Turner USD No. 202
RFP 252301 Boiler Replacement at Turner Sixth Grade Academy

Facilities

Turner USD 202

Facilities and Grounds

5800 Metropolitan

Kansas City, KS 66106

January 23, 2025

Request for Proposal

(This is not an order)

Invitation Number 252301

Opening:	**Time:**	**10:30 am**
	Date:	**Tuesday February 25, 2025**
On-Site Pre-Bid Meeting:	**Time:**	**9:00am**
	Date:	**February 13, 2025**
	Location:	**Turner Sixth Grade Academy**

Turner Unified School District 202 Board of Education invites your proposal for:

Boiler Replacement Turner Sixth Grade Academy

Opening will be held at:

Turner USD 202
FGM Building
5800 Metropolitan
Kansas City, KS 66106

We look forward to receiving your proposal.

Sincerely,

Chris Crockett
Facilities and Grounds Supervisor
Turner USD 202
913-288-3721

Turner USD No. 202
RFP 252301 Boiler Replacement at Turner Sixth Grade Academy

GENERAL TERMS

Written Contract

Unless a written contract is specified in the Specific Terms of the proposal documents and a written contract enclosed, the vendor's completed and signed response will be considered an offer and the School District's purchase order will be considered an acceptance and shall constitute a written contract. All terms included in the proposal documents shall be considered a part of the written contract.

Non-Discrimination

Vendors agree that if awarded a contract under this invitation, they shall comply with the applicable provisions of the Federal Civil Rights Act of 1964 and all amendments thereto and all regulations issued there under by the Federal and State governments. If the contractor fails to comply with such acts and regulations, the School District shall have the right to immediately terminate this contract.

Compliance Report and Plan of Action for Contractors

Successful contractors may be required to fill out the "Compliance Report and Plan of Action for Contractors" Kansas Commission on Civil Rights, at time of award of contract. The executed form shall be filed with the Kansas Commission of Civil Rights for their record, in compliance with Kansas Act against Discrimination, K.S.A. 1972, Supp. 44-1030.

Alternate Proposals

There will be no alternate proposals or exclusions.

Contractor's Representation

Each Vendor, by making his proposal, represents:

1) That they have read and understand the Drawings and Specifications.

2) That they have carefully examined all documents pertaining to the project's scope of work requirements, and shall provide and install in a professional manner, all materials, labor, equipment, freight, etc. resulting in the final intent of the project, as represented by the drawings and specifications.

3) As required by Executive Order 12549, Debarment and Suspension, and implemented at 34 CFR Part 85, for prospective participants in primary covered transactions, as defined at 34 CFR Part 85, Sections 85.105 and 85.110 –

a. The vendor certifies that it and its principals: Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any federal department or agency.

4.) That they have visited the site, where the performance of the work is to occur and have familiarized themselves with all existing conditions of the scope of work.

Proposal Withdrawal

A proposal may be withdrawn by written, faxed, or other documented means if received by the owner from the vendor prior to the time fixed for proposal receiving. Faxed proposal withdrawal requests will be accepted only if vendor confirms by telephone that the faxed request was received by Owner prior to the proposal opening time.

Extension Errors

In the case of an obvious error in the extension of prices in a Bid Proposal the contractor may either honor the bid presented or the bid may be determined as unresponsive and the bid will then be withdrawn.

Pricing Period

Bids submitted shall remain valid for a period of 90 days.

Rejection of Proposals

The Vendor acknowledges the right of the School District to reject any or all proposals and to waive any formality or irregularity in any proposal received whenever such rejection or waiver is considered to be in the best interest of the School District. The School District also reserves the right to reject the proposal of a contractor who has previously failed to perform properly or complete contracts of a similar nature on time, or the proposal of a contractor who is not qualified in the opinion of the School District, to perform within the proposal specification. The School District reserves the right to reject a proposal if the contractor failed to furnish any required bond or security, or to submit the data required by the proposal documents, or if the proposal is in any way incomplete/irregular.

Conflicting Terms

Whenever there is an apparent conflict between General Terms and the Specific Terms, the Specific Terms shall prevail.

Point of Delivery

All materials for this project should be shipped directly to the building where the performance of work is being conducted.

Refusal of Goods

The use of brand names and descriptions of merchandise is to indicate the minimum quality acceptable and, unless so stated, is not meant to preclude the submission of the proposals for products of equal quality. The School District reserves the right to return, at no expense, merchandise which in the opinion of the School District is in obvious non-compliance with specifications. All materials, systems, and equipment being considered by the Bidders, and differing from the Basis of Design, shall be approved by the Owner, prior to February 21, 2025 by means of an approved written product substitution form, on the Materials Suppliers letterhead, to be allowed and included with the bid. The Owner Representative and PKMR Engineers signature shall be attached thereto any approved substitution request form.

Payment

The Contractor must file a claim for payment by the 1st of the month prior to the second Board of Education meeting of the subsequent month. Payment will be made following approval by the Board of Education. 10% retainage will be held from the total balance of the overall cost until the project is complete and Owner's representative has approved. Pay applications must be submitted to and approved by PKMR Engineers prior to deadline.

Sales Tax

Sales tax will not be charged on School District's purchases. When materials are purchased by a contractor for use on a school district project, the School District will obtain an exemption certificate number from the State Tax Division. Proper tax exemption certificates will be issued by the School District and the Contractor shall extend certificates to all suppliers, and keep a record of same. Contractor is responsible for requesting this document from the Turner Facilities Department.

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SUBMITTAL TERMS

Document Identification

Proposals must be submitted in a sealed envelope with the proposal number and opening date and time clearly indicated on the lower left-hand corner of the envelope. Proposals must be received prior to the opening date and time. If mailed, proposals must be received by the bid date and time indicated and shall be addressed to:

Turner USD No. 202
Facility Supervisor
Attn: Chris Crockett
5800 Metropolitan
Kansas City, KS 66106

The School District shall accept no responsibility for the accidental premature opening or failure to open a proposal which is not identified as stated above.

Email Proposals

The School District will allow a Bid to be submitted by email. (When a vendor chooses to send an emailed proposal the vendor waives their right to a sealed proposal.) When an emailed proposal is received it will be printed and placed in an envelope. The envelope will be marked with the proposal number and opening date and time clearly indicated on the lower left-hand corner of the envelope. The emailed proposal will be opened along with the sealed proposals received at the normal proposal opening time.

The emailed proposal should be sent to: crockettc@turnerusd202.org it is strongly recommended to follow the email with a call to Shannon Schmitt at 913-288-3722 to verify that it was received. The email must be time stamped prior to the date and time of the bid opening.

Late Proposals

Late proposals will be rejected. The ultimate responsibility for the delivery of the proposal document lies with the vendor. The School District shall make no concessions regarding postal service or any other form of conveyance of the proposal document even when timely delivery of the proposal fails through no fault of the vendor.

Amendments by School District

Amendments to the proposal by the School District will be made by the Facility Supervisor and will be in writing.

Bid Bond

A 5% bid bond is required on any proposal equal to or exceeding $100,000.00 and are due at the time the bid is awarded to the contractor by the Turner USD 202 Board of Education.

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SPECIFIC TERMS

Factory New

All goods, products, materials, and equipment pursuant to this proposal shall be factory new and unused.

Safety Standards

Material must meet all federal, state, and local safety standards and specifications in effect at the time of production. In all cases, where conflict occurs, the more stringent provision or standard will apply.

Substitutions

Any "or equal" substitutions must be demonstrated to the School District's Facility Supervisor. All materials and equipment being considered by the Bidders, and differing from the Base of Design, shall be approved by the Owner Representative and PKMR Engineers prior to February 21, 2025 by means of an approved written product on the substitution form, on the Materials Suppliers letterhead, to be allowed and included with the bid. Wither the Owner's, Architect's, or Engineer's signature shall be attached thereto any approved substitution request form.

Liquidated Damages

This project can commence as early as May 26, 2025. If the project is not substantially complete by September 19, 2025, a penalty of $1,000.00/day shall be enforced. This penalty will be withheld from the final payment issued to the contractor, unless the contractor has written permission from Turner USD 202 stating that the deadline can be extended. Substantial competition shall be determined by Turner USD Facility Supervisor, Chris Crockett.

Warranty

Warranty requirements will be provided in the bid packet furnished by PKMR Engineers.

Award of Proposals

It is the intention of the school district administration to make a decision regarding the Award of the Project by Wednesday March 5, 2025.

Information regarding proposal awards will be made available to contractors on Wednesday March 5, 2025 or thereafter.

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SPECIFICATIONS

All specifications will be provided in the bid packets PKMR Engineers is furnishing for each of the projects.

GENERAL

DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: The Contractor awarded this project is responsible for the protection of any materials, tools and/or equipment on site. The contractor shall hold harmless Turner USD 202 and/or employee, volunteer or representative.

B. Hold Harmless: The above named group, person, or organization agrees to indemnify and hold harmless Turner USD 202, it's officers, agents, servants, board members, and employees from any and all liability of whatever kind of nature resulting from damage or injury to any person or property which occurs while such person, group, or organization is occupying or using its facilities or property.

Insurance:

A. The following minimum coverage shall apply to this contract:
   (a) Workers' compensation and employers' liability: Contractors are required to comply with applicable Federal and State workers' compensation and occupational disease statutes. If occupational diseases are not compensable under those statutes, they shall be covered under the employer's liability section of the insurance policy, except when contract operations are so commingled with a Contractor's commercial operations that it would not be practical to require this coverage. Employer's liability coverage of at least $100,000 is required.
   (b) General Liability: $2,000,000.00 per occurrences.
   (c) Automobile liability: $200,000.00 per person; $500,000.00 per occurrence and $20,000.00 property damage.
   (d) The successful bidder must present to the Owner, prior to award, evidence of general liability insurance without any exclusionary clauses that would void the general liability coverage
   (e) Owner, Architect and Engineer shall be added as an additional insured.

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VENDOR'S RESPONSE

RFP 252301 Boiler Replacement at Turner Sixth Grade Academy

Having carefully examined the specifications, the undersigned proposes the following:

Name of Vendor _____

Address _____

City _____ **State** _____ **Zip** _____

Telephone Number _____ **Date** _____

Submitted by: _____

Signature: _____

Proposal Opening, 10:30 am Tuesday 2/25/2025
5800 Metropolitan Ave. Kansas City, KS 66106

Lump Sum Total for both projects: **$**_____

Written Dollar Amount for Both Projects_____

_____

TURNER SCHOOL DISTRICT
USD 202

BOILER REPLACEMENT

Turner Sixth Grade Academy
6425 Riverview Avenue
Kansas City, KS 66102

Turner School District 202
Attn: Chris Crockett
FGM Building
5800 Metropolitan
Kansas City, KS 66106

Issue Date
January 23, 2025

Prebid Meeting
February 13, 2025 at 9:00 am
Turner Sixth Grade Academy (North Side of Building)
6425 Riverview Avenue
Kansas City, KS 66102

Sealed Proposals Due
By 10:30 am
February 25, 2025

pkmr ENGINEERS

PKMRENG.COM

BID FORM
LUMP SUM PROPOSAL
TURNER SCHOOL DISTRICT BOND IMPROVEMENT PROGRAM
Construction for:

Turner Sixth Grade Academy Boiler Replacement

PROPOSAL OF:_____
(Hereinafter called "Bidder"),

A CORPORATON* ORGANIZED AND EXISTING UNDER THE LAWS

OF THE STATE OF_____

A PARTNERSHIP* CONSISTING OF_____

AN INDIVIDUAL* TRADING AS_____

*Complete applicable designation.

TO: Turner School District 202
Attn: Chris Crockett
5800 Metropolitan Ave.
Kansas City, KS 66106

1. The undersigned, having familiarized itself with local conditions affecting the cost of the work at the place where the work is to be done and with all Bidding Documents, including the Instructions to Bidders, Plans and Specifications, General and Supplementary Conditions, the Standard Form of Agreement and the other Contract Documents, and having examined the location of the proposed work and considered the availability of labor and materials, hereby proposes and agrees to perform everything required to be performed, and to provide and furnish any and all labor, materials, supervision, necessary tools, equipment, and all utility and transportation service necessary to perform and complete in a workmanlike and timely manner all of the work required for the project, all in strict conformance with the Instructions to Bidders and other Contract Documents (including Addenda Nos. _____, through _____, the receipt of which is hereby acknowledged), for the lump sums hereinafter specified.

2. FOR BASE BID ON BASIS OF DESIGN UNITS

The Lump Sum of _____

_____ Dollars ($_____).

3. FOR BID ALTERNATE 1 – PUMP REPLACEMENT

The Lump Sum of _____

_____ Dollars ($_____).

5. TAX EXEMPTION

This project shall be considered Tax Exempt. Federal, State and local taxes shall not be included with the Bid. Subsequent to the award of the construction contract, the School District will obtain from the State of Kansas a sales tax exemption certificate number. The sales tax exemption certificate will permit the Contractor to purchase materials for incorporation into this project without paying sales tax, provided that the Contractor furnishes the certificate number to the material supplier.

6. CHANGES IN THE WORK

Changes in the work shall be as established in the Contract Documents. The following fees shall be used for lump sum pricing and actual cost pricing of additions and deletions to the work included in the Bid, Namely:

		Not to Exceed
A.	To Contractor for work performed by his own forces	10%
B.	To Contractor for work performed by other than his own forces	5%
C.	To Subcontractor for work performed by his own forces	10%
D.	To Subcontractor for work performed by other than his own forces	5%

Percentages for overhead and profit will not be allowed on bond premiums.

7. Unit Cost Breakdowns: N/A

8. A. In the execution of the Agreement, no person shall on the grounds of race, color, religion, sex, disability, or national origin be excluded from full employment rights, be denied the benefits of, or otherwise subject to discrimination under any program, service or activity under the provisions of any and all applicable Federal and state laws against discrimination. Bidder shall furnish all information and reports required by the rules, regulations, and order of the Secretary of Labor for purposes of investigating to determine compliance with such laws.

B. Bidder shall observe the provisions of the Kansas Acts Against Discrimination and shall not discriminate against any person in the performance of work under the Agreement because or race, religion, color, sex, physical handicap unrelated to such person's ability to engage in the particular work, national origin or ancestry.

C. In all solicitations or advertisements for employees, Bidder shall include the phrase, "equal opportunity employer", or similar phrase approved by the Owner.

D. If bidder fails to comply with the provisions of K.S.A. 441031, bidder shall be deemed to have breached the Agreement and it may be canceled, terminated or suspended in whole or in part, by Owner.

E. If bidder is found guilty of a violation of the Kansas Acts Against Discrimination under a decision or order of Owner that has become final, bidder shall be deemed to have breached the present Agreement and it may be canceled, terminated, or suspended in whole or in part, by Owner.

F. Bidder shall include the provisions of paragraphs A through E above in every subcontract or purchase order so that such provisions shall be binding upon all subcontractors and vendors.

9. The undersigned hereby proposes and agrees to substantially and/or finally complete the work or segments of the work on or before the scheduled dates listed in Section 010100 Summary of Work, and to pay as liquidated damages the corresponding amount stipulated in Section 010100 Summary of Work for each consecutive calendar day thereafter that the work or segment of the work remains substantially and/or finally incomplete in accordance with the Contract Documents. This provision shall be applied, and the daily liquidated damages amount(s) shall be calculated separately as to each substantial and/or final complete date stated.

10. Accompanying the Bid is Bid Security of at least 5% of the bid in the form of a Bid Bond in the amount of _ _____Dollars ($_____), payable without condition to the Owner, which it is agreed shall be retained as liquidated damages for the delay and extra expense caused the Owner, if the undersigned fails to execute the Contract and furnish the bonds required by the Contract Documents, within the time stated in the Contract Documents.

11. In submitting the Bid it is understood that the right to reject any and all bids has been reserved by the Owner and that this bid may not be withdrawn for a period of sixty (60) days from the opening.

Date this_____ day of_____, 201__.

_____
Name of Bidder

_____
Address of Bidder

_____
Authorized Officer

_____
Title

_____
Telephone Number

(Seal)

ATTESTED:

_____

SECTION 010100

SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of the Work.

B. Work under other contracts.

C. Products furnished by the owner.

C. Contractor use of site (and premises).

D. Code of Conduct.

E. Existing conditions.

F. Work sequence, Schedule for Completion and liquidated damages.

G. Time extensions for adverse weather.

H. Owner occupancy.

I. Time extension for factors other than weather.

H. Additional owner requested bid breakdown.

1.02 DESCRIPTION OF THE WORK

A. The Contractor shall furnish all labor, materials, facilities, insurance, management, equipment, services, employee training and testing, permits and agreements necessary to perform the work required for the

Turner Sixth Grade Academy – Boiler Replacement

Construction for this bid may require mobilization at multiple project sites. The bidder must perform the work in its entirety. Transferring or sharing prime responsibility for the work will not be allowed and will be considered cause for termination.

B. The General or Prime Contractor shall be represented at the site, by a competent Superintendent from beginning of the work, until final completion unless otherwise approved by the Owner. The superintendent shall oversee and direct the daily construction activities at the work site including scheduling of workers and delivery of equipment and materials to meet the project schedule. The superintendent shall also inspect work in progress to ensure that work conforms to the plans and specifications. The Superintendent shall be dedicated to these duties and shall physically perform work or "wear tools" only on a limited basis.

C. The work includes, but is not necessarily limited to the following:

1. Boiler replacements at:
   Turner Sixth Grade Academy
   6425 Riverside Avenue
   Kansas City, KS 66102

1.03 WORK UNDER OTHER CONTRACTS.

A. All work is to be coordinated with the district, other projects performed with the district, and school programs.

B. Items noted 'NIC' (Not in Contract), will be furnished and installed by owner.

C. Owner will remove and retain possession of the following items prior to start of building and/or demolition activities: N/A

D. The architect and/or owner has paid $_0_____ for plan check fee with the applicable City, Codes Administration. The contractor is responsible for the balance of fee required to obtain the building permit. All other permits required remain the contractor's responsibility.

E. Utility relocations and extensions will be performed by utility suppliers or their agents. The contractor is responsible for the scheduling, phasing, and coordination of all work performed by the respective utility suppliers or their agents. This includes, but is not limited to, work performed by:

1. Water/Sanitary Sewer – BPU
2. Electric – BPU
3. Gas – BPU

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Limit use of site and premises to allow owner occupancy and use of the existing building, parking lots, and hard play areas during construction.

B. The contractor shall coordinate the use of the site and locations for all equipment storage, job trailers, portable lavatory facilities, generators, etc., with the owner. The owner shall have the final approval for all site use by the contractor.

1.05 CONTRACTOR AND VENDOR EMPLOYEES CODE OF CONDUCT

Turner School District insists that all contractor and vendor employees conduct themselves in an acceptable manner while performing work on school district property. The following items are prohibited on school district property:

1. No physical or verbal contact is to be made with students or non-designated school district staff.
2. No smoking or other use of tobacco products in any manner is permitted on district property.
3. No drugs and/or alcohol are to be consumed or present on district sites.
4. No firearms, or hunting items, are to be present on the site.
5. Foul and/or abrasive language is not to be used.
6. All workers are to wear clothing on all parts of their body; no shirtless workers. Apparel should be appropriate to a school campus.

7. Anyone working while students are in the building must have a valid State issued ID/DL and be ran through the districts background check system (Raptor) prior to entering the facility.

Utilize designated areas for vehicle access and parking, material storage, etc.

All workers are to wear a nametag, or identification which identifies the company name and the individual's name.

1.06 EXISTING CONDITIONS

A. The contract drawings are based on information taken from original construction drawings and from inspections of the site.

B. Bidders are advised that "as-built" conditions may vary from those shown on the drawings. Bidders shall not later request, nor expect to receive, additional payment for work related to variations which can be determined by examination of the existing building and site, by the date set for receipt of Bids for this Contract.

C. Bidders are required to visit the site and view existing conditions prior to bid. There is a Pre-Bid Meeting scheduled for February 13, 2025 at 9:00 a.m.

