shall have provisions for a field installable electrical interlock.

F. Switch operating mechanism shall be quick make, quick break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.

G. The operating handle shall be an integral part of the box, not the cover.

H. The handle position shall travel at least 90 degrees between OFF and ON positions to clearly distinguish and indicate handle position.

I. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

J. Switch enclosure shall be NEMA 1 unless otherwise on the Drawings or required by the NEC in accordance with the project conditions.

K. The enclosure shall be finished with Gray baked enamel paint which is electrodeposited on cleaned, phosphate pre treated steel (Type 1), or Gray baked enamel paint which is electrodeposited on cleaned, phosphate pre treated galvannealed steel (Type 3R).

L. The enclosure shall have ON and OFF markings on the cover to clearly identify the position of the switch.

M. All switches shall have provisions to lock the operating handle in the OFF position.

N. Tangential knockouts shall be provided to facilitate ease of conduit entry for switches rated 30 200A.

O. Enclosures for Type 3R switches through 200 ampere shall have provisions for interchangeable bolt on hubs in the top endwall.

P. Switches shall be horsepower rated for ac and/or dc as indicated on the plans.

Q. The UL listed short circuit current rating of the switches shall be: 200,000 rms symmetrical amperes when used with or protected by Class R fuses (30 600 ampere switches employing appropriate fuse rejection schemes).

2.3 SWITCH ACCESSORIES

A. Where switches are designated to be used as service entrance, the switch shall be labeled for such use.

B. Where fused switches are designated to have type "R" fuses, the switch shall be provided with rejection clips.

C. Provide fuse clip adaptors as required to accommodate smaller fuses when required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches to meet N.E.C. working clearance requirements.

B. Install fuses in fusible disconnect switches.

3.2 FIELD QUALITY CONTROL

A. Subsequent to completion of installation of disconnects, energize circuits and demonstrate capability and compliance with requirements. Demonstrate switch operation through six (6) opening/closing cycles with circuit unloaded. Open each switch enclosure to display interior, mechanical and electrical connections and fuse installation, and for verification of type and rating of fuses installed. Where possible, correct deficiencies at project site, then retest or demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION 16470

SECTION 16477 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of Drawings, General Conditions of the Contract, Supplementary Conditions and Division-1, General Requirements are hereby made a part of this section as fully as if repeated herein.

B. Division-16, "Basic Electrical Requirements" sections apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of fuse work required by this section is indicated by drawings and by requirements of this section and other sections of Division-16.

1.3 CODES AND STANDARDS

A. UL Compliance and Labeling: Comply with applicable provisions of UL 198D, "High-Interrupting-Capacity Class K Fuses". Provide overcurrent protective devices which are UL-listed and labeled.

B. NEC Compliance: Comply with NEC as applicable to construction and installation of fusible devices.

C. ANSI Compliance: Comply with applicable requirements of ANSI C97.1 "Low-Voltage Cartridge Fuses 600 Volts or Less".

PART 2 - PRODUCTS

2.1 FUSES

A. Provide fuses of types, sizes, ratings, and average time-current and peak let-through current characteristics indicated, which comply with manufacturer's standard design, materials, and constructed in accordance with published product information, and with industry standards and configurations.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide fuses of one of the following:

1. Bussmann Div; Cooper Industries.
2. General Electric Co.
3. Little Fuse Co.
4. Shawmut Div; Gould Inc.

PART 3 - EXECUTION

3.1 INSTALLATION OF FUSES

A. Install fuses as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC, and NEMA standards.

B. Coordinate with other work, including electrical wiring, as necessary, to interface installation of fuses with other work.

3.2 EXAMINATION

A. Examine areas and conditions under which fuses are to be installed, and notify Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to Engineer.

3.3 APPLICATION OF FUSES

A. Combination Starters: Class RK5, time delay.

3.4 FIELD QUALITY CONTROL

A. Prior to energization of fusible devices, test devices for continuity of circuitry and for short-circuits. Replace malfunctioning units with new units, and then demonstrate compliance with requirements.

B. Maintenance Stock, Fuses: for types and ratings required, furnish additional fuses, amounting to one set for every 5 installed sets, but not less than one set of three of each kind.

END OF SECTION 16477

SECTION 16481 - ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual motor controllers.

B. Combination magnetic motor controllers.

1.2 RELATED SECTIONS

A. Section 16190 - Supporting Devices.

B. Section 16195 - Electrical Identification.

C. Section 16477 - Fuses.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

B. NECA "Standard of Installation," published by National Electrical Contractors Association.

C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

E. NEMA KS 1 - Enclosed Switches.

1.4 SUBMITTALS

A. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

B. Test Reports: Indicate field test and inspection procedures and test results.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Square D Company.

B. Siemens

C. Cutler Hammer

D. General Electric

2.2 DISCONNECT SWITCH TYPE COMBINATION MAGNETIC MOTOR CONTROLLERS - NON-REVERSING (SQUARE D CLASS 8538 OR EQUAL)

A. Description: Combine magnetic motor controllers with fusible switch disconnect in common enclosure. Switch shall have a color coded externally operated handle. Operating handle shall give positive visual indication of ON-OFF with red and black color coding.

1. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class R fuses and visible blades. Operating handle shall give positive visual indication of ON-OFF with a color coded operating handle.

B. Switch shall have fuse clips to accept dual element, time delay, 250 volt, UL 198E, Class RK 5. Interrupting Rating: 200,000 rms amperes.

C. Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

D. Coil operating voltage: 120 volts, 60 Hz. Verify voltage with Owner prior to ordering equipment.

E. Coil: Be of encapsulated type.

F. Poles: Three.

G. Size: 1 or as indicated.

H. Contacts: Totally enclosed, double-break, silver- cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.

I. Wiring: Straight-through wiring with all terminals clearly marked.

J. Overload: Adjustable electronic trip units, class 20 trip curves. Set trip unit in accordance with the NEC to accommodate motor inrush current.

K. Enclosure: ANSI/NEMA ICS 6, Type 1.

2.3 PRODUCT ACCESSORIES

A. Auxiliary Contacts: NEMA ICS 2, 2 each normally open, field convertible contacts in addition to seal-in contact.

B. Cover Mounted Pilot Devices: NEMA ICS 2, standard duty type.

C. Pilot Device Contacts: NEMA ICS 2, Form Z.

D. Push buttons: Unguarded type. Provide “RESET” button.

E. Indicating Lights: Incandescent type. Provide “RUN” light.

F. Selector Switches: Rotary type. Provide “H-O-A” switch.

G. Control Power Transformers: 120 volt secondary. Provide fused secondary, and bond unfused leg of secondary to enclosure. Verify voltage with Owner prior to ordering equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.

B. Install enclosed controllers plumb. Provide supports in accordance with Section 16190.

C. Mounting Height: 5'-0" to operating handle.

D. Install fuses in fusible switches.

E. Select and install overload heater elements in motor controllers to match installed motor characteristics.

F. Provide engraved plastic nameplates under the provisions of Section 16195.

G. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.2 FIELD QUALITY CONTROL

A. Inspect and test each enclosed controller to NEMA ICS 2.

B. Adjust trip settings for proper motor operation.

END OF SECTION 16481