1.07 WORK SEQUENCE AND SCHEDULING

A. The Contractor and all Subcontractors, sub-subcontractors and Suppliers shall furnish sufficient forces, supervision, construction plant and equipment, and shall work such hours as may be required to insure the prosecution of the work in accordance with the Progress Schedule stated herein. If in the opinion of the Owner, the Contractor falls behind the Progress Schedule, the Contractor shall take such steps as may be necessary to improve the progress and the Owner may require them to increase the number of shifts, and/or overtime operations, days of work including holidays, Saturdays and Sundays, all without additional costs to the Owner.

D. Schedule requirements for each Option and Phase are outlined as follows.

Building	Start Date	Substantial Completion	Final Completion
Turner Sixth Grade Academy Boilers	5/26/25	9/19/25	10/3/25

C. This project needs to be substantially complete prior to September 19, 2025. In the event the project is not substantially complete prior to the date referenced, Turner USD 202 will require the contractor awarded this project a penalty of $1,000 per day. This penalty will be withheld from the final payment issued to the contractor, unless the contractor has written permission from Turner USD 202 stating that the deadline can be extended. Substantial competition shall be determined by Turner USD Facility Supervisor, Chris Crockett or Doug Powers, Assistant Superintendent of Business and Public Relations.

1.08 TIME EXTENSIONS FOR ADVERSE WEATHER

A. The Contractor shall comply with all provisions of the General Conditions in submitting any request for extension of Contract Time due to unusually severe weather.

B. Definitions:

1. Adverse Weather - atmospheric conditions at a definite time and place which are unfavorable to construction activities.
2. Unusually Severe Weather - weather which is more severe than the adverse weather anticipated for the season, location, or activity involved.

C. In order for any request of time extension due to unusually severe weather to be valid, the Contractor must document both of the following conditions.

1. The weather experienced at the project site during the Contract period is more severe that the adverse weather anticipated for the project location during any given month.
2. The unusually severe weather actually caused a delay to the scheduled progress and/or completion of the project. The delay must be beyond the control and without fault or negligence by the Contractor.

D. The following schedule of monthly anticipated adverse weather delays will constitute the baseline for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all weather-affected activities:

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS
BASED ON FIVE (5) DAY (Monday – Friday) WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10	8	7	6	7	7	5	5	5	4	5	9

E. Upon receipt of the Notice to Proceed, and continuing throughout the contract, the Contractor shall record on their daily construction report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50% or more of contractor's scheduled work day.

F. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in the previous month), and shall be calculated chronologically from the first to the last day of each month, and be recorded as full work days.

1. If the number of actual adverse weather delay days in a given month exceeds the number of days anticipated in Paragraph D, above, the difference shall be multiplied by 7/5 to convert any qualifying workday delays to calendar days. The resulting number of qualifying lost days shall be added upon approval by the Architect and Owner to the contract time.
2. The determination that unusually severe weather occurred does not automatically mean an extension of time will be granted. The contractor must substantiate the unusually severe weather delayed work activities on the critical path of the Progress Schedule.

G. Full consideration for equivalent fair weather workdays shall be given. If the number of actual adverse weather delays in a given month is less than the number of days anticipated in Paragraph D, above, the difference shall be multiplied by 7/5 to convert any work day increases to calendar days. The resulting number of qualifying extra days will be accumulated and subtracted from any future month's days lost due to unusually severe weather.

1. The net cumulative total of extra days/lost days shall not result in a reduction of Contract Time and the Date of Substantial Completion shall not be changed as a result of unusually favorable weather.

H. In converting workdays to calendar days, fractions 0.5 and greater shall be rounded up to the next whole number. Fractions less than 0.5 shall be dropped.

I. The contractor shall summarize and report all actual adverse weather delay days for the preceding month to the architect by the tenth (10th) day of the following month. A narrative indicating the impact of adverse weather conditions on the scheduled critical activities shall be included.

1. Any request or claim for an extension of time due to unusually severe weather shall be submitted to the architect and owner within twenty-one (21) days of the last day of the month in which the delay occurred.

Resolution of any weather delay claim shall follow the procedures established by the general conditions and as prescribed above.

J. The contractor shall include and indicate the monthly anticipated adverse weather days, listed in Paragraph D, above, in their progress schedule.

1. The contractor shall indicate the actual adverse weather days (whether less or more than the anticipated days) in their monthly progress schedule update.

1.09 OWNER OCCUPANCY

A. The existing building, parking lots and hard play areas will be used and occupied by the Turner School District during portions of the Contract Time. Occupants will include, but not be limited to: students, faculty, parents, and other groups so authorized to use the building and/or site by the school district.

B. School will be generally in session from 8:00 a.m. to 3:30 p.m., Mondays through Fridays, spring and fall semesters, throughout the contract time. In addition, the hours from 7:30 a.m. to 9:00 a.m. and from 2:30 p.m. to 4:00 p.m., Monday through Friday, will be reserved for arrival and departure of the school district occupants. Delivery of materials and equipment is to be scheduled outside of these hours.

C. The work shall be confined to limited areas of the site. The contractor shall work with the architect and school district staff to develop a schedule of areas to receive work. The schedule will identify specific areas of the building and site to receive work at specific times. This schedule shall be submitted by the Contractor to the Architect for approval before the work begins.

D. Unless otherwise indicated, the owner will move loose furnishings out of the existing building with his own work forces prior to scheduled demolition. This will include furniture, equipment, wall hangings, books, maps, clocks, and loose educational materials prohibiting work.

1.10 TIME EXTENSION FOR FACTORS OTHER THAN WEATHER

A. If the contractor incurs a delay due to factors out of his control, the contractor shall submit a claim within twenty-one (21) days after the occurrence of the delay to the architect and school district. The claim shall include a description of the cause of the delay and resultant request for additional time.

B. If a proposal request for additional work causes the contractor additional time to perform the original contract requirements the contractor may submit a claim for additional time to the Architect and Owner. The Contractor shall include in his proposal the request for time extension (if any), and shall include sufficient information and dates to demonstrate whether and to what extent the change will delay the completion of the contract in its entirety.

A. The determination that delays have occurred beyond the Contractor's control does not automatically mean an extension of time will be granted. The Contractor must substantiate the delay by indicating suspended work activities on the critical portion of the project schedule.

1.11 ADDITIONAL OWNER REQUESTED BID BREAKDOWN

A. The following listing of major subcontractors/material suppliers performing work on the project is to be submitted within 72 hours of the bid. Work to be self-performed by the General or Prime contractor shall be noted "self-perform". Work that is not part of the project shall be noted as not applicable "N/A". Substitutions in the submitted list require the owner's written permission.

Work Scope	Subcontractor/Material Supplier
Site Utilities:	
Excavation:	
Interior Demolition:	
Concrete:	
Masonry:	
Structural Steel:	
Rough Carpentry:	
Wood Doors:	
Millwork:	
Roofing/Architectural Sheet Metal:	
Finish Hardware Supplier:	
Doors and Frames Supplier:	
Windows:	
Drywall:	
Acoustical Ceiling:	
Painting:	
Toilet Partitions:	
HVAC:	
Plumbing:	
Electrical:	

END OF SECTION

SECTION 01020

CONTRACT CONSIDERATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash Allowances.

B. Schedule of values.

C. Bid Cost Breakdown.

D. Application for Progress Payment.

E. Application for Final Payment

F. Change Orders and/or Clarifications.

1.02 RELATED SECTIONS

A. N.A.

1.03 CASH ALLOWANCES

(Architect to include allowances, as applicable.)

1.04 SCHEDULE OF VALUES

A. The Contractor will submit to the Architect, a Schedule of Values that includes all major categories of work and per building if applicable. The dollar amounts are to include all labor, material, overhead and profit applicable to each item in the breakdown. As a sub-breakdown, each item is to be separated into an estimated labor and materials line item. The Contractor must submit a total value for the projected cost of supplies, materials, and equipment required. Submit typed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form of electronic media printout will be considered as an alternate form of submission.

B. Submit Schedule of Values in duplicate within fourteen (14) calendar days after the contract for construction is executed and prior to any submission of an Application for Payment. Schedule shall list the installed value of the component parts of the work, broken down in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Format: At a minimum, use the Table of Contents in this Project Manual to identify each line item with number and title of the major specification section.

D. Add to the Schedule of Values approved Change Orders, as applicable with each Application for Payment. List Change Orders in numerical sequence with each Application for Payment.

E. Correlate line items in the Schedule of Values with other required additional schedules and forms including:

a. Contractor's construction schedule.
b. Contract payment request form.
c. List of subcontractors.
d. List of products.
e. List of principle suppliers and fabrications.
f. Schedule of submittals.

F. Prior to making application for the first progress payment, the Contractor must submit the Schedule of Values. No progress payments will be made until the schedule of values has been received, reviewed, and approved by the Architect and the School District. The costs assigned to the breakdown are to total the contract sum. The approved Schedule of Values is to be used by the Contractor on their Application for Payment.

1.05 BID COST BREAKDOWN
(See Bid Form for any applicable requirements)

1.06 APPLICATION FOR PROGRESS PAYMENTS

A. At a time consistent with the requirements of this section, the General Conditions, and the Owner-Contractor Agreement, and for each calendar month during the progress of the work, submit a properly notarized itemized Application for Payment prepared in a manner consistent with the Schedule of Values.

B. The amount shown on the Application for Payment shall be established by the value of work completed through the last day of the application period based upon the Contractor's estimate of labor and materials incorporated in the work and of materials suitably stored in accordance with the contract through the last day of the previous application, less the aggregate of previous payments, and less the retainage as specified in this section.

C. The form of application for payment shall be the latest edition of AIA Document G702. "Application and Certificate for Payment", supported by AIA Document G703. "Continuation Sheet", corresponding edition.

D. Provide the following itemized data on Continuation Sheet:

a. Format, schedules, line items, and values shall be from the Schedule of Values accepted by Architect.
b. Include names, trades and amount for subcontractors.

1. Application Form:

a. Fill in required information, including that for change orders executed prior to the date of submittal application.
b. Fill in summary of dollar values to agree with the respective totals indicated on the continuation sheet.
c. Execute certificate with the signature of a responsible officer of the contractor's firm.

2. Continuation sheets:

   a. Fill in total list of all scheduled component items of work, with each number and the scheduled dollar value of each item.
   b. Fill in the dollar value in each column for each scheduled line item when work has been performed or products stored. Round off values to nearest dollar, or as specified in the Schedule of Values.
   c. List each change order executed prior to the date of submission, at the end of the continuation sheets. List by change order number, description, and breakdown of costs as for an original component item of work.

E. Substantiating Data for Progress Payments:

1. Substantiating data is required to verify a payment request. Contractors are to include a cover letter identifying:

   a. Project.
   b. Application number and date.
   c. Detailed list of enclosures.
   d. For stored products: Item number and identification as shown on application, and description of specific material. Include Bill of Sale, Non-Negotiable Bailment Receipt and applicable insurance certificate.

2. Submit one copy of the data cover letter for each of the applications.

F. Applications for Payment shall be accompanied by cost breakdowns from the contractor, subcontractors and sub-sub-contractors.

F. The application for payment will be transferred to the architect to be certified for payment. Provide a (non-notarized) electronic or paper copy to the owner's representative.

G. Requests for Payment sould be issued to the district by the first Friday of the Month and the district will issue payment at the BOE meeting held on the 3rd Tuesday of the same month. (Payments are only issued at the 2nd BOE meeting of each month)

1.07 APPLICATION FOR FINAL PAYMENT

A. Submit final Application for Payment following the procedures specified above for progress payments.

B. Before submitting final Application for Payment, forward concurrently to the Architect, the written warranties and guarantees, Record Documents, and Operations and Maintenance Manuals and other documents required by the contract documents. Place properly in approved storage at the site the extra stock and spare parts specified. Contractor will obtain the signature of a school district representative verifying receipt of the extra stock and spare parts.

C. Properly executed "Final Lien Waiver and Release" and Contractor's "Affidavit" shall be submitted to the Architect in duplicate prior to final payment.

D. Application for Final Payment shall be accompanied by a properly executed "Consent of Surety Company to Final Payment: AIA Document G707, latest edition.

1.08 CHANGES AND/OR CLARIFICATIONS

A. Request for Information (RFI)

1. If during the construction of the project, clarification of the documents is required, it shall be brought to the attention of the Architect. The Architect will either provide clarification or the Contractor will issue a Request for Information (RFI) to the Architect. Each RFI will be dated and sequentially numbered. The Architect shall provide his written response to the RFI and return the RFI response to the Contractor for distribution to all affected subcontractors and /or suppliers.
2. Responses to RFI's are not authorization to proceed with work requiring additional compensation. If additional compensation is required, the Contractor shall immediately advise the Architect, and Owner.

B. Proposal Request (PR)

1. Should the owner contemplate making a change in the work, the architect will issue a Proposal Request (PR) to the Contractor. If the described change impacts cost and/or time, the Contractor will prepare a proposal and submit it to the Architect. The Contractor's proposed cost shall be broken down completely giving quantity and unit costs by each trade of each item, labor cost with hourly rates, allowable overhead and profit (both adds and deducts). The Owner and Architect will review the pricing to determine if a change order will be issued. Contractors are not to proceed with additional work until written authorization has been received. No additional amount will be paid for submittal in this form or for resubmittal should the breakdown be considered inadequate by the Architect and Owner.

C. Change Orders (CO)

1. If the Owner determines that a Proposal Request will be accepted, the Architect will prepare a change order (CO) which will be dated and numbered sequentially. The change order will describe the change or changes, will refer to the Proposal Request and Proposal number and becomes valid when signed by the Owner, the Architect and the Contractor.
2. Where unit prices are not required by the bid documents and value of changes or extra work is determined by a lump sum, by cost and percentages, or by cost and a fixed fee, the percentages for overhead and profit, or commission to be allowed for net increases shall in no case exceed the figures identified on the bid form.
3. Estimates for material shall be based on reasonable current market value at which materials are available to the Contractor and Subcontractor. Upon request, submit satisfactory evidence of such costs. Labor unit costs shall include associated insurance.
4. When authorized by the Owner, time and material accounting of a change in work may be used. The Contractor shall maintain an accurate account of labor and material involved in each change. Such time and material records are subject to verification. Notify Architect and Owner when work on each change is to start and when it has been completed. To receive full recognition, labor assigned to Contract changes must, insofar as possible, work continuously on the change, rather that interchanging between contract work and the change.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

FINAL LIEN WAIVER AND RELEASE

Reference that certain Agreement between _____, as Contractor, and _____, as Owner, dated _____, on the project known as _____ located at _____ for work to be performed by said Contractor.

Reference also that certain invoice of Contractor to said Owner in the Amount of $_____ for work, labor and materials installed in or furnished for said project by and through _____.

The receipt by Contractor of Owner's remittance for the amount said invoice, contingent upon the final clearance and payment of said remittance, shall constitute payment for the full contract amount, including change orders and all other claims or demands of any nature whatsoever which Contractor has or may have in connection with the Project or Contract referenced herein, of $_____, for which Contractor (a) agrees to and does hereby waive and release said property, project and the Owner and all bond or payment sureties and guarantors from; and (b) does hereby agree to protect, indemnify, defend and hold harmless said property, project, Owner, sureties and guarantors against;

(1) any and all liens, statutory or otherwise, and

(2) any or all obligations under any bond or guaranty for payment furnished by or to said Owner, whether pursuant to agreement or requirement of law, and

(3) any and all other claims whatsoever, statutory or otherwise,

for any and all work, labor and materials furnished by or through said Contractor, its subcontractors and material suppliers for the entirety of said project.

The remittance of the Owner, identified as payment of said above invoice and endorsed by Contractor and marked "paid" or otherwise canceled by the bank against which said remittance was drawn shall constitute conclusive proof that said invoice was paid and the payment thereof was received by the Contractor, and thereupon, this final lien waiver shall become effective automatically and without requirement of any further act, acknowledgment or receipt of the part of said Contractor.

Contractor does further warrant that Contractor has not and will not assign its claims for payment nor its right to perfect a lien against said property and project, and the undersigned representative of the contractor has the right to execute this waiver and release thereof.

The undersigned representative of Contractor does hereby certify under oath that he is fully authorized and empowered to execute this instrument for and in behalf of said Contractor and to bind them hereto and does in fact so execute this final lien release.

Dated this _____ day of _____, 20__.

Contractor:

_____

By:

_____

Title:

_____

Subscribed and affirmed to before me, the undersigned Notary Public within and for the State of _____and the County of , this _____ day of _____, 20__, in the City of _____.

_____
Notary Public within and for said County and State

NON-NEGOTIABLE
BAILMENT RECEIPT

Receipt Number

BAILOR: Owner

BAILEE: Contractor/Supplier

PROJECT: _____

LOCATION OF STORAGE:

The goods and materials described below are held and stored pursuant to the Contract by and between Bailee, as Contractor/Supplier, and Bailer as Owner for Work to be performed at the above referenced Project location. Said goods and materials are to be transferred or delivered to the project site in conjunction with the performance of Bailee's contract referenced above or upon the direction of Bailor or the Architect and no other. The Bailee acknowledges that it has no ownership rights or title in, nor shall claim any lien or interest in or upon, said goods and materials.

QUANTITY	DESCRIPTION OF ITEM

Received and Acknowledged
Contractor/Supplier

DATED: _____ BY:

Authorized Signature

The undersigned representative of Contractor does hereby certify under oath that he is fully authorized and empowered to execute this instrument for and in behalf of said Contractor and to bind them hereto and does in face so execute this final lien release.

Dated this _____ day of _____, 20 ____.

Contractor:

_____

By:

_____

Title:

_____

Subscribed and affirmed to before me, the undersigned Notary Public within and for the State of

_____ and the County of _____, this _____ day of _____, 20 ____,

in the City of _____.

_____
Notary Public within and for said County and State

SECTION 01040

COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Coordination.

B. Coordination Drawings.

C. Lockout/Tagout Procedures

D. General Installation Provisions

E. Cleaning and Protection

1.02 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various sections of specifications to assure efficient and orderly sequence of the project.

B. Verify that utility requirements for the project have been properly installed and that such water, gas, and electrical, data, and/or phone service hookup is compatible with other construction and demolition operations occurring at the site. Coordinate Work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements and installation of all Work including mechanical and electrical Work that is indicated diagrammatically on drawings prior to initiating Work on site. Bring discrepancies to the attention of the Architect in a timely manner. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Provide labeling as specified per individual specification sections. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

E. The Contractor is to coordinate his Work with the Work of the Owner's Contractors, as applicable.

F. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.

G. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with contract documents, to minimize disruption of Owner's activities. This work will include off-hours to avoid conflict with Owner's activities.

H. Coordinate construction activities included under various sections of these specifications to assure efficient, safe, and orderly installation of each part of the Work. Coordinate construction operations included under different sections of the specifications that are dependent upon each other for proper installation, connection, and operations.

1.Where installation of one part of the Work is dependent on installation of other components either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

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

I. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

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

J. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules.
2. Installation and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Conducting progress meetings.
5. Orchestrating pre-installation and quality assurance meetings.
6. Project closeout activities.

1.03 COORDINATION DRAWINGS

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

1. Show the interrelationship of components.
2. Indicate required installation sequences.
3. Comply with requirements contained in product or equipment "Submittals".
4. Refer to specific coordination drawing requirements for mechanical and electrical installations.
5. As applicable for the project, prepare coordination drawings or sketches for:
   a. Mechanical equipment rooms.
   b. Electrical equipment rooms.
   c. Elevator equipment rooms.
   d. Roof plan with ALL penetrations, equipment supports, etc., including mechanical and electrical items.
   e. Ductwork, piping, electrical conduit.
6. Submit coordination drawings or sketches to the Architects as an "Informational Submittal". The Architect will not take responsive action.

1.04 LOCKOUT/TAGOUT PROCEDURES

A. Comply with the most recent requirements of OSHA Regulations for the safety of the workers. All equipment shall be locked/tagged out to a zero energy state when new installation, replacement, repair, maintenance or servicing is done on machinery or equipment to protect against accidental or inadvertent operation when such operation could cause injury to personnel.

B. Contractors are required to lockout/tagout machinery and equipment prior to maintenance or service. Compliance with this policy/procedure is mandatory.

C. Contractor employees must be able to:

1. Prepare equipment for shut down.
2. Shut down equipment.
3. Isolate equipment.
4. Apply lockout/tagout devices.
5. Control any stored energy.
6. Verify equipment isolation.
7. Remove the lockout.

D. When a lockout is placed on a piece of equipment or a system, it shall have a tag attached with a written warning from the person attaching the lockout.

E. If the energy source cannot be locked out, the tag should clearly state that there is no lockout on the equipment and that it has been de-energized for service.

F. Procedures:

1. Preparation

Contractor(s) performing lockouts must verify which switches, valves or other energy isolating devices apply to the equipment being services.

2. Shutdown

a) Notify any affected personnel (includes other contractors and/or district staff) of the equipment or machinery being locked/tagged out.
b) Shut the equipment down using its normal operating controls.

3. Isolation

a) Isolate the equipment or machinery from *every* power source.
b) Insure any secondary power is isolated from the equipment or machinery.

4. Application of Lockout/Tagout

a) Lockout the energy isolating device with an assigned lock. Only locks assigned for lockout purposes shall be used. General purpose locks shall not be utilized.

5. Stored Energy

a) Insure all moving parts are stopped.
b) Release any stored energy from the equipment or machinery. Spring pressure, elevated parts, rotating parts, hydraulics, air, gas, steam, water, etc., must be dissipated or restrained by other methods such as grounding, blocking or bleeding down.

6. Isolation & Verification

a) Insure no personnel are exposed to the equipment or machinery.
b) Operate the controls of the equipment or machinery to make sure the equipment or machinery will not operate.
c) Return the controls to the off position.
d) Electrical testing equipment shall be used to verify electrical isolation.

7. Restoring Equipment/Machinery to Operation

a) Upon completion of maintenance or service, verify the equipment/machinery is safe to operate.
b) Remove all tools from the work area.
c) Insure the system is fully assembled.
d) Be sure all personnel are clear of the equipment.
e) Inform everyone affected by the equipment or machinery that the lockout/tagout is being removed.
f) Remove the lockout/tagout devices. Devices are only to be removed by the person that put them on, except in the case of an emergency.

1.05 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major Work component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in contract documents.

1. Where applicable, comply with manufacturer's instructions, including each step in sequence.
2. Should manufacturer's instructions conflict with contract documents, request clarification from Architect before proceeding.
3. Installation must be performed to conform to the requirements of manufacturer's warranty.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

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

F. Recheck measurements and dimensions, before starting each installation.

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

H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated (install individual components at standard mounting heights recognized within the industry for the particular application indicated). Refer questionable mounting height decisions to the Architect for final decision.

1.06 CLEANING AND PROTECTION

A. Clean and maintain construction area(s) as frequently throughout the project. Contractor will provide up to and have use of at least one dumpster during the course of the Work. The dumpster to be located as coordinated with the Owner. The Contractor shall be responsible for any damages and shall repair and/or replace grass sod, concrete curbing, sidewalks, paved surfaces or other items if damaged due to the Contractor's activities.

B. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

C. Comply with Environmental Protection Agency Standards for Lead Renovation, Repair, and Painting Program (RRP); 40 CFR Part 745 and Kansas Department of Health and Environment Regulations K.A.R. 28-72-1 to 28-72-54.

1. Conduct pre-renovation education and notification.
2. Supervise construction activities to ensure that lead safe work practices are performed and take proper precautions concerning presumed lead materials.
3. Prevent discharge, dispersal, release or escape of lead dust and debris.
4. Isolate work areas and ensure that renovation dust or debris does not spread beyond contract limits or the project work areas. If latent emissions occur, perform cleaning, recleaning, and subsequent cleaning verifications as necessary. The Contractor shall not leave lead dust hazards in Owner facilities. Lead dust hazard means surface dust that contains a dust-lead loading (area concentration of lead) at or exceeding the levels promulgated by State of Kansas and Federal regulations. The Contractor shall not impair the Owner's ability to occupy work areas under this contract beyond substantial completion dates by leaving lead dust hazards.
5. During construction the Contractor shall perform visual inspections and cleaning verifications and shall weigh and assess the risks presented by the actual or presumed presence of lead-based paint and/or lead-based paint hazards.
6. The Contractor shall comply with State of Kansas and Federal lead safe work practices to clean and reclean each work area for safe post renovation occupancy by unprotected workers, children, and other building occupants.
7. Comply with the US Occupational Safety and Health Administration's Lead in Construction Rule, 29 CFR Park 1926 et al., 29 CFR Part 1910 et al.

    a. Communicate information concerning lead hazards according to the requirements of OSHA's Hazard Communication Standard for the construction industry, 29 CFR 1926.59.

b. Employee notification: Prior to the commencement of work activities, make available to the affected parties information developed for the hazard communication standard for this purpose.
c. The Contractor shall properly clean all areas where suspect or identified lead-based paint products are disturbed prior to project completion.

8. At the Pre-Construction Meeting the Contractor shall submit documents which indicate:

a. Contractor and subcontractors are lead certified firms.
b. That each firm employees at least one lead certified renovator who is specifically trained to supervise and direct lead safe work practices, post signage, and perform cleaning verifications.
c. That individual workers are trained to use lead safe work practices.

9. Product Prohibition: Do not install lead-based paints or coatings. Do not install lead bearing materials. The Contractor shall not install lead or lead-bearing products as defined by the US Consumer Product Safety Commission's Ban of Lead-Containing Paint and Certain Products Bearing Lead-Containing Paint 16 CFR 1303 et. Al.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01095

REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Related documents

B. Definition

C. Industry Standards

D. Governing Regulations/Authorities

E. Submittals

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to this section.

1.03 DEFINITIONS

A. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the drawings, other paragraphs or schedules in the specifications, and similar requirements in the contract documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used, it is to help the reader locate the reference; no limitation on locating is intended.

B. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the architect/consultant", "requested by the architect/consultant", and similar phrases.

C. Approve: The term "approved", where used in conjunction with the architect/consultant's action on the Contractor's submittals, applications, and requests, is limited to the architect/consultant's duties and responsibilities as stated in General, Supplementary, and Special Provisions.

D. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the asbestos removal, hazardous waste, and construction industries that control performance of the work.

E. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations".

F. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".

G. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use".

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

1. The term "experienced" when used with the term "Installer" means having a minimum of five previous projects similar in size and scope to this project, being familiar with the precautions required, and having complied with requirements of the authority having jurisdiction.
2. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter". It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.

I. Assignment of Specialists: Certain sections of the specifications require that specific construction activities shall be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility offer fulfilling contract requirements remains with the Contractor.

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

J. Project Site is the space available to the Contractor for performance of activities, either exclusively or in conjunction with others performing other work as part of the project. The extent of the Project Site is shown on the drawings and may or may not be identical with the description of the actual Project Site. All dimensions and locations should be field verified and noted by the Contractor.

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

1.04 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the contract documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the contract documents. Such standards are made a part of the contract documents by reference.

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

C. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, but apparently equal, and uncertainties to the architect and/or owner for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity level shown or specified shall be the minimum provided or performed. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirement. Refer uncertainties to the architect and/or owner for a decision before proceeding.

D. Copies of Standards: Each entity engaged in activities on the project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the contract documents.

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

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

1.05 GOVERNING REGULATIONS/AUTHORITIES

A. As applicable, the architect and/or engineer has contacted authorities having jurisdiction to obtain information necessary for preparation of contract documents. Contact authorities having jurisdiction directly for information and decisions having a bearing on the work.

1.06 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Related Documents

B. Summary

C. Pre-Construction Conference

D. Pre-Installation Conference

E. Progress Meetings

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division-1 specification sections, apply to this section.

1.03 SUMMARY

A. This section specifies administrative and procedural requirements for project meetings including, but not limited to:

1. Preconstruction conference.
2. Preinstallation conferences.
3. Coordination meetings.
4. Progress meetings.

1.04 PRECONSTRUCTION CONFERENCE

A. The Contractor shall schedule a preconstruction conference and organizational meeting at the project site or other convenient location within fourteen (14) days of contract execution, and at least seven (7) days prior to commencement of any construction activities. The Contractor shall conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: Turner School District, the Architects/Consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.

C. Agenda: As applicable, discuss items of significance that could affect progress, including such topics as:

1. Construction schedule.
2. Critical work sequencing.
3. Designation of responsible personnel.
4. Procedures for processing field decisions.
5. Procedures for processing applications for payment.
6. Distribution of contract documents.

7. Submittal of Shop Drawings, Product Data and Samples.
8. Preparation of record documents.
9. Use of the premises.
10. Office, work and storage areas.
11. Equipment deliveries and priorities.
12. Safety procedures and compliance with Lock Out/Tag Out procedures.
13. Lead safe work practices and lead hazard prevention procedures.
14. First aid.
15. Security.
16. Housekeeping.
17. Working hours.
18. Testing agencies and procedures.
19. Temporary utilities; water, electric, phone.
20. Temporary lavratory facilities.
21. Quality control.

D. The Contractor shall record meeting minutes and distribute copies to everyone in attendance and to others affected by decisions of actions resulting from the meeting.

1.05 PREINSTALLATION CONFERENCES

A. The Contractor shall convene a preinstallation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the architect and owner of scheduled meeting dates.

B. Review the progress of the construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for:

1. Deliveries.
2. Shop drawings, product data and quality control samples.
3. Possible conflicts.
4. Compatibility problems.
5. Time schedules.
6. Weather limitations.
7. Manufacturer's recommendations.
8. Compatibility of materials.
9. Acceptability of substrates.
10. Temporary facilities.
11. Space and access limitations.
12. Governing regulations.
13. Safety.
14. Inspection and testing requirements.
15. Required performance results.
16. Protection.
17. Punchlist procedures and Architect/Engineer responsibilities limitations.

C. Notify architect and owner four days in advance of meeting date when their attendance is required by individual section.

D. The Contractor shall prepare agenda, preside at the conference and record significant discussions and agreements of each conference, along with the approved schedule. The Contractor shall distribute the record of the meeting to everyone concerned, promptly, including the owner and architect.

E. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.

1.06 PROGRESS MEETINGS

A. Conduct progress meetings at the Project Site as directed by the Architect. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: The Owner and Architect. Each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities

C. Agenda: Review discussions of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the project.

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

2. Produce and review a three-week "look ahead" schedule outlining planned construction activities for the next three weeks (or the period of time until the next progress meeting).

3. Review the present and future needs for each contractor or subcontractor involved, including such items as:

a. Interface requirements.
b. Time.
c. Sequences.
d. Deliveries.
e. Off site fabrication status.
f. Access.
g. Site utilization.
h. Temporary facilities and services.
i. Hours of work.
j. Hazards and risks.
k. Housekeeping.
l. Quality and work standards.
m. Change orders.
n. Documentation of information for payment requests.
o. Outstanding items; submittals, proposal requests, RFIs.
p. Quality assurance.
q. Safety.
r. Performance of lead safe work practices.

D. Reporting: No later than three days after each progress meeting date, the Contractor is to distribute copies of minutes of the meeting to each the Architect and Owner.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01210A

CASH ALLOWANCES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and procedural requirements governing the use of cash allowances.

1. A cash allowance, if specified, will be established to address additive cost changes in the Work and/or to address unforeseen conditions associated with construction. The use of the cash allowance is solely at the discretion of the Owner, and cannot be authorized by the Architect, Engineer, or other consultant.

B. Related Sections include the following:

1. Division 1 Section 1020 "Contract Considerations" for procedures for submitting and handling Change Orders.
2. Division 1 Section "Unit Prices" for procedures for using unit prices.
3. Applicable Sections for items of Work that may be covered by allowances.

1.03 USE OF ALLOWANCES

A. At the earliest practical date during construction, advise Architect and Owner of unforeseen conditions that affect the Work.

B. At Architect's request, obtain cost proposals for the corrections of the noted unforeseen conditions.

C. Based on cost proposals received, the Owner will make a decision to utilize available allowance amounts to correct an applicable unforeseen condition.

1.04 SUBMITTALS

A. Submit proposals for additive costs for unforeseen conditions in the same form specified for proposal requests.

1.05 RESPONSIBILITIES

A. Architect Responsibilities:

1. Consult with Owner in consideration and selection of additive cost items for consideration for application using cash allowances.
2. Prepare Proposal Requests and assess proposals for application of cash allowances for Owner approval.

B. Contractor Responsibilities:

1. Identify unforeseen conditions as they may occur and advise the Architect and Owner.
2. Obtain proposals and offer recommendations.
3. On notification of approval of cash allowance, execute agreement with designated supplier and/or sub-contractor as applicable.
4. Arrange for and process applicable shop drawings, product data, and samples. Arrange for delivery.
5. Coordinate and install Work of approved Cash Allowances.
6. The Contractor shall include in his Bid all fees for all Cash Allowances.

C. Funds will be drawn from Cash Allowances only by written authorization of the Owner.

E. Cash Allowances:
1. None

1.06 SCHEDULE OF VALUES

A. The Contractor will submit to the Architect a Schedule of Values that includes all major categories of work, including applicable Cash Allowances.

1.07 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.08 ALLOWNACE COSTS

A. Allowance shall include cost to Contractor of products and materials, freight and delivery to Project Site, labor, and installation.

B. Contractor's costs for overhead and profit, and similar costs of Bonds and Insurance shall be included as part of the Contract Sum and not part of the allowance.

C. Any unused portion of the Allowance shall be credited to the Owner at the completion of the Work via a Deductive Change Order, along with the associated overhead and profit.

PART 2 – PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES
(Architect to include a schedule of applicable allowances.)

END OF SECTION 01210A

SECTION 01230

ALTERNATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this section.

1.02 SUMMARY

A. This section includes administrative and procedural requirements governing alternates.

1.03 DEFINITIONS

A. Definition: An alternate is an amount stated on the bid form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept the corresponding alternate cost in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the contract documents.

1. The cost or credit for each alternate is the net addition to or deduction from the base bid amount to incorporate the alternate into the work. No other adjustments are made to the base bid amount.

1.04 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely and fully integrate that work into the project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the alternate.

B. Notification: Immediately following the award of the contract, notify each party involved, in writing, of the status of each alternate. Indicate whether alternates have been accepted, rejected, or deferred for later consideration.

1. Prices for alternates that are deferred for later consideration shall be held for the same period of the Bid as noted on the Bid Form. The Contractor may choose to hold alternate pricing for a period of time that is greater than the original bid; however, may not reduce that period from the original bid.

C. Execute accepted alternates under the same conditions as work of this contract.

D. Schedule: A "Schedule of Alternates" is included at the end of this section. Specification sections referenced in the schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

(Include listing of individual alternates as approved by the Owner and Architect.)

END OF SECTION

SECTION 01270

UNIT PRICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A.Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this section.

1.02 SUMMARY

A. This section includes administrative and procedural requirements for unit prices.

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

1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling change orders.
2. Division 1 Section "Quality Requirements" for general inspection requirements.

1.03 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the bid form, as a price per unit of measurement for materials or services added to or deducted from the contract sum by appropriate modification, if the estimated quantities of work required by the contract documents are increased or decreased.

1.04 PROCEDURES

A The Owner reserves the right to accept or reject the unit cost bid by the Contractor for each scheduled unit price. Acceptance or rejection of unit prices shall be determined by the Owner prior to the execution of the contract for construction.

B. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, profit, and applicable taxes.

C. Measurement and Payment: Methods of measurement and payment for unit prices are specified on the bid form.

D. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to the Owner.

E. Schedule: A "Unit Price Schedule" is included at the end of this section. Specification sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 UNIT PRICE SCHEDULE

(Include a listing of individual unit price items to be included on the Bid Form.)

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Contractor's Quality Control

B. Contractor's Quality Control Program

C. Pre-Installation Conferences

D. Initial and Follow-up Inspections

E. Mock Up

F. Field Samples

G. Manufacturer's Field Services and Reports

H. References

I. Inspection and Testing Laboratory Services

J. Quality Assurance and Control of Installation

K. Safety

1.02 RELATED SECTIONS

A. Section 01040 - Coordination and Meetings

B. Section 01300 - Submittals

C. Section 01700 - Contract Closeout

1.03 CONTRACTOR'S QUALITY CONTROL

A. The quality of all work shall be the responsibility of the Contractor. Sufficient inspections and tests of all items of work, including that of subcontractors, to ensure conformance to applicable specifications and drawings with respect to the quality of materials, workmanship, construction finish, functional performance, and identification shall be performed on a continuing basis. The Contractor shall furnish qualified personnel, appropriate facilities, instruments and testing devices necessary for the performance of the quality control function. The controls shall be adequate to cover all construction operations both on and off site, shall be keyed to the proposed construction sequence and shall be correlated by the Contractor's quality control personnel.

1.04 CONTRACTOR'S QUALITY CONTROL PROGRAM

A. The Contractor's Quality Control representative may be the superintendent or other key contract representative. The quality control representative must have the authority to make all decisions relating to quality control issues.

1.05 PREINSTALLATION CONFERENCES

A. Pre-installation conferences shall be performed prior to beginning each feature of work for any on-site construction work. Preparatory inspections for the applicable feature of work shall include: review of submittal requirements and all other contract requirements with the foreman or supervisors directly responsible for the performance of the work; check to assure that provisions have been made to provide required field control testing; examine the work area to ascertain that all preliminary work has been completed; verify all field dimensions and advise the project Architect of any discrepancies; and perform a physical examination of materials and equipment to assure that they conform to approved shop drawings or submittal data and that all materials and/or equipment are on hand; review special requirements, review shop drawings and sample construction mockups as appropriate.

B. The Contractor shall prepare agenda, preside at conference, record minutes, and distribute copies within five (5) days after conference to participants, with copies to the Architect and Owner.

1.06 INITIAL AND FOLLOW UP INSPECTIONS

A. An initial inspection shall be performed as soon as a representative portion of the particular feature of the work is complete and shall include examination of the quality of workmanship as well as a review of the work for compliance with contract requirements. The initial inspection shall be performed by the Contractor's Quality Control representative and results noted in the Contractor's daily reports. Any deviations from the contract requirements shall be brought to the immediate attention of the Architect.

1.07 MOCK UP

A. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals and finishes.

B. Where mock up is specified in individual sections to be removed, clear area after mock up has been accepted by the Architect.

1.08 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications sections for review.

B. Acceptable samples represent a quality level for the work.

C. Where field sample is specified in individual sections to be removed, clear area after field sample has been accepted by the Architect.

1.09 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of

surfaces and installation, quality of workmanship, start up of equipment, and test, adjust, and balance of equipment as applicable, and to initiate instructions when necessary.

1.10 REFERENCES

A. Conform to reference standard by date of issue or current date of contract documents.

B. Obtain copies of standards when required by contract documents.

C. Should specified reference standards conflict with contract documents, request clarification from Architect before proceeding.

D. The contractual relationship of the parties to the contract shall not be altered from the contract documents by mention or inference otherwise in any reference document.

1.11 INSPECTION AND TESTING LABORATORY SERVICES

A. Architect or Owner will appoint, employ, and pay for services of an independent firm to perform inspection and testing, except when a specification section specifically states that testing of that work be provided for by the Contractor.

B. The independent firm will perform inspections, tests, and other services specified in individual specification sections and as required by the Architect.

C. Reports will be submitted by the independent firm to the Architect and/or Owner in duplicate, indicating observations and results of tests and indicating compliance or noncompliance with contract documents.

D. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.

1. Notify Architect and independent firm forty-eight hours prior to expected time for operations requiring services.
2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

E. Retesting required because of nonconformance to specified requirements shall be performed by the same independent firm on instructions by the Architect. Payment for retesting will be charged to the Contractor by deducting inspection or testing charges from the contract sum.

1.12 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply fully with manufacturer's instructions, including each step in sequence.

C. Should manufacturer's instructions conflict with contract documents, request clarification from Architect before proceeding.

D. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality. Work that properly should be done by skilled labor shall not be attempted with common laborers. The Contractor shall have on the job, at all times, ample equipment to carry on the work properly, including such tools as may be necessary to meet emergency requirements.

1.13 SAFETY

A. Contractors who perform any work under this contract will fully comply with the provisions of the Federal Occupational Safety and Health Act of 1970 and to the rules and regulations promulgated pursuant to this Act.

B. Hazardous Material: In the event the Contractor encounters material on the site, reasonably believe to be asbestos or polychlorinated biphenyl (PCB) that has not been rendered harmless, the Contractor shall immediately stop work and notify the Architect and Owner. Such notification shall be documented in writing.

C. Provide any and all measures of protection required by the applicable local municipality for the protection of the public and employees during excavation operations and at completion of work. Measures taken shall include, but not be limited to, sidewalks, barricades, warning lights and signs/ and shall comply with American Standard Safety Code and all local laws and ordinances. Maintain in good condition during operations.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Related Documents

B. Summary

C. Submittals

D. Quality Assurance

E. Project Conditions

F. Temporary Construction and Support Facilities

G. Security and Protection Facilities Installation

H. Operation, Termination, and Removal

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and other Division-1 Specification sections, apply to this section.

1.03 SUMMARY

A. This section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.

B. Temporary utilities that may be required include, but are not limited to:

1. Water service and distribution.
2. Temporary electric power and light.
3. Gas service.
4. Telephone and/or data service.
5. Storm sewer.
6. Irrigation.

C. Temporary construction and support facilities that may be required include, but are not limited to:

1. Temporary heat.
2. Field offices and storage sheds.
3. Temporary roads and paving.
4. Sanitary facilities, portable toilets, potable and non-potable water.
5. Dewatering facilities and drains.
6. Temporary enclosures.
7. Hoists and lifts.
8. Temporary project identification signs
9. Waste and refuse disposal services.
10. Rodent and pest control.

11. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities required include, but are not limited to:

1. Temporary fire protection.
2. Barricades, barrier fences, temporary chain link fences, warning signs, and lights.
3. Environmental protection.

1.04 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.

1.05 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.
5. Environmental protection regulations.

B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations: ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical facilities."

1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.
2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA temporary electric service. Install service in compliance with National Electrical Code (NFPA 70).

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.06 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES

A. Locate field offices, storage containers, sanitary facilities and other temporary construction and support facilities of ready access within project limit lines.

1. Maintain temporary construction and support facilities until near substantial completion. Personnel remaining after substantial completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
2. Location of all temporary buildings shall be subject to the approval of the Owner and the governing authority.

B. Provide incombustible construction for field offices, sheds or containers located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.

C. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection if installed construction from adverse effect of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirement to produce the ambient condition required and minimize consumption of energy.

D. Heating Facilities: Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.

E. Field Offices: provide insulated, weather tight temporary offices of sufficient size to accommodate required office personnel at the project site. Keep the office clean and orderly for use of small progress meetings. Furnish and equip offices.

F. Storage Trailers: Place storage trailers, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service. Trailers are to be fully enclosed and placed on the site with prior approval of the Owner.

G. Temporary Roads and/or Equipment Access Paths: Construct and maintain temporary roads and/or access paths to adequately support the construction activity, during the construction period. Locate temporary roads, storage areas and parking where the same permanent facilities will be located, if possible.

1. Coordinate temporary road and/or access path development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
2. Install temporary roads and/or access paths to minimize the need to rework the installations and to result in permanent roads and/or access paths and paved areas that are without damage or deterioration when occupied by the Owner.
3. Extend temporary roads and/or access paths in and around the construction area as necessary to accommodate building structure erection, delivery and storage of materials, equipment usage, administration and supervision.
4. Fully remove rock, gravel, and/or other materials used to create roads and access paths that will not become pavement to the satisfaction of the owner.

H. Sanitary facilities include temporary toilets and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operations and maintenance of fixtures and facilities. All sanitary conveniences shall be satisfactory to the Owner and shall conform to the regulations of the City, County, and State Health Departments.
1. Install where facilities will best serve the project's needs, with prior owner approval.

2. Provide toilet tissue, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.

I. Toilets: Install well-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.

J. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual sections, comply with dewatering requirements of applicable sections. Where feasible, utilize the same facilities. Maintain the site, excavations and construction free of water.

K. Temporary Enclosures: Provide temporary enclosure of protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities, and to provide security from vandalism and theft.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.

L. Temporary Enclosures for Lead Safe Work Area Isolation.

1.Before beginning the renovation, the Contractor shall isolate the work area so that no dust or debris leaves the work area while the renovation is being performed. Prevent latent dust emissions. Protect other areas of the facility from contamination by fugitive dusts.
2.In addition, the Contractor shall maintain the integrity of the containment by ensuring that any plastic or other impermeable materials are not torn or displaced, and taking any other steps necessary to ensure that no dust or debris leaves the work area while the renovation is being performed.
3.The Contractor must also ensure that containment is installed in such a manner that it does not interfere with occupant and worker egress in an emergency.

M. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

N. Project Identification and Temporary Signs: The Contractor will not erect free-standing or post any signs on property under the control of the Turner School District without prior approval by the Owner. This includes signs on construction trailers, portable sheds, etc., which might legitimately be temporarily parked on said property by and for the Contractor's use as part of this project. The Owner may provide and erect one or more project signs as they deem necessary.

O. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold waste materials more than seven days during normal weather or three days when the temperature is expected to rise above 80 degrees. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

P. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished permanent stairs with a protective covering of plywood or similar material so finish will be undamaged at the time of acceptance.

3.02 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.

B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonable predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguisher", and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."

1. Locate fire extinguisher where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguisher, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires.
4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

C. Permanent Fire Protection: At the earliest feasible date in each area of the project, complete installation of the permanent fire protection facility, including connected services, and place into operations and use. Instruct key personnel on use of facilities.

D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.

E. Enclosure Fence: Prior to demolition or excavation, install an enclosure fence with lockable entrance gates. Locate where indicated , or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. Provide an open mesh chain link construction fence and gates, minimum 6-'0" high, with galvanized steel pipe posts.
2. Utilize concrete block or pegged steel pipe stabilizer brackets where fence panels adjoin or end.
3. Upon removal of the fencing, repair any disturbed areas to restore to original condition.
4. Locate the construction fence and gates to facilitate all jurisdictional exit and entry requirements from existing buildings and new construction.
5. If requested by the owner, the gates shall be double locked (lock to lock) with the contractor's lock and the owner's lock to allow owner access.
6. Locate the fence and gates to facilitate owner operations that may be in progress during construction.
7. Maintain the fence and gates throughout construction.

F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.

1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise making tools and equipment harmful to humans so as to minimize complaints from persons or firms near the site.

1. Contractor shall comply with all Federal, state and local laws and regulations relating to environmental protection. Daily clean up of adjacent streets, sidewalks, and public structures due to construction debris shall be required at Contractor's expense.

3.03 OPERATION, TERMINATION AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.
2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

B. Termination and Removal: Unless the Architect or Owner requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or not later than substantial completion. Complete, or if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of project identification signs.
2. At substantial completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:

a. Replace air filters and clean inside of ductwork and housings.
b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Related Documents

B. Summary

C. Definitions

D. Submittals

E. Quality Assurance

F. Product Requirements and Selection Procedures

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to this section.

1.03 SUMMARY

A. This section specifies administrative and procedural requirements governing the Contractor's selection of products for use on the project.

B. The Contractor's construction schedule and the schedule of submittals are included under Division 1 Section "Submittals."

C. Standards: Refer to Division 1 Section "Reference Standards and Definitions" for applicability of industry standards to products specified.

D. Administrative procedures for handling requests for substitutions made after award of the contract are included under Division 1 Section "Product Substitutions."

1.04 DEFINITIONS

A. Definitions used in this article are not intended to change the meaning of other terms used in the contract documents, such as "specialties," "systems," "structure," "accessories," and similar terms. Such terms such are self-explanatory and have well recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature that is current as of the date of the Contract Documents.

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

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

1.05 SUBMITTALS

A. Product List Schedule: Prepare a schedule showing products specified in a tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names of each item listed.

1. Coordinate the product list schedule with the Contractor's Construction Schedule and the Schedule of Submittals.
2. Form: Prepare the product listing schedule with information of each item tabulated under the following column headings:

a. Related Specification Section Number.
b. Generic Name Used in Contract Documents.
c. Proprietary Name, Model Number and Similar Designations.
d. Manufacturer's Name and Address.
e. Supplier's Name and Address.
f. Installer's Name and Address.
g. Projected Delivery Date, or Time Span of Delivery Period.

3. Initial Submittal: Within fourteen (14) days after date of commencement of the work, identify of an initial product list schedule. Provide a written explanation for omissions of data, and for known variations from contract requirements.
4. Architect's Action: The Architect will respond to the Contractor within two weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or product, but does not constitute a waiver of the requirement that products comply with contract documents. The Architect's response will include the following:

a. A list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.06 QUALITY ASSURANCE

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

B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the project, the product selected shall be compatible with products previously selected products that were also options.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

a. Name of product and manufacturer.

b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

1.07 PRODUCT REQUIREMENTS AND SELECTION PROCEDURES

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

1.Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

2. Standard products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: Product selection is governed by the Contract Documents and government regulations, not by previous project experience. Procedures governing product selection include the following:

1.Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.

2. Semi-Proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
3. Non-Proprietary Specifications: When the specifications list products or manufacturers that are available and may be incorporated in the work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with contract requirements. Comply with contract document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
4. Descriptive Specification Requirements: Where specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with contract requirements.

5.Performance Specification Requirements: Where specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.

a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

END OF SECTION

SECTION 01631

POST-BID PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Related Documents

B. Summary

C. Definition

D. Submittals

E. Substitution

1.02 RELATED DOCUMENTS

a. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to this section.

1.03 SUMMARY

A. This section specifies administrative and procedural requirements for handling requests for substitutions made after award for the contract.

1.Certain materials, products or systems are specified for which no substitutions are allowed. Refer to individual specification sections for specific items.

B. Refer to "Instructions to Bidders" for substitution requirements made prior to bid opening.

C. The Contractor's construction schedule and the schedule of submittals are included under Division-1 Section "Submittals".

D. Standards: Refer to Division-1 Section "Reference Standards and Definitions" for applicability of industry standards to products specified.

E. Procedural requirements governing the Contractor's selection of products and product options are included under Division-1 Section "Materials and Equipment:

1.04 DEFINITIONS

A. Definitions used in the article are not intended to change or modify the meaning of other terms used in the contract documents.

B. Substitutions: Requests for changes in product, materials, equipment, and methods of constructing required by Contract Documents proposed by the Contractor after award of the contract are considered requests for post-bid product substitutions. The following are NOT considered substitutions:

1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of contract via addendum, are considered as included in the contract documents and are not subject to requirements specified in this section for post-bid substitutions.
2. Revisions to contract documents requested by the Owner or Architect.
3. Specified options of products and construction methods included in Contract Documents.
4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.05 SUBMITTALS

A. Post Bid Substitution Request Submittal: Only one request for post bid substitution will be considered for each product.

1. Submit requests in the form and in accordance with procedures stated herein. Use form depicted at end of this section. Contractor is responsible for reproduction of forms.
2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related specification section and drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

   a. Product data, including drawings and descriptions of products, fabrication and installation procedures.
   b. Samples, where applicable or requested.
   c. A detailed comparison of significant qualities of the proposed substitution with those of the work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect. Units of weights and measure shall be the same as used in the contract documents.
   d. Coordination information, including a list of changes or modifications needed to other parts of the work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall contract time.
   f. Cost information, including a proposal of the net change, if any, in the Contract Sum. Additional cost substitutions will generally not be accepted or approved.
   g. Certification by the Contractor that the substitution proposed is equal to or better in every significant respect to that required by the contract documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

3. Architect's Action: Within one week of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request. Within two weeks of the receipt of the request, or one week of the receipt of the additional information or documentation, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name.

PART 2 -- PRODUCTS

2.01 SUBSTITUTIONS

A. Conditions: The Contractor's post bid substitution request will be received and considered by the Architect when all of the following conditions 1, 2 and 3 and one or more of the following conditions 4, 5, 6, 7, 8 and 9 are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to contract documents are not required.
2. Proposed changes are in keeping with the general intent of contract documents.
3. The request is timely, fully documented and properly submitted.
4. The specified product or method of construction cannot be provided within the contract time.
5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
6. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.

B. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or sample that related to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

POST-BID SUBSTITUTION REQUEST FORM

ONE ITEM PER FORM
FILL IN ALL BLANKS

Project:_____ Date:_____

We hereby submit for your review the following post-bid substitution for the following specified material for the above project.

Section Page Paragraph Specified Material

_____ ____ _____ _____

PROPOSED POST-BID SUBSTITUTION:

_____

Attach complete technical data, including laboratory tests, if applicable. Include complete information on changes to drawings and/or specifications which proposed substitution will require for its proper installation.

A. Does the substitution affect dimensions shown on drawings in any way?

_____

B. Will the undersigned pay for any changes to the building design, including engineering and detailing costs caused by the requested substitution?

C. What effect does substitution have on schedule or other trades?

_____

D. What effect does substitution have on cost?

_____

E. Differences between proposed substitution and specified items are:
_____ Same _____ Different (Explain)

_____

F. Contractor represents that he has investigated the proposed product and determined that it meets or exceeds the quality of the specified product.

SUBMITTED BY:

___ Accepted ___ Accepted as Noted
___ Not Accepted ___ Received Too Late

_____
(Firm)

_____ _____ _____
(Address) (By) (Date)

_____ _____
(Telephone) (Remarks)

_____ _____
(Signature)

SECTION 01650

STARTING OF SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES:

A. Starting systems.

B. Demonstration and instructions.

C. Testing, adjusting, and balancing.

1.02 RELATED SECTIONS

A. Section 01400 – Quality Control: Manufacturer's field reports.

B. Section 01700 – Contract Closeout: System operations and maintenance data and extra materials.

1.03 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner fourteen (14) days prior to start up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions that may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start up under supervision of responsible manufacturer's representative in accordance with manufacturer's instructions.

1.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel prior to date of substantial completion. Contractor will prepare and distribute meeting minutes of each demonstration and associated instruction.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season as soon as practical prior to the season and per the owner's availability and agreement. Demonstration shall be performed under applicable seasonal conditions.

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start up, operation, control, adjustment, troubleshooting, servicing, maintenance,

and shutdown of each item of equipment at a scheduled agreed upon time, at designated location.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

F. The minimum amount of time required for instruction on each item of equipment and system may be specified in individual sections. Reference individual sections for requirements.

1.05 TESTING, ADJUSTING AND BALANCING

A. Contractor will appoint, employ, and pay for services of an independent firm to perform testing, adjusting and balance.

B. The independent firm will perform services as specified per applicable HVAC, electrical, and/or plumbing section (s).

C. Reports will be submitted by the independent firm to the Architect indicating observations and results of tests and indicating compliance or noncompliance with specified requirements and with the requirements of the contract documents. Reports will be provided with warranty and close-out documentation.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01700

PROJECT CLOSEOUT

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Related documents.

B. Summary.

C. Completion of a building and/or phase.

D. Final completion and final payment.

E. Record document submittals.

F. Starting systems.

G. Operating and maintenance instructions.

H. Final cleaning.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to this section.

B. Refer to Section 01020 for Final Lien Waiver.

1.03 SUMMARY

A. This section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Inspection procedures.
2. Project record document submittal.
3. Operating and maintenance manual submittal.
4. Submittal of warranties.
5. Final cleaning.
6. Record digital drawings.

B. Closeout requirements for specific construction activities are included in the appropriate sections of technical specifications.

C. Refer to Division-1 Section "Warranties and Bonds" for specific requirements.

1.04 SUBSTANTIAL COMPLETION

A. Substantial Completion:

1. The Contractor and Subcontractors shall carefully and regularly check their work for conformance with the contract documents as the Work is being done. Unsatisfactory work shall be corrected as the Work progresses and not be permitted to remain and become a part of the punch list.
2. The Contractor shall conduct a pre-punch list inspection. The written pre-punch list shall be distributed to affected subcontractors, for immediate correction of noted items. The Contractor shall provide a copy of the pre-punchlist inspection to the Architect and Owner and advise both of the correction of the pre-punch list. This Contractor shall notify the Architect when the work is ready for the Architect's punch list inspection.
3. The Architect shall make arrangements to perform his punch list inspection at the earliest possible date following Contractor notification. The Architect shall provide his punch list to the Contractor as soon as practical. Upon receipt of the Punch List, the Contractor shall, within seven (7) days, bring to the attention of the Architect, in writing, any questions that he or any of his subcontractors may have concerning the requirements of the Punch List.
4. When advised that the Punch List items have been completed, the Architect shall conduct a reinspection with the Contractor and any needed subcontractors (and the Owner's representative where applicable) to determine whether the Certificate of Substantial Completion can be issued. A Certificate of Substantial Completion will only be issued after codes administration authorities document approval and or permit occupancy of the building or phase. Also note Paragraph 12 of this section.
5. The Certificate of Substantial Completion shall name the date, triggering the beginning of the warranty period (with any items to have a later starting date specifically noted). The certificate shall also have attached to it any uncompleted Punch List items, and shall name the date for their final completion.
6. The signature of all parties on the certificate implies possession of the premises by the Owner. The subsequent completion of incomplete punch list items by the Contractor and the subcontractors shall occur at the Owner's convenience. The Owner shall cooperate in permitting the Contractor reasonable access to the work for the completion of punch list items.
7. A Certificate of Substantial Completion for the work, or portion of work will only be issued after the requirements for the demonstration and instruction of operation and maintenance procedures have been provided to the Owners personnel.
8. A list of items required for submission at Substantial Completion is listed at the end of this section. This list may include specific maintenance agreements, maintenance manuals, tools, keys, spare parts, extra stock materials, operational instruction to Owner's operating personnel, etc. Any items not here-in specifically listed as required at Substantial Completion shall be submitted at Final Completion.

9. Substantial Completion Cleaning: At Substantial Completion for each project or portion of the project, clean the entire work area to a level acceptable to the Owner. Remove non-permanent protection and labels, polish glass, clean exposed finishes, touch-up minor finish damage, clean or replace filters of mechanical systems, remove debris and broom clean non-occupied spaces, sanitize plumbing/food service facilities, clean light fixtures and replace burned out/dimmed lamps, sweep and wash paved areas, police yards and grounds. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces. Mop VCT or seamless floor surfaces clean. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

10. Lead Safe Project Report: As applicable to the project, the Contractor shall furnish a single report documenting compliance with recordkeeping and reporting of requirements of 40 CFR Part 745.85 including documentation that a certified renovator was assigned to the project, that the certified renovator provided on-the-job training for workers used on the project, that the certified renovator performed or directed workers who performed all of the tasks described in Part 745.85, and that the certified renovator performed the post-renovation cleaning verification described in Part 745.85. If the renovation firm was unable to comply with all of the requirements of this rule due to an emergency as defined in Part 745.82, the Contractor shall document the nature of the emergency and the provisions of the rule that were not followed. This documentation must include a copy of the certified renovator's training certificate, and a certification by the certified renovator assigned to that project that:
    a. Training was provided to workers (topics must be identified for each worker).
    b. Pre-renovation education and hazard communication was performed before and updated during the project.
    c. Warning signs were posted at the entrances to the work area.
    d. The work area was contained by:
        (1) Removing or covering all objects in the work area (interiors).
        (2) Closing and covering all HVAC ducts in the work area (interiors).
        (3) Closing all windows in the work area (interiors) or closing all windows in and within 20 feet of the work area (exteriors).
        (4) Closing and sealing all doors in the work area (interiors) or closing and sealing all doors in and within 20 feet of the work area (exteriors).
        (5) Covering doors in the work area that were being used to allow passage but prevent spread of dust.

(6) Covering the floor surface, including installed carpet, with taped-down plastic sheeting or other impermeable material in the work area 6 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to contain the dust, whichever is greater (interiors) or covering the ground with plastic sheeting or other disposable impermeable material anchored to the building extending 10 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to collect falling paint debris, whichever is greater, unless the property line prevents 10 feet of such ground covering, weighted down by heavy objects (exteriors).

(7) Installing (if necessary) vertical containment to prevent migration of dust and debris to adjacent property (exteriors).

e. Waste was contained on-site and while being transported off-site.

f. The work area was properly cleaned after the renovation by:

(1) Picking up all chips and debris, misting protective sheeting, folding in dirty side inward, and taping it for removal.

(2) Cleaning the work area surfaces and objects using a HEPA vacuum and/or wet clothes or mops (interiors).

g. The certified renovator performed the post-renovation cleaning verification (the results of which must be briefly described, including the number of wet and dry cloths used).

11. Substantial Completion Drain Clearing. At Substantial Completion for each project or portion of the project, perform drain clearing in each building area affected by new construction or renovation work. Clear drains of debris and/or construction materials using methods acceptable to the school district. Test all affected drains to ensure proper operation prior to turn-over to the district. As required, demonstrate proper operation.

12. The Owner has contracted with the Architect/Engineer to perform a limited number of punchlist inspections and reinspections. Typically, the Architect/Engineer is responsible for the initial punchlist inspection and one reinspection. If the Owner incurs additional cost from the Architect/Engineer for the performance of more than one initial punchlist inspection and one reinspection, costs for any necessary additional reinspection will be assessed to the Contractor in the way of a deductive cost change order.

B. Final Completion:

1. Submit executed warranties, workmanship bonds, remaining maintenance agreements, inspection certificates and similar required documentation for specific units of work, enabling Owner's unrestricted occupancy and use.

2. Submit maintenance manuals, tools, keys, spare parts, extra stock materials not required at substantial completion.

3. Complete instruction of Owner's operating personnel with start up of all systems, not previously required at substantial completion.

4. Complete final cleaning and remove temporary facilities.

a. Final Cleaning: Reclean the work affected by punch list corrections. Remove non-permanent protection, polish glass, clean exposed finishes, touch-up minor finish damage, remove debris and broom clean non-occupied spaces, sanitize plumbing/food service facilities, clean light fixtures, sweep and wash paved areas, police yards and grounds, and perform similar clean up operations needed to produce a "clean" condition as judged by Architect and Owner.

5. All punch list work must be completed, reviewed and accepted by the Architect and Owner.

1.05 FINAL COMPLETION AND FINAL PAYMENT

A. Provide submittals to Architect that are required by governing or other authorities. Confirm that all submittals required by the construction documents have been transmitted.

B. Final Completion: For the purpose of determining a date at which the project is finished, final completion may be defined to include, but is not limited to:

1. Substantial completion.
2. Submission and acceptance by the Architect of project record drawings.
3. Operation and maintenance data (including all air and water balance reports).
4. All applicable Owner training sessions with meeting notes distributed (video tapes, if applicable).
5. Final cleaning.
6. Adjusting (hardware, HVAC, etc.)
7. Warranties submitted by Contractor and accepted by Architect.
8. Spare parts and maintenance materials turned over to proper District personnel.
9. All Punch List work completed, reviewed and accepted by the Architect.

a. All of the above items are as required by individual specification requirements as found in the contract documents. These individual requirements shall take precedence over this definition if any conflict should arise.

C. Upon written notice by the Contractor that the reinspection punch list items are completed, the Architect shall verify this by inspection and shall issue to the Owner a final certificate of payment stating that, to the best of their knowledge, information and belief, the work has been completed in accordance with the terms and conditions of the contract documents, and that the entire balance found to be due the Contractor, and noted in said final certificate of payment, is due and payable.

1.06 RECORD DOCUMENT SUBMITTAL

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings: A set of blue- or black-line drawings of the original bidding documents will be provided by the Architect to the Contractor for the following use:

1. If the Contractor elects to vary the work from the Contract Documents, and secures prior approval from the Architect, he shall record in a neat, readable manner, all such variances on the blue- or black-line drawings furnished.
2. For plumbing; heating; ventilating; and air conditioning; electrical and fire protection work, record document drawings shall be maintained by the Contractor as the work progresses and as follows:

a. All deviations from the sizes, locations, and from all other features of all installations showing the contract documents shall be recorded.

b. Drawings shall correctly locate, identify and establish sizes of piping, direction etc., as well as all other features of work that will be concealed.

1. Locations of underground work shall be established by dimensions to column lines or walls, by locating all turns, etc., and by properly referenced centerline or invert elevations and rates of fall.

2. For work concealed in the building, sufficient information shall be given so it can be located with reasonable accuracy and ease. This may be by dimension; or it may be sufficient to illustrate the work on the drawings in relation to the spaces in the building near which it was actually installed. Architect's decision in this matter shall be final.

3. Blue- or black-line record drawings shall be kept up to date during the entire course of the work and shall be available upon request for examination by the Architect.
4. The following requirements apply to all record document drawings:

a. They shall be maintained at the Contractor's expense.

b. All such drawings shall be produced carefully and neatly by a competent draftsperson and in an approved form.
c. Additional drawings shall be provided as necessary for clarification.
d. The record document drawings (both blue- and black-line and reproducible) shall be returned to the Architect upon completion of the work and are subject to the approval of the Architect.
d. Delete Architect title block and seal from record document drawings.

C. Record Specifications: Maintain one complete copy of the project manual, including addenda, and one copy of other written construction documents such as change orders and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and product data.

1. Legibly mark and record at each product section description of actual products installed, including the following:

a. Manufacturer's product name and product model number.
b. Product substitutions or alternates utilized.
c. Changes made by addenda and modifications.

2. Upon completion of the work, submit record specifications to the Architect for the Owner's records.
3. Record project manual shall be maintained at the Contractor's expense.
4. Record project manual shall be maintained in a neat, readable manner. Contract work variations shall be recorded in the correct corresponding technical section of the project manual.
5. Delete Architect seal from record project manual.
6. Complete final cleaning and remove temporary facilities.

D. Record Shop Drawings: Maintain a clean, undamaged set of blue or black line white prints of shop drawings as finally approved. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown. Mark drawings accurately; record a cross reference at the corresponding location on the contract drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1.Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.
2. Mark new information that is important to the Owner, but was not shown on shop

drawings.
3. Note related change order numbers where applicable.
4. Organize record shop drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

E. Record Product Data: Maintain one copy of each product data submittal. Mark these documents to show significant variations in actual work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instruction and recommendations. Give particular attention to concealed products and portions of the work that cannot otherwise be readily discerned later by direct observation. Note related change orders and mark up of record drawings and specifications.

1. Upon completion of mark ups, submit complete set of record product data to the Architect for the Owner's records.

F. Record Documents and Shop Drawings: Contractor to supply one complete set of approved shop drawings. Legibly mark each item to record actual construction including:

1. Measured depths of foundations in relation to final (main) floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenance, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenance concealed in construction, referenced to visible and accessible features of the work.
4. Field changes of dimension and detail.
5. Details not on original contract drawings.

G. Record Sample Submitted: Immediately prior to the date or dates of substantial completion, the Contractor will meet at the site with the Architect and the Owner's representative personnel to determine which of the submitted samples that have been maintained during progress of the work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's sample storage area.

H. Miscellaneous Record Submittal: Refer to other specification sections for requirements of miscellaneous recordkeeping and submittal in connection with actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.

I. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Submit two sets prior to Substantial Completion or final inspection, as applicable. Bind properly indexed data in individual heavy-duty, three inch, three ring vinyl-covered binders, 8½ x 11 inch test page format, with pocket folders for folded sheet information.

1. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
2. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

3. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.
4. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, subcontractors, and major equipment suppliers where they can be reached for emergency service at all times, including nights, weekends, and holidays.

5.Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

a. Significant design criteria.

b. List of equipment.
c. Parts list for each component.
d. Operating instructions.
e. Maintenance instructions for equipment and systems.
f. Maintenance instructions for all other portion of the work.
g. Emergency instructions.
h. Spare parts list.
i. Wiring diagrams.
j. Recommended "turn around" cycles.
k. Inspection procedures.

6. Part 3: Project documents and certificates, including the following:

a. Shop drawings and product data.

b. Air and water balance reports.
c. Certificates.
d. Photo copies of warranties and bonds.

7.Submit one copy of completed volumes in final form for Architect review. This copy will be returned after review, with Architect comments. Revise content of documents as required prior to final submittal for the applicable submission requirement.

8. Submit final revised volumes within ten (10) days after Architect review and comment.

J. Contractor shall submit one electronic copy of all record contract drawings to the Owner.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 -- EXECUTION

3.01 STARTING SYSTEMS

A. Coordinate schedule of start up of various equipment and systems.

B. Notify Architect and Owner seven (7) days prior to start up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions that may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start up under supervision of responsible manufacturer's representative (Contractor's personnel) in accordance with manufacturer's instructions.

G. When specified in individual specification sections, require manufacturer to provide authorized

representative to be present at site to inspect, check and approve equipment or system installation prior to start up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed and is functioning correctly.

3.02 OPERATING AND MAINTENANCE INSTRUCTIONS

A. General: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance, if applicable. If Installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

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

1. Start up.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures including lock-out/tag out instructions.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

END OF SECTION

SECTION 01711

CLEANING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Description

B. Disposal Requirements

C. Materials

D. During Construction

E. Dust Control

F. Final Cleaning

1.02 DESCRIPTION

A. Contractor will be responsible to execute daily cleaning, during progress of the Work and at completion of the Work. The Contractor will daily, broom clean debris and remove refuse, rubbish, scrap material caused by his operation. The Contractor shall remove all excess spoils.

1.03 CLEANING AND DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with Scope of Work Section 01710 Construction Housekeeping, codes, ordinances, regulations, and anti-pollution laws.

1.04 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by the manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

1.05 DURING CONSTRUCTION

A. Contractor keep the premises free from accumulation of waste materials or rubbish caused by his operations or his subcontractor's operations and ensure that building and grounds are maintained free from accumulations of waste materials and rubbish. Do not allow waste materials, rubbish and debris to accumulate and become an unsightly or hazardous condition.

B. Transport waste materials in a controlled manner with minimal handling as possible; do not drop or throw materials from heights. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces. Sprinkle dusty debris with water.

C. Burning or burying of rubbish and waste materials on the project site is strictly prohibited. Disposal of volatile fluid wastes (such as mineral spirits, oil, or paint thinner) in storm or sanitary sewer systems is strictly prohibited. Remove waste materials, rubbish and debris from the site and legally dispose of at public or private dumping areas off the Owner's property.

1.06 DUST CONTROL

A. Clean interior spaces prior to the start of finish painting and/or other applicable work, and continue cleaning on as as-needed basis until such work is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

C. Broom clean interior building areas when ready to receive finish painting and/or other applicable work, and continue cleaning on as-need basis until building is ready for acceptance or occupancy.

1.07 FINAL CLEANING

A. At completion of construction and just prior to acceptance or occupancy, the Contractor will conduct a final inspection of exposed interior and exterior surfaces. Perform final cleaning and maintain cleaning until building or portion thereof, is accepted by Owner.

B. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from interior and exterior surfaces. Repair, patch and touch-up marred surfaces to match adjacent finishes. Broom clean paved surfaces; rake clean other surfaces of grounds.

C. Clean all glass and all other finish surfaces, replace all broken and scratched glass; remove stains, spots marks and dirt from decorated work; clean all hardware; remove paint spots and smears from all surfaces, clean all fixtures and wash or vacuum all floors; leaving work in a clean and spotless condition.

D. Mechanical subcontractor shall replace air conditioning filters if units that were operated during construction. Clean ducts, blowers and coils if air conditioning units were operated without filters during construction.

E. Remove all waste materials and rubbish from and about the Project as well as all tools, construction equipment, machinery and surplus materials.

F. Use experienced workmen or professional cleaners for final cleaning.

G. Comply with cleaning instructions contained in the Specifications. In absence of specific cleaning instructions, follow accepted cleaning practices or the recommendations of the manufacturer of the material to be cleaned.

END OF SECTION

SECTION 01732

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
(Architect to provide listing of items affected.)

B. Related Sections include the following:

1. Division 1 Section "Summary of Work" for use of the premises and phasing requirement.

2. Division 1 Section "Construction Facilities and Temporary Controls" for temporary construction and environmental-protection measures for selective demolition operations.

3. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
4. Applicable sections for demolishing, cutting, patching, or relocating mechanical and plumbing items.
5. Applicable sections for demolishing, cutting, patching, or relocation electrical items.

1.03 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

B. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1. Coordinate with Owner to establish special procedures for removal and salvage.

C. Specific items may be identified for salvage and turn-over to the Owner at the completion of the project. Any items so identified, are the property of the Owner but shall be protected and maintained by the Contractor for the duration of the construction project. Carefully remove and salvage each item or object in a manner to prevent damage, and protect such items in a secure location for prompt delivery to the Owner at the conclusion of the project.

1.05 SUBMITTALS

A. Proposed Dust-Control and Noise-Control Measures: Submit plan or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services.
3. Coordination for shutoff, capping and continuation of utility services.

C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

C. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.07 PROJECT CONDITIONS

A. Owner will occupy portions of the site/building in and around the demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Maintain access to existing occupied or used facilities.

1.Do not close or obstruct access way, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for condition of areas to be selectively demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials, other than possible lead bearing materials, will be encountered during the work.

1. Hazardous materials will be removed by Owner before start of the Work, except lead based paints and coatings.
2. If other non-lead containing materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Not-lead bearing hazardous materials will be removed by Owner under a separate contract.
3. The Contractor shall be fully and solely responsible for work involving lead bearing materials.

E. Storage or sale of removed items or materials on-site will not be permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire protection facilities in service during selective demolition operations.

PART 2 – PRODUCTS

A. Use repair materials identical to existing materials.

1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installed requirements specified

PART 3 -- EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

1.Provide at least 72 hours (3 working days) notice to Owner if shutdown of service is required during changeover.

C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2.If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition; provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of the building.
3.Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.03 PREPARATION

A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

3.04 POLLUTION CONTROLS

A. Dust Control: Use suitable methods to limit spread of dust and dirt. Comply with governing environmental protection regulations.

1.Do not use water when it may create hazardous or objectionable conditions, such as ice, flooding, and pollution.

B. Disposal: Remove and transport debris in a manner that will prevent damage to adjacent surfaces and areas.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.05 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically.
2.Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces.
3.Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire suppression devices during flame-cutting operations.
4.Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off site.
5. Dispose of demolished items and materials promptly.
6.Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with Owner's requirements for using and protecting walkways, driveways, entries, and other facilities during selective demolition operations.

C. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items: Comply with the following:

1.Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4.Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

F. Existing Items to be Abandoned in Place: Fill underground piping systems to be abandoned with sand or flowable fill as required to prevent future collapse.

G. Concrete: Demolish in small sections. Cut concrete to a depth of at least ¾ inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

3.06 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching: Comply with Division 1 Section "Cutting and Patching".

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.08 SELECTIVE DEMOLITION SCHEDULE

A. Existing Construction to be Removed:
(Architect to provide list of applicable items.)

B. Existing Items to be Removed and Salvaged:
(Architect to provide list of applicable items.)

C. Existing Items to Remain:
(Architect to provide list of applicable items.)

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Related Documents

B. Summary

C. Definitions

D. Warranty Requirements

E. Submittals

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to this section.

1.03 SUMMARY

A. This section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

1.Refer to the general conditions of the contract for construction of terms of Contractor's warranty of workmanship and materials.

2. General closeout requirements are included in Division-1, Section "Project Closeout".
3. Specific requirements for warranties for the work and products and installations that are specified to be warranted, are included in the individual sections of technical specification sections.
4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

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

1.04 DEFINITIONS

A. Standard product warranties are reprinted written warranties published by individual manufacturers for particular product and are specifically endorsed by the manufacturer to the Owner.

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

1.05 WARRANTY REQUIREMENTS

A. 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.

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

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

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

E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.06 SUBMITTAL

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's certificate of substantial completion designates a commencement date for warranties other than the date of Substantial Completion of the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen (15) days of completion of that designated portion of the Work.

2. In all other instances, warranty periods will not begin prior to Substantial Completion, regardless of equipment use prior to dates of Substantial Completion.

B. When a special warranty is required 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 Architect for approval prior to final execution.

1. Refer to individual sections of technical specifications for specific content requirements, and particular requirements of submittal of special warranties.

C. Form of Submittal: At final completion, compile each required warranty and bond properly executed by the Contractor, or the Contractor, subcontractor, supplier or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the project manual.

D. Bind warranties and bonds in heavy-duty, commercial quality, durable three-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½" x 11" paper.

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

2. Identify each binder on the front and the spine with the typed or printed title 'WARRANTIES AND BONDS", the project title or name, and the name of the Contractor.
3. When operating and maintenance manuals are required for warranted constitution, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

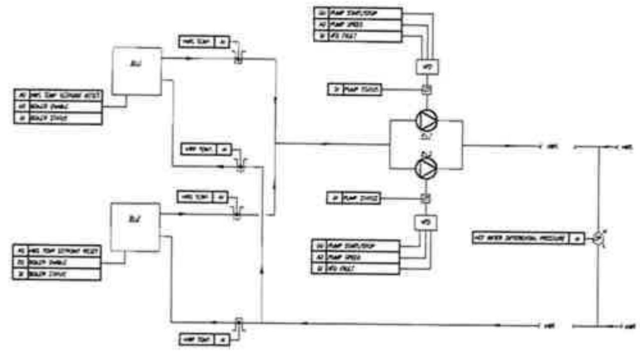
END OF SECTION

TURNER SIXTH GRADE ACADEMY - BOILER REPLACEMENT

6425 RIVERVIEW AVE, KANSAS CITY, KS 66102

TEMPERATURE CONTROL SYMBOLS

DO	DIGITAL OUTPUT	LS	LIMIT SWITCH
DI	DIGITAL INPUT	FS	FLOW SWITCH
AO	ANALOG OUTPUT	DP	DIFFERENTIAL PRESSURE SENSOR
AI	ANALOG INPUT	SP	STATIC PRESSURE SENSOR
LAT	LEAVING AIR TEMPERATURE	DATS	DISCHARGE AIR TEMPERATURE SENSOR
EAT	ENTERING AIR TEMPERATURE	MATS	MIXED AIR TEMPERATURE SENSOR
RA	RETURN AIR	CT	CURRENT TRANSDUCER
SA	SUPPLY AIR	STG	STAGE OF HEATING/COOLING
OA	OUTSIDE AIR	S/S	START / STOP
LWT	LEAVING WATER TEMPERATURE	DM	DAMPER MOTOR
EWT	ENTERING WATER TEMPERATURE	NC	NORMALLY CLOSED
CHW	CHILLED WATER	CO2	CARBON DIOXIDE
CWS	CHILLED WATER SUPPLY	VOC	VOLATILE ORGANIC COMPOUNDS
CWR	CHILLED WATER RETURN	DX	DIRECT EXPANSION
HW	HOT WATER	VFD	VARIABLE FREQUENCY DRIVE
HWS	HOT WATER SUPPLY	FAC	FIRE ALARM CONTROL PANEL
HWR	HOT WATER RETURN	CTLR	CONTROLLER
		AFMS	AIR FLOW MEASURING STATION



SEQUENCE OF OPERATION

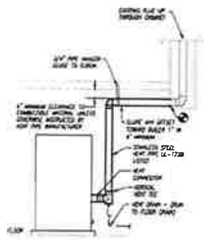
THE HOT WATER HEATING SYSTEM SHALL BE ENABLED WHEN THE OUTSIDE AIR TEMPERATURE IS BELOW 60 DEGREE F (ADJ.)

THE LEAD BOILER SHALL BE ENABLED UPON CONFIRMATION OF FLOW AT THE LEAD PUMP. IF FLOW IS NOT CONFIRMED IN 60 SECONDS THE STANDBY PUMP SHALL BE ENABLED AND AN ALARM GENERATED. IF FLOW IS NOT CONFIRMED FROM THE STANDBY PUMP THE HOT WATER SYSTEM SHALL BE DISABLED AND AN ALARM SHALL BE GENERATED.

THE HOT WATER SUPPLY TEMPERATURE SHALL BE PROPORTIONALLY RESET VIA BOILER OPERATION AND STAGING ACCORDING TO THE FOLLOWING SCHEDULE:

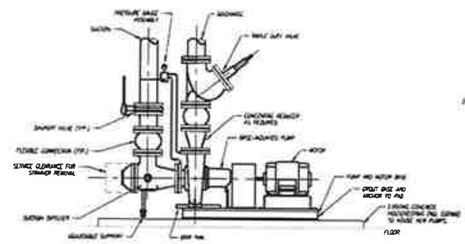
OA TEMP DEG. F	HWS TEMP DEG. F
-10	160
60	130

PROVIDE AUTOMATIC, ALTERNATING LEAD-LAG CONTROL OF HOT WATER PUMPS AND BOILERS.



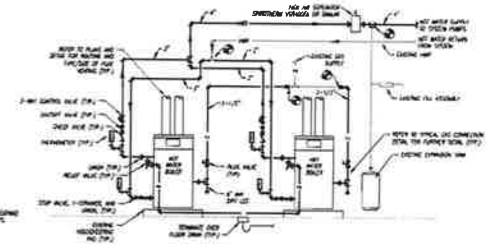
BOILER VENTING DETAIL

NOT TO SCALE



BASE-MOUNTED PUMP DETAIL

NOT TO SCALE

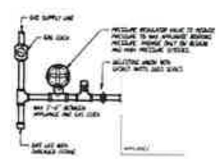


DUAL HOT WATER BOILER SYSTEM DETAIL

NOT TO SCALE

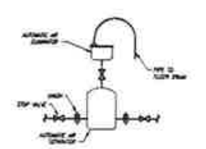
PIPE HANGER DETAIL

NOT TO SCALE



TYPICAL GAS CONNECTION

NOT TO SCALE



AIR SEPARATOR/ELIMINATOR DETAIL

NOT TO SCALE

BID ALTERNATE #1: PUMP REPLACEMENT

ALL WORK INCLUDING BUT NOT LIMITED TO REPLACING EXISTING P-1 AND P-2 AND ASSOCIATED PIPING, ACCESSORIES, AND CONTROLS AS SHOWN ON PLANS.

pkmr

SHEET TITLE: CONTROLS AND DETAILS

DATE: 01/23/2025

24.487

SHEET NUMBER: ME0.3

DIVISION 26
TABLE OF CONTENTS

SECTION 260010 – ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. All contract documents including drawings, alternates, addenda and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specification Sections, apply to work of this section. All preceding and following sections of this specification division are applicable to the Electrical Contractor, all sub-contractors, and all material suppliers.

1.2. SCOPE OF WORK

A. This DIVISION requires the furnishing and installing of complete functioning Electrical systems, and each element thereof, as specified or indicated on Drawings or reasonably inferred, including every article, device or accessory reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include materials, labor, supervision, supplies, equipment, transportation, and utilities.

B. In case of an inconsistency between the Drawings and Specifications or within either document, the better quality or the greater quantity of work shall be provided in accordance with the Architect or Engineer's interpretation.

C. Refer to Architectural, Structural and Mechanical Drawings and all other contract documents and to relevant equipment drawings and shop drawings to determine the extent of clear spaces and make all offsets required to clear equipment, beams and other structural members to facilitate concealing conduit in the manner anticipated in the design.

1.3. SPECIFICATION FORM AND DEFINITIONS

A. The Engineer indicated in these specifications is Pearson Kent McKinley Raaf Engineers LLC. 13300 W 98th Street, Lenexa, KS 66215, PHONE 913-492-2400, EMAIL admin@pkmreng.com.

B. Contractor, wherever used in these specifications, shall mean the Company that enters into contract with the Owner to perform this section of work.

C. When a word, such as "proper", "satisfactory", "equivalent", and "as directed", is used, it requires the Architect-Engineer's review.

D. "PROVIDE" means to supply, purchase, transport, place, erect, connect, test, and turn over to Owner, complete and ready for regular operation, the particular Work referred to.

E. "INSTALL" means to join, unite, fasten, link, attach, set up, or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular Work referred to.

F. "FURNISH" means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application for the particular Work referred to.

G. "WIRING" means the inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such Work.

H. "CONDUIT" means the inclusion of all fittings, hangers, supports, sleeves, etc.

I. "AS DIRECTED" means as directed by the Architect/Engineer, or his representative.

J. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed above hung ceilings.

1.4. QUALIFICATIONS

A. The contractors responsible for work under this section shall have completed a job of similar scope and magnitude within the last 3 years. The contractors shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Unlicensed workers and general laborers shall be adequately supervised to insure competent and quality work and workmanship required by this contract and all other regulations, codes and practices. At all times the contractors shall comply with all applicable local, state and federal guidelines, practices and regulations. Contractor may be required to submit a statement of qualifications upon request before any final approval and selection. Failure to be able to comply with these requirements is suitable reason for rejection of a bid.

1.5. LOCAL CONDITIONS

A. The contractor shall visit the site and determine the existing local conditions affecting the work required. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

1.6. CONTRACT CHANGES

A. Changes or deviations from the contract documents; including those for extra or additional work must be submitted in writing for review of Architect-Engineer. No verbal change orders will be recognized.

1.7. LOCATIONS AND INTERFERENCES

A. Locations of equipment, conduit and other electrical work are indicated diagrammatically by electrical drawings. Layout work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturers shop drawings.

1. Contractor shall be responsible for confirming adequate working space (depth, width, and height) is maintained about all equipment as required per applicable sections of the NEC, including all entrance and egress requirements.
2. Coordinate with other trades to verify adequate Dedicated Equipment Space is maintained about all equipment as required per NEC.

B. Study and become familiar with contract drawings of other trades and in particular general construction drawings and details in order to obtain necessary information for figuring installation. Cooperate with other workmen and install work in such a way to avoid interference with their Work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Architect-Engineer.

C. Any conduit, apparatus, appliance or other electrical item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed, relocated and reconnected without extra cost. Damage to other Work caused by this contractor, subcontractor, workers or any cause whatsoever, shall be restored as specified for new work.

D. Do not scale electrical drawings for dimensions. Accurately layout work from dimensions indicated on Architectural drawings unless they are found to be in error.

1.8. PERFORMANCE

A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

B. The Contractor warrants to the Owner and Architect-Engineer the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.

1.9. WARRANTY

A. The Contractor warrants to the Owner and Architect-Engineer that upon notice from them within a one year warranty period following date of acceptance, that all defects that have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense.

B. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

1.10. ALTERNATES

A. Refer to General Requirements for descriptions of any alternates that may be included.

1.11. MATERIALS, EQUIPMENT AND SUBSTITUTIONS

A. The intent of these specifications is to allow ample opportunity for the Contractor to use their ingenuity and abilities to perform the work to their and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.

B. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.

C. In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product is used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.

D. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.

E. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for

comparison.

F. If the Contractor wishes to incorporate products other than those named in the Base Bid Specifications they shall submit a request for approval of equivalency in writing no later than (10) ten calendar days prior to bid date. Substitutions after this may be refused at Engineers option. Equivalents will ONLY be considered approved when listed by addendum.

1. In proposing a substitution prior to or subsequent to receipt of bids, include in such bid the cost of altering other elements of this project, including adjustments in mechanical or electrical service requirements necessary to accommodate such substitution.

G. Within 10 working days after bids are received, the apparent low bidder shall submit to the Architect-Engineer for approval, three copies of a list of all major items of equipment they intend to provide. Within 30 working days after award of Contract, Contractor shall submit shop drawings for equipment and materials to be incorporated in work, for Architect-Engineer review. Where 30-day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, Contractor shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

1.12. ELECTRONIC PLAN FILES

A. Electronic files of the contract documents may be available from the Engineer to successful bidders and manufacturers for a fee of $50 per sheet, $100 minimum and $25 email/shipping charge. A release of liability form will be required along with payment prior to release of files.

1.13. OPENINGS, ACCESS PANELS AND SLEEVES

A. This Contractor shall include the installation of all boxes, access panels and sleeves for openings required to install this work, except structural openings incorporated in the structural drawings. Sleeves shall be installed for all conduits passing through structural slabs and walls. Contractor shall set and verify the location of sleeves that pass through beams, as shown on structural plans. All floor and wall penetrations shall be sealed to meet fire-rating requirements.

B. All penetrations through interior or exterior and rated or non-rated walls and floors shall be appropriately sealed prevent entry and movement of rodents and insects. Contractor shall coordinate their work with all other trades.

1.14. ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS

A. Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.

1.15. EXTENT OF CONTRACT WORK

A. Provide electrical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of electrical systems. In no case will claims for "Extra Work" be allowed for work about which Electrical Contractor could have been informed before bids were taken.

B. Where specific information for devices, lights or equipment shown on the plans is missing, provide an allowance in the contract amount for furnishing a product reasonably implied by the level of other devices, lights and equipment provided in the contract documents.

C. Electrical Contractor shall be familiar with equipment provided by other Contractors that require electrical connections and control. Follow circuiting shown on drawings for lighting, power and equipment connections.

D. Make required electrical connections to equipment provided under Architectural and Mechanical divisions of this project. Receive and install electric control devices requiring field installation, wiring, and service connection. Equipment supplied by the automatic temperature control contractor shall be installed by the mechanical or automatic temperature control subcontractor. Make required internal field wiring modifications indicated on wiring diagrams of factory installed control systems for control sequence specified. These field modifications shall be limited to jumper connections and connection of internal wiring to alternate terminal block lugs. The cost for field modifications requiring rewiring of factory installed control systems for equipment provided by General or Mechanical Contractors shall be included in base bid of the respective contractor. All temperature control wiring shall be by a licensed electrician under the supervision of temperature control contractor.

E. Check electrical data and wiring diagrams received from Mechanical Contractor of compliance with project voltages, wiring, controls and protective devices shown on electrical drawings. Promptly bring discrepancies found to attention of Architect-Engineer for a decision.

F. Provide safety disconnect switches, contactors, and manual and magnetic motor starters for mechanical and electrical equipment requiring such devices. Omit these devices where included as part of factory installed prewired control systems provided with mechanical equipment. With exception of factory installed devices, provide safety disconnect switches, contacts and motor starters by one manufacturer to allow maximum

interchangeability of repair parts and accessories for these devices.

G. To maximum extent possible electrical controls in boiler rooms, equipment rooms, and control rooms shall be grouped in accessible locations and arranged according to function. Where possible use group control panels and combination starters in lieu of individually enclosed devices.

1.16. CODES, ORDINANCES, RULES AND REGULATIONS

A. Provide work in accordance with applicable rules, codes, ordinances and regulations of Local, State, Federal Governments, and other authorities having lawful jurisdiction.

B. Conform to latest editions and supplements of following codes, standards or recommended practices.

C. BUILDING CODES:

1. International Building Codes (Latest adopted version of applicable codes)

D. SAFETY CODES:

1. National Electrical Safety Code Handbook H30 - National Bureau of Standards
2. Occupational Safety and Health Standard (OSHA) Department of Labor
3. Safety Code for Elevators ANSI A17.1

E. NATIONAL FIRE CODES AND STANDARDS:

1. NFPA No. 30 Flammable and Combustible Liquids Code
2. NFPA No. 37 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
3. NFPA No. 70 National Electrical Code
4. NFPA No. 72 National Fire Alarm and Signaling Code
5. NFPA No. 90A Air Conditioning & Ventilation Systems
6. NFPA No. 99 Standard for Health Care Facilities
7. NFPA No. 101 Life Safety Code
8. NFPA No. 110 Standard for Emergency and Standby Power Systems
9. NFPA No. 780 Standard for the Installation of Lightning Protection Systems

F. UNDERWRITERS LABORATORIES INC.:

1. All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

G. MISCELLANEOUS CODES:

1. ANSI A117.1 - Handicapped Accessibility
2. Americans with Disabilities Act (ADA)
3. FGI Guidelines for Design and Construction of Health Care Facilities, 2014 Edition

H. ENERGY EFFICIENCY REQUIREMENTS:

1. All electrical systems and components shall be manufactured and installed in compliance with ASHRAE 90.1 – 2007 and latest adopted version of IECC.

1.17. STANDARDS

A. Drawings and specifications indicate minimum construction standard, should any work indicated be sub-standard to any ordinances, laws, codes, rules or regulations bearing on work, Contractor shall promptly notify Architect/Engineer in writing before proceeding with work so that necessary changes can be made. However, if Electrical Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

1.18. PERMITS/FEES

A. Electrical Contractor shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules or regulations. Keep a written record of all permits and inspection certificates and submit two copies to Architect/Engineer with request for final review.

B. Contractor shall include in bid any charges by local utility providers to establish new services to the structure. Coordinate with the utility suppliers to verify exact which part of the work is to be performed by whom.

PART 2 - PRODUCTS

A. Not Used

PART 3 - EXECUTION

3.1. SUBMITTALS

A. Contractor shall furnish submittals of all materials and equipment required by the specifications. Refer to each specification section for the submittals (if any) required for that section.

B. Submittal format shall be as indicated below. Submittals not meeting these requirements will be returned without action for re-submittal.

1. Submittals shall be furnished in an Adobe PDF format.
2. Submittals shall be per individual submittal section, as listed in the table of contents. All required submittals within that section shall be grouped together in a single submittal.
    a. Furnishing submittals by division or by individual item may result in delayed reviewing of the submittal(s) due to additional administrative time required to process the large size and/or quantity of files.
3. Submittals shall have a cover page containing the following information: The project name, the applicable specification section and paragraph, the submittal date, and the Contractor's stamp (see below for requirements).
4. Mark each submitted item as applicable with scheduled mark, name, etc. corresponding to the plans.
5. Where generic catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fitting sizes, etc. that are to be provided. Each catalog sheet shall bear the equipment manufacturer's name and address.
6. Where equipment submitted does not appear in base specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization.
7. All submittals on materials and equipment listed by UL shall indicate UL approval on submittal.

C. Contractor review:

1. Contractor shall check all submittals to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Architect-Engineer for their review. All submittals submitted to Architect-Engineer shall bear contractor's approval stamp that shall indicate that Contractor has reviewed submittals and that they meet specification and/or drawing requirements. Contractor's submittal review shall specifically check for but not be limited to the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return and drainage connections to building systems. All submittals not meeting Contractor's approval shall be returned to their supplier for re-submittal.
2. No submittals will be considered for review by the Architect-Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of the Contractor's review.
3. Before submitting shop drawings and material lists, verify that all equipment submitted is mutually compatible and suitable for the intended use. Verify that all equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

D. Review Schedule:

1. The shop drawing / submittal dates shall be at least as early as required to support the project schedule and shall also allow for two weeks Architect-Engineer review time plus a duplication of this time for re-submittal if required.
2. Submittal of all shop drawings as soon as possible after permitting approval but before construction starts is preferred.
3. Approval of shop drawings submitted prior to receipt of a permit for that respective scope of work should be considered conditional pending review/approval of the construction documents by the AHJ. Changes required to the submittal as a result of permitting comments received after architect's/engineer's review shall not be a justification for a change in price.
4. Any time delay caused by correcting and re-submitting submittals/shop drawings will be the Contractor's responsibility.

E. The Architect's-Engineer's checking and subsequent review of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect's-Engineer's attention to such deviations at the time of submission, and secured their written approval; nor shall it relieve the contractor from responsibility for errors in dimensions, details, size of members, or omissions of components for fittings; or for coordinating items with actual building conditions and adjacent work.

F. Any corrections or modifications made by the Architect-Engineer shall be deemed acceptable to the Contractor

at no change in price unless written notice is received by the Architect-Engineer prior to the performance of any work incorporating such corrections or modifications.

G. Submittals that require re-submission shall have the items that were revised "flagged" or in some other manner marked to call attention to what has been changed.

H. Coordination

1. After shop drawings have been reviewed and approved by all parties, transmit a set of submittals to each other trade (eg Plumbing, Mechanical, Electrical, Controls, etc) that will interface with installation. Each other contractor shall review the submittal for coordination and return a stamped submittal indicating they have reviewed the submittal for coordination purposes.

3.2. SHOP DRAWINGS

A. Shop drawings shall meet all of the above requirements for submittals.

B. Contractor shall submit Adobe PDF sets of all fabrication drawings. Cost of drawing preparation, printing and distribution shall be paid for by the contractor and included in his base bid.

C. No work shall be fabricated until Architect-Engineer's review has been obtained.

D. Electrical equipment location and conduit coordination shop drawings for conduit fabrication and electrical equipment clearances shall be a minimum of 1/4" scale. Shop drawings shall not be a reproduction of the contract document and shall show details of the following: Fabrication, assembly, and installation, including plans, elevations above finished floor, sections, components, and attachments to other work.

3.3. OPERATING AND MAINTENANCE INSTRUCTIONS (O & M MANUALS)

A. Submit with shop drawings of equipment, three sets of operating and maintenance instructions and parts lists for all items of equipment provided. Instructions shall be prepared by equipment manufacturer.

B. Keep in safe place, keys and wrenches furnished with equipment under this contract. Present to Owner and obtain receipt for same upon completion of project.

C. Prepare a complete brochure, covering systems and equipment provided and installed under his contract. Submit brochures to Architect/Engineer for review before delivery to Owner. Contractor at his option may prepare this brochure or retain an individual to prepare it for him. Include cost of this service in bid. Brochures shall contain following:

1. Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined under Section this specification.
2. Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
3. Record copy of all submittals indicating actual equipment installed indicating options, characteristics. Copies of submittals shall bear the stamps of all parties that reviewed submittals.
4. Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of system.
5. Record Set Drawings: The Contractor shall mark up a set of contract documents during construction noting all changes and deviations including change orders. These will be delivered to Architect at end of the project. After the originals are changed to reflect the blue line set, a copy shall be included in the brochure.
6. Provide brochure bound in black vinyl three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:

a. Project name and address.
b. Section of work covered by brochure, i.e., Electrical.

3.4. RECORD DOCUMENTS

A. During construction, keep an accurate record of all deviations between the work as shown on Drawings and that which is actually installed. Keep this record set of prints at the job site for review by the Architect/Engineer.

B. Upon completion of the installation and acceptance by the owner, transfer all record drawing information to one neat and legible set of prints. Then deliver them to the Architect/Engineer for transmittal to the Owner.

C. Provide one copy of on high quality heavy weight presentation type paper. Blueprints or other media which fade shall not be used.

D. Provide one electronic scanned version of record documents in Adobe PDF format – PDFs may be submitted on electronic media (DVD, USB) or via an FTP or other file sharing site. Provide electronic copies in conjunction with hard copy documents.

3.5. PREMIUM TIME WORK

A. The following Work shall be performed at night or weekend other than holiday weekends as directed and coordinated with the Owner.

1. All tie-in, cut-over and modifications to the existing electrical system and other existing system requiring tie-ins or modifications shall be arranged and scheduled with the Owner to be done at a time as to maintain continuity of the service and not interfere with normal building operations.

3.6. CLEANING UP

A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc., resulting from the installation of his work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean.
B. Contractor shall clean up all fixtures and equipment at the completion of the project.
C. All switchboards, panelboards, wireways, trench ducts, cabinets and enclosures shall be thoroughly vacuumed clean prior to energizing equipment and at the completion of the project. Equipment shall be opened for observation by the Architect/Engineer as required.

3.7. WATERPROOFING

A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect/Engineer and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
B. If Contractor penetrates any walls or surfaces after they have been waterproofed, he shall restore the waterproof integrity of that surface as directed by the Architect/Engineer at his own expense

3.8. CUTTING AND PATCHING

A. Contractor shall do cutting and patching of building materials required for installation of work herein specified. Remove walls, ceilings and floors (or portions thereof) necessary to accomplish scope of work. Do not cut or drill through structural members including wall, floors, roofs, and supporting structure, without the Architect's and Structural Engineer's approval and in a manner approved by them.
B. Make openings in concrete with concrete hole saw or concrete drill. Use of star drill or air hammer for this work will not be permitted.
C. Patching shall be by the contractors of the particular trade involved, shall match the existing construction type, quality, finish and texture, and shall meet approval of Architect-Engineer. Damage to building finishes, caused by installation of electrical work shall be repaired at Contractor's expense to approval of Architect-Engineer.

3.9. SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

A. Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown or specified. Level, shim, and grout equipment bases as recommended by manufacturer. Mount motors, align and adjust drive shafts and belts according to manufacturer's instruction. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.
B. Floor or pad mounted equipment shall not be held in place solely by its own dead weight. Include anchor fastening in all cases.
A. Provide indoor floor or slab mounted equipment with 3-1/2" high concrete bases unless specified otherwise. Electrical contractor shall form all pads; General contractor shall provide and place all concrete and reinforcing for said pads. Individual concrete pad shall be no less than 4" wider and 4" longer than equipment, and shall extend no less than 2" from each side of equipment. Provide welded wire mesh in pad and tie pad to underlying concrete substrate.
B. Provide outdoor slab mounted equipment with 6" thick concrete pad. Provide on an 8" based of crushed gravel or to match other concrete construction on the site. Provide ½" rebar on 12" centers each way. Elevate top of pad at least 2" above surrounding grade. Pad shall be a minimum of 18" wider and longer for generators and similar large equipment requiring service and maintenance. Smaller equipment shall be sized a minimum of 4" longer and wider unless specified or detailed otherwise. Electrical contractor shall form all pads; General contractor shall provide and place all concrete and reinforcing for said pads.
C. Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform or carrier in accordance with best recognized practice. Electrical contractor shall arrange for attachment to building structure, unless otherwise indicated on drawings or as specified. Provide hangers with vibration eliminators where required. Contractor shall verify that structural members of building are adequate to support equipment. Submit details of hangers, platforms and supports together with total weights of mounted equipment to Architect/Engineer for review before proceeding with fabrication or installation.
D. Provide 3-1/2" high concrete housekeeping pad as specified above where two or more conduits penetrate floor below panelboards.

3.10. START-UP, CHANGEOVER, TRAINING AND OPERATION CHECK

A. Electrical Contractor shall be responsible for training Owner's operating personnel to operate and maintain

systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructor's name, names of Owner's personnel attending and total hours of instruction given each individual.

B. All owner-training sessions shall be orderly and well organized and shall be video recorded digitally. At the end of the owner training, the "training" session recording shall be transmitted to the owner via DVD and shall become property of the owner.

3.11. FINAL CONSTRUCTION REVIEW

A. At final construction review, Electrical Contractor and the major sub-contractors shall be present or shall be represented by a person of authority. Each Contractor shall demonstrate, as directed by Architect/Engineer, that the work complies with purpose and intent of plans and specifications. Respective Contractor shall provide labor, services, instruments or tools necessary for such demonstrations and tests.

END OF SECTION 260010

SECTION 260011 – BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1. NEUTRAL AND GROUND WIRES

A. Where individual circuit homeruns (hots, neutral, and ground as part of a single circuit) are indicated on the plans serving lighting and branch circuit receptacle loads, these shall be individual circuits with individual neutrals (no sharing of neutrals and/or grounds).
B. Where shared circuit homeruns (hots, neutral, and ground as part of separate circuits) are indicated on the plans, these shall be allowed to share one (common) ground for three (3) circuits from different phases occurring in one (1) conduit run. When additional circuits occur in conduit run, additional ground wires shall be installed. Conduit shall be upsized and conductors shall be de-rated based on NEC current carrying conductor tables, counting all hots and neutrals as current carrying conductors.

    1. No sharing of neutral conductors is allowed in multi-wire branch circuit homeruns, unless the installation meets the requirements of 2014 NEC 210.4(B), and is specifically approved by the engineer of record.

3.2. TESTS RECORDING, REPORTING TESTS AND DATA

A. Record nameplate horsepower, amperes, volts, phase service factor and other necessary data on motors and other electrical equipment furnished and/or connected under this contract.
B. Record motor starter catalog number, size and rating and/or catalog number of thermal-overload units installed in all motor starters furnished and/or connected under this contract. See motor starter specification for instructions for proper sizing of thermal-overload units.
C. Record amperes-per-phase at normal or near-normal loading of each item of equipment furnished and/or connected.
D. Record correct readings of each feeder conductor after energized and normally loaded, and again after balancing of feeder loads as required by current readings.
E. Record voltage and ampere-per-phase readings taken at service entrance equipment after completion of project with building operating at normal electrical load.
F. Short-Circuit Calculations

    1. Contractor shall contact utility company after utility company design is complete and determine exact available fault current in amperes at the point of utility connection (Service Point).
    2. Contractor shall utilize the above available fault current to calculate the available fault current in amperes (RMS-SYM) at the service equipment.
    3. The available fault current shall be labeled on the service equipment – refer to Section 260553.

G. Submit at least two (2) typewritten copies of data noted above to Architect-Engineer for review prior to final inspection.
H. Keep a record of all deviations made from routes, locations, circuiting, etc. shown on contract drawings. Prior to final inspection submit one new set of project drawings with all deviations and changes clearly indicated.

3.3. CLEANING AND PAINTING OF MATERIALS AND EQUIPMENT

A. Before energizing switchboards, transformers, panelboards, starters, variable frequency drive and other similar electrical equipment, Contractor shall thoroughly vacuum out all dirt, dust and debris from inside of equipment and shall thoroughly clean outside and inside of equipment.
B. Touch-up painting and refinishing of factory applied finishes shall be by Electrical Contractor. Contractor shall be responsible for obtaining proper type of painting materials and color from equipment manufacturer.
C. Unless specified otherwise factory built equipment shall be factory painted. Paint shall be applied over surfaces only after they have been properly cleaned and coated with a corrosion resistant primer.
D. After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.
E. Where extensive refinishing is required equipment shall be completely repainted.

3.4. EXCAVATION AND BACKFILL

A. Perform necessary excavation to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. for this operation, and remove at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with OSHA Safety Standards.
B. Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.
C. Conduct excavations so no walls or footings are disturbed or injured.
D. Backfill excavations made under or adjacent to footing with selected earth or sand and tamp to compaction required by A/E.
E. Mechanically tamp backfill under concrete and pavings in 6" layers to 95% standard density, Reference Division 2.
F. Backfill trenches and excavations to required heights with allowance made for settlement.
G. Tamp fill material thoroughly and moistened as required for specified compaction density.
H. Dispose of excess earth, rubble and debris as directed by Architect.
I. When available, refer to test hole information on architectural drawings or specifications for types of soil to be encountered in excavations.

3.5. FIRE BARRIERS

A. Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around piping with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.
B. Equivalent by Dow, Chemelex, 3M.
C. All holes or voids created by the electrical contractor to extend conduit or wiring through fire rated floors and walls shall be sealed with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures of 250 degrees F. It shall have ICBO, BOCAI and SBCCI (NRB 243) approved ratings to 3 hours per ASTM E-814 (UL 1479). Acceptable Material: 3M Fire Barrier Caulk, Putty, Strip and sheet forms.

3.6. TEMPORARY COVERINGS

A. Provide temporary covering over all electrical panels, distribution panelboards, outlet boxes and other equipment as required to keep same free from damage due to moisture, plaster, paint, concrete or other foreign materials. Any equipment with finish damaged by moisture, paint, plaster or other foreign materials shall be cleaned and refinished as directed by the Architect without additional cost to the Owner.
B. All temporary openings in conduits shall be covered with metal or plastic caps.

3.7. PROTECTIVE COVERS

A. Provide protective wire guards over all wall mounted and ceiling mounted devices subject to damage in areas such as gymnasiums, shops and similar occupancies.
B. Provide lockable covers over thermostats and similar wall mounted devices where items are located in public spaces but should not be operable by the general public.

3.8. SLEEVES

A. Provide proper type and size sleeves to General Contractor for electrical ducts, busses, conduits, etc. passing through building construction. Supervise installation to insure proper sleeve location. Unless indicated or approved install no sleeves in structural members.
B. Provide cast iron sleeves extending 1 inch above finished floor where sleeves pass through floors subject to flooding such as toilet rooms, bathrooms, equipment rooms and kitchen. Seal opening between pipe and sleeve with Thunderline Corp. Link Seal.
C. Unless specified otherwise provide 18 gauge galvanized sheet metal sleeves through floors and non-bearing walls. Where piping passes through exterior walls, equipment room walls, air plenum walls and walls between areas that must be isolated from occupied areas, seal space between sleeves and piping, air or water tight are required with Thunderline Corp. Link Seal.
D. Provide O-Z Electrical Manufacturing Co., Inc. Type "FSK" or "WSK" or equivalent thruwall and floor seals where conduits pass through concrete foundation walls below grade.
E. Provide Zurn Z-195 or equivalent flashing sleeve through walls and floors with waterproof membrane. Seal annular space between conduit and sleeve with Thunderline Link Seal or O-Z type CSM sealing bushing.

3.9. CABLE TRAY

A. Provide where indicated on plans aluminum cable tray as specified herein.
B. Equivalents by B-Line, Square D, P-W Industries, Inc., Mono-Systems, Thomas and Betts or approved equal.
C. Cable tray shall be aluminum ladder type tray consisting of (2) longitudinal side rails connected by individual cross members. All rung and side rail edges shall be smooth. Cable tray rung spacing shall be 9", tray width

shall be 12". Tray loading depth shall be 4 inches. Load capacity of tray shall be a minimum of 66 lbs/ft with a maximum deflection of 1.10 inches at a maximum support span of 12'-0". Tray shall be minimum NEMA Class 12C.

D. Provide required fittings and supports for installation layout as indicated on drawings. Radius of fittings shall be 12 inches. Provide required splice plates, hangers, hold down clips, connectors, endplates and miscellaneous hardware for complete installation.

E. Fire Stopping:

1. Provide reusable heat expanding pillow/bags. Fire stop material must be FM approved and UL classified. Fire seal method must have UL fire rating equal to wall or floor penetrations. The penetration seal must allow future changes such as removal or addition of cables with no damage to the integrity of the seal. The fire stop system shall be UL tested and approved for use with galvanized steel and aluminum cable tray.
2. The seal method must provide immediate seal with no cure time. The penetration seal must be unaffected by atmospheric conditions, water exposure or constant high humidity.
3. The fire seal must be installed in strict accordance with the manufacturer's published instructions. The material must be free of asbestos and shall not emit any toxic fumes. The containment bag shall be constructed of heavy woven fiberglass. The penetration fire stop system shall be KBS seal bags or approved equal.
4. Alternatively, or as shown on the plans, cable tray shall be stopped short of the fire barrier, and one or more pre-assembled fire-rated pathways shall be used. Pathways shall meet all above requirements for cable tray fire stops.

3.10. OPERATING ROOMS

A. Furnish and install isolated power distribution system in the operation rooms, as indicated on drawings. System shall consist of panelboard, auxiliary equipment and all conduit, wire and miscellaneous installation materials necessary for a complete and operational system. All components and installation shall conform to applicable National Fire Protection bulletins and articles of the National Electrical Code.

1. Refer to Section 260519 for wiring – all conductors in operating rooms shall be Type XHHW.
2. Refer to Section 262417 for Isolated Power Panelboard Requirements.
3. Wall devices shall be "Power Modules" in lieu of standard receptacles. Reference Section 262417 for same.

END OF SECTION 260011

SECTION 260013 – PROJECT COORDINATION

PART 1 GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.
4. Requests for Interpretation (RFIs).
5. Wiring of equipment furnished by others

B. Each related sub-contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.3. COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Delivery and processing of submittals.
2. Progress meetings.
3. Preinstallation conferences.
4. Project closeout activities.
5. Startup and adjustment of systems.

1.4. SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate required installation sequences.
c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 40 inches. Format shall be PDF or other electronic format to facilitate multiple user commenting and sharing easily.
3. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including project managers, superintendent and other personnel in attendance at Project site to the General Contractor and other major subcontractors. Identify individuals and their duties and responsibilities; list email addresses and telephone numbers. Update the list as required during the project if personnel change.

1.5. COORDINATION

A. Certain materials will be provided by other trades. Examine the Contract Documents and reviewed record Submittals to ascertain these general requirements. Contract Documents reflect a basis of design and may not reflect actual equipment or items being utilized.
B. Carefully check space requirements with other trades and the physical confines of the area to insure that all material can be installed in the spaces allotted thereto including finished suspended ceilings and the spaces within the existing building. Make modifications thereto as required and approved.
C. Transmit to other trades all information required for work to be provided under their respective Sections in ample time for installation.
D. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.
E. Obtain equipment submittal information for all pieces of equipment to be connected to from other trades that clearly indicates all connection requirements, locations, sizes, and similar requirements. Obtain this information in ample time to coordinate other trade submittals and equipment coordination. Where requirements differ from that on plans or differs from provisions made in the work, immediately notify the Architect/Engineer. Do not proceed with work that is incompatible with equipment provided.
F. Coordinate, project and schedule work with other trades in accordance with the construction sequence.
G. Coordinate with the local Utility Companies to their requirements for service connections and provide all necessary materials, labor and testing.
H. Coordinate with contractors for work under other Divisions of this specification for all work necessary to accomplish this contractor's work.
I. Conduct a coordination meeting after reviewing all other trade coordination drawings with other relevant trades. This meeting shall be held to prevent conflicts during construction. Each major relevant subcontractor shall attend this meeting. Report any potential conflicts or clearance problems to Architect/Engineer after meeting.
J. Adjust location of piping, ductwork, conduit, wiring, etc. to prevent interferences, both anticipated and encountered. Determine the exact route and location of each item prior to fabrication.

1. Right-of-Way:

a. Lines that pitch have the right-of-way over those that do not pitch. For example: steam, condensate, and plumbing drains normally have right-of way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.
b. Make offsets, transitions and changes in direction in raceways as required to maintain proper headroom in pitch of sloping lines whether or not indicated on the Drawings.

1.6. DRAWINGS AND FILES.

A. The Drawings show only the general run of MEP systems, equipment, fixtures, piping and ductwork and other components as well as approximate location of items such as outlets, switches, diffusers, lights, and equipment connections, etc. Coordinate all exact locations of items with other trades, architectural elevations, equipment requirements, owner requirements, ceilings, access, serviceability, etc. All such modifications and coordination shall be made without additional cost to the Owner. Any significant changes in location of items necessary in order to meet field conditions shall be brought to the immediate attention of the Architect/Engineer and receive his approval before such alterations are made
B. Wherever the work is of sufficient complexity, additional Detail Drawings to scale similar to that of the bidding Drawings, prepared on tracing medium of the same size as Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field. Attend meetings with other trades to review all documents.
C. When directed by the General Contractor for areas of necessary coordination provide 3D building modelling coordination files and documents with other trades. Transmit information electronically and attend meetings as directed by the G/C as well as take part in coordination activities and documentation. Contractor shall be required to generate their own electronic files for this process.

1.7. PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. The Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Possible conflicts.
i. Compatibility problems.
j. Time schedules.
k. Manufacturer's written recommendations.
l. Warranty requirements.
m. Compatibility of materials.
n. Space and access limitations.
o. Regulations of authorities having jurisdiction.
p. Testing and inspecting requirements.
q. Installation procedures.
r. Coordination with other work.
s. Required performance results.
t. Protection of adjacent work.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

C. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contractor is on time, ahead or behind schedule, in relation to Construction Schedule. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time. Discuss impact of various contractor schedules upon other contractors and how to remedy impacts.
b. Review present and future needs of each contractor present, including the following:

i. Interface requirements.
ii. Sequence of operations.
iii. Status of submittals.
iv. Deliveries.
v. Off-site fabrication.
vi. Access.
vii. Quality and work standards.
viii. Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.8. REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI.

1. Submit Contractor's suggested solution(s) to RFI. If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
2. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

3.1. EQUIPMENT FURNISHED BY OTHERS

A. Description:

1. Items furnished by other trades (mechanical or plumbing contractor, etc.) such as mechanical/plumbing equipment, line voltage actuators, VFDs (not by electrical contractor), etc.
2. Kitchen equipment (may be furnished by owner, owner's vendor, or separate sub-contractor)
3. Equipment furnished by general contractor
4. Equipment furnished by owner

B. General

1. Fully review manufacturer's installation instructions for equipment. Installation of all related electrical items noted below shall be per same.

a. Electrical contractor shall obtain same from others if not readily available.

C. Disconnecting Means

1. An approved disconnecting means shall be provided at all equipment and shall serve to disconnect power from same.
2. Disconnecting means may be a switch, circuit breaker, or a cord-and-plug type connection.
3. Disconnecting means shall be within sight of equipment, as defined by NEC.
4. Disconnect switches may be non-fused, unless specifically shown fused on the plans or otherwise required by code to be fused.

a. All disconnect switches serving elevator equipment shall be provided with an overcurrent protective device.

D. Wiring of Equipment

1. Wire sizes used shall be as directed on plans or installation instructions, whichever is greater. Contractor shall notify engineer of any deviations from wire sizes listed on construction documents.
2. Wiring shall include a neutral conductor where shown on plans or required by installation instructions.

a. If a neutral conductor is shown on the plans but not required by installation instructions, verify removal of neutral wire with engineer via RFI prior to proceeding.

3. Wiring of elevators and other such equipment shall account for voltage drop limitations of equipment.
4. Wiring of VFDs shall be as follows:

a. Secondary VFD cables shall be symmetrically shielded and grounded or, where the length of the conductors is less than the VFD manufacturer's recommended maximum, be copper conductors installed in metallic conduit. Same shall not be installed in the same raceway as other cables or combined in wire gutters or cable trays

END OF SECTION 260013

SECTION 260505 – ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SCOPE

A. Demolition work to be performed whether shown or not on the drawings. Disconnect and remove any lights, equipment, conduit, wiring, devices, etc. not required to remain and/or required to be removed to accommodate new construction.

1.3. SUMMARY

A. This Section requires the selective removal and subsequent offsite disposal of the following:

a. Mechanical and electrical equipment, devices, piping, conduits, ductwork, insulation, lighting, etc in existing building as required to accommodate new construction.
b. Removal of MEP items in interior partitions.
c. Removal and protection of existing fixtures, materials, and equipment items to be removed, salvaged, relocated, reinstalled, etc.

1.4. SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Schedule indicating proposed sequence of operations for selective demolition work to Architect for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.

1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
2. Coordinate with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed remodeled areas.

C. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Architect prior to start of work.

1.5. JOB CONDITIONS

A. Occupancy: Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in such a manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.
B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at time of Contractor's inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.
C. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed. Storage or sale of removed items on site will not be permitted.
D. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.

a. Provide protective measures as necessary and required to provide free and safe passage of Owner's personnel and general public to any occupied portions of building.
b. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or elements to be demolished and adjacent facilities or work to remain.
c. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
d. Construct temporary insulated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
e. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

f. Remove protections at completion of work.

2. Damages: Promptly repair damages caused to adjacent facilities by demolition work.
3. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

E. Flame Cutting:

1. Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

F. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

G. Maintain fire protection services during selective demolition operations.
H. Environmental Controls:

a. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing and/or approved regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1. PREPARATION

A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of systems and components to be demolished and adjacent facilities to remain.
B. Cease operations and notify Architect immediately if safety of structure or system integrity appears to be endangered. Take precautions to support structure and systems until determination is made for continuing operations.
C. Provide all necessary temporary supports of items and systems to remain that were supported from or otherwise affected by removal of other building components. Maintain integrity of all systems to remain and protect during the construction process.
D. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to any occupied portions of the building.

a. Where selective demolition occurs immediately adjacent to any occupied portions of the building, construct dust-proof partitions of minimum 4-inch studs, 5/8-inch drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with sound-deadening insulation as required by Architect.
b. Provide weatherproof closures for exterior openings resulting from demolition work.

E. Locate, identify, stub off, and disconnect utility services that are not indicated to remain. Provide bypass connections as necessary to maintain continuity of service to any occupied areas of building. Provide minimum of 72 hours advance notice to Architect if shutdown of service is necessary during changeover.

3.2. DEMOLITION

A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

1. Demolish components in small sections. Cut systems at junctures with system components to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
3. Provide services for effective air and water pollution controls as required.
4. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter.

5. Completely fill elevated slabs and existing structures, walls, slabs etc areas and voids resulting from demolition work. Provide patching of existing structure, walls, slabs etc with like materials for a like new appearance and maintain all ratings and integrity of same.

B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to architect in written accurate detail. Pending receipt of directive from Architect, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3. SALVAGED MATERIALS

A. Salvaged Items: Where indicated on Drawings as "Salvage - Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain a receipt.

3.4. DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish, and other materials resulting from demolition operations from building site. Transport and legally dispose off site.
B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
C. Burning of removed materials is not permitted on Project site.

3.5. CLEANUP AND REPAIR

A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 260505

SECTION 260519 – WIRE AND CABLE

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3. SUBMITTALS

A. Product Data: For each type of product indicated.
B. Qualification Data: For testing agency.
C. Field quality-control test reports.

1.4. QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

1.5. COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1. CONDUCTORS AND CABLES

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

1. Southwire Company.
2. General Cable Corporation.
3. Encore Wire Corporation.
4. AFC Cable Systems, Inc. (Multiconductor cable only)

B. Copper Conductors: Comply with NEMA WC 70.
C. Aluminum Conductors: Comply with NEMA WC 70.

a. Same shall be compacted aluminum (Stabiloy)

D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN-2.

1. Provide consistent color coding of all circuits as follows:

	Distribution System	
Phase	**120/208**	**277/480**
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
N	White	Gray
Ground	Green	Green w/ Stripe [1]

Notes:

1) Stripe shall be white or yellow in color.

2. For Isolated Power Systems provide consistent color coding of all circuits as follows:

	Distribution System
Phase	**Isolated Power Systems [2]**
A	(L2) Brown w/ Stripe [1,3]

N	(L1) Orange w/ Stripe [3,4]
Ground	Green w/ Stripe [3]

Notes:

1) L2 Conductor shall be connected to lower terminal on breaker and brass (typical hot) screw on receptacle.
2) "Isolated Power System" as referenced by NEC 517.160 for anesthetizing locations.
3) Stripe shall be of a color other than white, green, or gray.
4) L1 Conductor shall be connected to upper terminal on breaker and silver terminal (typical neutral) screw on receptacle.

E. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2. CONNECTORS AND SPLICES

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

1. Cable manufacturers listed above under 2.1, Item A.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1. CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

1. Aluminum conductors acceptable only when specifically shown/scheduled on drawings.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

1. Aluminum conductors are not permitted for branch circuit wiring.

3.2. CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Provide insulation / cable types for conductors as follows:

Application	Insulation / Cable Type		
	THHN/THWN-2 [1]	XHHW-2 [1]	MC Cable [3]
Service Entrance	X [2]	X	
Feeders:			
Exposed, Exterior	X [2]	X	
Exposed, Interior	X		
Concealed in Ceilings, Walls, Partitions, and Crawlspaces	X		
Concealed in Concrete, below Slabs-on-Grade, and Underground	X [2]	X	
Branch Circuits:			
Exposed, Exterior	X [2]	X	
Exposed, Interior - Including Crawlspaces	X		
Concealed in Ceilings, Walls, and Partitions	X		X
Concealed in Concrete, below Slabs-on-Grade, and Underground	X [2]	X	
Isolated Power Systems		X	

Notes:

1) Single conductors in raceway. Refer to Section 260533 - Raceway & Boxes for acceptable raceway types/applications.
2) THHN/THWN-2 is acceptable for these installations at contractor's discretion.
3) Metal Clad (MC) cable installations shall be in accordance with the following:

(i) MC cable shall not be used for emergency system wiring (emergency system wiring shall be installed in non-flexible metallic conduit).
(ii) MC cable used in patient care areas shall be health-care MC cable and the outer sheath shall qualify as an equipment grounding conductor independent of any separate wire-type equipment grounding conductor.
(iii) Standard MC cable may be used for non-emergency circuits in other than patient care areas.
(iv) MC cable shall not be used for homeruns.
(v) MC cable may be used for light fixture and equipment whips in lengths no longer than 6'-0". The use of MC cable from lighting fixture to lighting fixture shall not be allowed.
(vi) MC cable shall not be installed in exposed locations for lighting purposes. MC cable may be exposed in mechanical spaces for equipment whips.

B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
C. Class 1 Control Circuits: Type THHN-THWN-2, in raceway.
D. Class 2 Control Circuits: Type THHN-THWN-2, in raceway or Power-limited cable, concealed in building finishes.

3.3. INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
E. Support cables per National Electrical Code requirements.
F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4. CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. For Aluminum Conductors:

a. Use oxide inhibitor in each splice and tap conductor, and at all terminations.
b. Provide compression-type one-hole or two-hole lug terminations.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5. FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Test Reports: Prepare a written report to record the following:

a. Test procedures used.
b. Test results that comply with requirements.
c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260529 – HANGERS & SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3. DEFINITIONS

A. EMT: Electrical metallic tubing.
B. IMC: Intermediate metal conduit.
C. RMC: Rigid metal conduit.

1.4. PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5. QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Comply with NFPA 70.

1.6. COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 PRODUCTS

2.1. SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and

sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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

      i. Hilti Inc.
      ii. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      iii. MKT Fastening, LLC.
      iv. Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

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

      i. Cooper B-Line, Inc.; a division of Cooper Industries.
      ii. Empire Tool and Manufacturing Co., Inc.
      iii. Hilti Inc.
      iv. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      v. MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2. FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.1. APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Support raceways at intervals no greater than ten (10) feet and with one support within three (3) feet of each coupling, box, fitting, or outlet box. Provide one support within three (3) feet of each elbow or bend.

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 20 percent in future without exceeding specified design load limits.

   1. Secure raceways and cables to these supports.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

F. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

G. Use one or two-hole saddle-type clamps where single conduits are exposed below 6'-0" AFF.

3.2. SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel:
    a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts
    b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
    c. Spring-tension clamps].
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3. INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4. CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03."
C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 260529

SECTION 260533 – RACEWAYS AND BOXES

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION OF WORK

A. Provide complete raceways systems, boxes and fittings for all required electrical systems.

1.3. STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:

1. Rigid Steel Conduit
   a. U.L. Standard UL-6
   b. A.N.S.I. C80-1
   c. Federal Specification WW-C-581E
2. Intermediate Metallic Conduit
   a. U.L. Standard UL-1242
   b. Federal Specification WW-C-581E
3. Electrical Metallic Tubing
   a. U.L. Standard UL-797
   b. A.N.S.I. C80-3
   c. Federal Specification WW-C-563
4. Flexible Steel Conduit
   a. U.L. Standard UL-1
5. Liquid Tight Flexible Conduit
   a. U.L. Standard UL-360
6. Non-Metallic Conduit
   a. U.L. Standard UL-651
   b. A.N.S.I. Standard F512
   c. N.E.M.A. Standard TC-2
   d. Federal Specifications GSA-FSS and W-C-1094-A
7. Wireways and Auxiliary Gutters
   a. U.L. Standard UL-870
8. Rigid Aluminum Conduit
   a. A.N.S.I. C80.5

1.4. SUBMITTALS

A. Provide manufacturer's catalog cuts of fittings.
B. Where wireways and/or auxiliary gutters are employed full erection drawings must be submitted. Drawings to include plan views, elevations, size of wireways, type and quantity of conductors proposed to be installed therein, etc.
C. Indicate duct banks or multi-trade coordinated shop drawings.
D. Submit shop drawings or catalog descriptive data on boxes exceeding twenty-four (24")inches for any one dimension.
E. Submit shop drawings or catalog descriptive for floor boxes and accessories.

PART 2 - PRODUCTS

2.1. RACEWAY TYPES

A. Standard Threaded Rigid Steel Conduit.

1. Rigid conduit heavy wall galvanized.
2. Threaded type fittings: "Erickson" couplings where threaded cannot be used.

B. Intermediate Metallic Conduit

1. Light weight rigid steel conduit.
2. Threaded type fittings: "Erickson" couplings where threaded cannot be used.

C. Electrical Metallic Tubing

1. Continuous, seamless tubing, galvanized or sherardized on the exterior, coated on the interior with a smooth hard finish of lacquer, varnish, or enamel.
2. Couplings and connectors:
   a. Indoor and two (2") inches in size and smaller, shall be steel set-screw type fittings.
   b. 2-1/2 inch size and larger must employ steel compression gland fittings.
   c. Outdoor shall be raintight steel compression gland fittings.
3. Indent type fittings shall not be used.
4. All connectors shall have insulated throat.
5. Where installed in slab or concrete work, provide approved concrete tight fittings.

D. Flexible Steel Conduit

1. Single strip, continuous, flexible interlocked, double-wrapped steel, galvanized inside and outside, forming smooth internal wiring channel.
2. Maximum length: (six 6) feet.
3. Each section of raceway must contain an equipment grounding wire bonded at each end and sized as required. Provide connectors with insulating bushings.
4. Steel squeeze-type or steel set screw type fittings.

E. Liquid Tight Flexible Electrical Conduit

1. Same as flexible steel conduit except with tough, insert water-tight plastic outer jacket.
2. Cast malleable iron body and gland nut, cadmium plated with one-piece brass grounding bushings which thread to interior of conduit. Spiral molded vinyl sealing ring between gland nut and bushing and nylon insulated throat.

F. Non-Metallic Raceway

1. Composed of polyvinyl chloride suitable for 90 degrees C. Provide rigid polyvinyl chloride (PVC) type EPC 40 heavy wall plastic conduit meeting current NEMA Standard TC-2. Conduit shall be listed UL 651 for underground and exposed use.
2. Exposed conduit shall be UV-resistant.
3. Raceway, fittings, and cement must be produced by the same manufacturer who must have had a minimum of ten (10) years experience in manufacturing the products.
4. Materials must have a tensile strength of 7,000-7,200 psi at 73.4 degrees F., flexural strength of 12,000 psi and compressive strength of 9,000 psi.
5. All joints shall be solvent cemented in accordance with the recommendations of the manufacturer.

G. Wireways and Auxiliary Gutters

1. Painted steel or galvanized steel.
2. Of sizes and shapes indicated on the Drawings and as required.
3. Provide all necessary elbows, tees, connectors, adapters, etc.
4. Wire retainers not less than twelve (12") inches on center.

H. Duct Banks

1. Provide duct banks and concrete encasements for both interior and exterior work as indicated on the Drawings and for all circuits in excess of 600 volts and as otherwise indicated.
2. Concrete shall be minimum fc = 3,000 pounds per square inch.
3. Support raceways installed in duct banks every five (5) feet to assure correct alignment.
4. Terminate raceways with flared bells to enable ease of pulling cable and to eliminate stress on the cable. Free bells and raceway terminations of burrs and rough edges.

5. Provide concrete markers at grade where duct banks are stubbed out for future use.
6. Install utility duct banks not less than thirty (30") inches below grade top elevation.
7. Provide rigid steel elbows for vertical risers.
8. Provide vinyl tracer ribbon twelve (12") inches above each duct bank buried in backfill.

I. Aluminum Conduit

1. Do not use aluminum conduit unless specifically indicated on the drawings for special purposes.

2.2. LOCKNUTS AND BUSHINGS

A. Locknuts shall be steel. Die cast locknuts shall not be used.
B. All bushings shall be insulated. Use nylon insulated metallic bushings for sizes 1" and larger. Plastic bushings may be used in 1/2" and 3/4" sizes.

2.3. OUTLET BOXES

A. General

1. Recessed wall boxes shall be 2-1/2" deep.
2. Surface-mounted wall boxes shall be 1-1/2" or 2-1/2" deep as required.
3. Lighting Fixture Box
   a. Four (4") inch octagon with 3/8" fixture stud.
   b. For suspended ceiling work, four (4") inch octagon with removable backplate where required, and two (2) parallel bars for securing to the cross-furring channels and extend flexible conduit to each fixture.
4. Plug any open knockouts not utilized.

B. Cast Type Conduit Boxes, Outlet Bodies and Fittings

1. Use Ferrous Alloy boxes and conduit bodies with Rigid Steel or IMC.
2. Use Ferrous Alloy or cast aluminum boxes and conduit bodies with Electrical Metallic Tubing.
3. Covers: Cast or sheet metal unless otherwise required.
4. Tapered threads for hubs.

C. Masonry Outlet Boxes

1. Use for all devices recessed in concrete or masonry.
2. Galvanized steel construction.

D. Drawn Steel Boxes

1. Use for all interior exposed devices (where not required or indicated to be cast type).
2. Drawn construction, minimum 0.625" thick galvanized steel.
3. Raised ground connection.
4. Provide with raised, drawn galvanized steel covers.

E. Welded Steel Boxes

1. May be used for recessed devices only, or as a junction box where located above ceiling or on walls where same is located above 6'-0" A.F.F.
2. Minimum 1/16" thick steel construction.

F. Weatherproof Boxes

1. Use for all exterior exposed devices.
2. Cast aluminum construction.
3. Internal hub threads.
4. NEMA 3R listed.

G. Non-Metallic Boxes

1. May be used for wood-frame construction only.
2. Thermoplastic construction.
3. UL Listed to UL 514C
4. UL Classified for two hour or less fire wall assemblies
5. Meets NEMA OS-2

2.4. JUNCTION AND PULL BOXES

A. Outlet boxes as listed above may be used as junction boxes where provided as a 2-gang box minimum.
B. Steel Boxes

1. No. 12 USS gauge sheet steel for boxes with maximum side less than forty (40") inches, and maximum area not exceeding 1,000 square inches; riveted or welded 3/4 inch flanges at exterior corners.
2. No. 10 USS gauge sheet steel for boxes with maximum side forty (40") to sixty (60") inches, and maximum area 1,000 to 1,500 square inches; riveted or welded 3/4 inch flanges at exterior corners.
3. No. 10 USS gauge sheet steel riveted or welded to 1-1/2 by 1-1/2" by 1/4" welded angle iron framework for boxes with a maximum side exceeding sixty (60") inches and more than 1,500 square inches in area.
4. Covers

    a. Same gauge steel as box.
    b. Subdivided single covers so no section of cover exceeds fifty (50) pounds.
    c. Machine bolts, machine screws threaded into tapped holes, or sheet metal screws as required; maximum spacing twelve (12") inches.

5. Finish: Galvanized steel or paint with rust inhibiting primer and ANSI No. 61 light gray finish coat.
6. Where size of box is not indicated, size to permit pulling, racking and splicing of cables.
7. For Boxes over 600 Volts

    a. Provide insulated cable supports and removable steel barriers to isolate each feeder. Stencil cable voltage class in red letters on the front cover of the box.
    b. Braze a ground connector suitable for copper cables to the inside of the box.

C. Exterior Pull / Junction boxes

1. NEMA 3R or 4X rated.
2. Stainless steel or reinforced non-metallic construction.

D. In-Grade Pull Boxes (Quazite or similar)

1. Polymer concrete box. Removable cover with stainless steel bolts.
2. Box shall be traffic-rated where located in pavement or other areas subject to vehicle traffic.

2.5. FLOOR BOXES

A. General

1. Class I, water-tight, normal depth cast iron construction Type I, fully adjustable, for use in concrete.
2. Single Gang Round type.
3. Multiple Gang or Combination.

    a. Rectangular type partitions for separating power from communication sections.

B. Floor Box Covers

1. Rugged construction, impervious to cleaning detergents.
2. Compatible with floor covering.
3. Brass or bronze for flush lid mounting with devices below floor level. Lid shall have hinged or guarded openings for wires to route through the closed lid.
4. Providing continuous ground path to box.
5. Provide carpet flange in carpeted areas.

2.6. FIRE-RATED POKE-THROUGHS

A. General

1. 4, 6 or 8" fire rated poke throughs, UL listed for installation in fire rated concrete construction. Hubbell System One - Recessed Activation.
2. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
3. Comply with UL 514 scrub water exclusion requirements. Class I, water-tight, normal depth cast iron construction Type I, fully adjustable, for use in concrete.
4. Partitions for separating power from communication sections.

B. Covers

1. Rugged construction, impervious to cleaning detergents.
2. Compatible with floor covering.

3. Brass or bronze for flush lid mounting with devices below floor level. Lid shall have hinged or guarded openings for wires to route through the closed lid.
4. Providing continuous ground path to box.
5. Provide carpet flange in carpeted areas.

PART 3 - EXECUTION

3.1. APPLICATION OF RACEWAYS

A. The following applications must be adhered to except as otherwise required by Code. Raceways not conforming to this listing must be removed by the Contractor and replaced with the specified material at the Contractor's expense.

1. Rigid Steel - Application: Where exposed to mechanical injury, where specifically required, exterior exposed locations, and where required by codes and for all circuits in excess of 600 volts.
2. I.M.C. - Application: Same as standard threaded rigid steel conduit.
3. E.M.T. - Applications: Use in every instance except where another material is specified. EMT shall not be used underground or in slab on grade.
4. Flexible Steel - Applications: Use in dry areas for connections to lighting fixtures in hung ceilings, connections to equipment installed in removable panels of hung ceilings at bus duct takeoffs, at all transformer or equipment raceway connections where sound and vibration isolation is required.
5. Liquid-Tight Flexible Conduit - Applications: Use in areas subject to moisture where flexible steel is unacceptable at connections to all motors, and all raised floor areas.
6. Non-Metallic Conduit - Application: Where specifically indicated on the drawings and for raceways in slab or below grade.
    a. Schedule 80 PVC shall be used for locations susceptible to damage and/or where otherwise required to be mechanically protected per code. Schedule 40 PVC is acceptable for all other non-metallic conduit applications as indcated above.
7. Wireways and Auxiliary Gutters - Application: Where indicated on the Drawings and as otherwise specifically approved.

3.2. RACEWAY SYSTEMS IN GENERAL

A. Provide raceways for all wiring systems, including security, data transmission, paging, low voltage et. al. Where non-metallic raceways are utilized, provide sizes as required with the grounding conductor considered as an insulated additional conductor. Wiring of each type and system must be kept independent and installed in separate raceways – including, but not limited to:

1. Wiring of different voltages (480/277V vs. 208/120V)
2. Emergency / Normal Wiring (except as permitted by NEC 700)
3. Essential Electrical System Branch Wiring (except as permitted by NEC 517)

B. All emergency system wiring shall be run in non-flexible metallic conduit.
C. Below-grade raceways may NOT be used to serve patient care areas without the permission of the engineer.
D. Install capped bushings on raceways as soon as installed and remove only when wires are pulled. Securely tie embedded raceway in place prior to embedment. Lay out the work in advance to avoid excessive concentrations of multiple raceway runs.
E. Locate raceways so that the strength of structural members is unaffected and they do not conflict with the services of other trades. Install one (1") inch or larger raceways, in or through structural members (beams, slabs, etc.) only when and in the manner accepted by the Architect/Engineer. Draw up couplings and fittings full and tight.
F. Install no conduits or other raceways sized smaller than permitted in applicable NEC Tables. Where conduit sizes shown on drawings are smaller than permitted by code, Contractor shall include cost for proper size conduit in his base bid. In no case reduce conduit sizes indicated on drawings or specified without written approval of Architect-Engineer. Minimum conduit size shall be 3/4".
G. Above-grade raceways to comply with the following:

1. Install raceways concealed except at surface cabinets and for motor and equipment connection in electrical and mechanical rooms. Install a minimum of six (6") inches from flues, steam pipes, or other heated lines. Provide flashing and counter-flashing for waterproofing of raceways, outlets, fittings, etc., which penetrate the roof. Route exposed raceways parallel or perpendicular to building lines with right-angle turns and symmetrical bends. Run concealed raceways in a direct line and, where possible, with long sweep bends and offsets. Provide sleeves in forms for new concrete walls, floor slabs, and partitions for passage of raceways. Waterproof sleeved raceways where required.
2. Raceways shall not be run on roofs or exposed on the outside of the buildings unless specifically noted

as exposed on the drawings or approved by the Architect/Engineer.

3. Provide raceway expansion joints for exposed and concealed raceways with necessary bonding conductor at building expansion joints and between buildings or structures and where required to compensate for raceway or building thermal expansion and contraction. Provide expansion fittings every 200 feet on outdoor conduit.
4. Provide one (1) empty 3/4 inch raceway for each three (3) spare unused poles or spaces of each flush-mounted panelboard. Terminate empty 3/4 inch conduit in a junction box, which after completion, is accessible to facilitate future branch circuit extension.
5. Provide raceway installation (with appropriate seal-offs, explosion-proof fittings, etc.) in special occupancy area, as required. Provide conduit seal-offs where portions of an interior raceway system pass through walls, ceiling, or floors which separate adjacent rooms having substantially different maintained temperatures, as in refrigeration or cold storage rooms.
6. Provide pull string in spare or empty raceways. Allow five (5) feet of slack at each end and in each pull box. Tie each end of the string to a washer or equivalent that does not fit into the conduit. Tag both ends of string denoting opposite end termination location.

H. Below Grade

1. Below grade raceways to comply to the following:
   a. Do not penetrate waterproof membranes unless proper seal is provided.
2. Protect steel raceway in earth or fill with two (2) coats of asphalt base paint. Touch up abrasions and wrench marks after conduit is in place.
3. In lieu of the above, protect steel raceways with a minimum of ten (10) mil tape approved for the purpose and overlapped a minimum of one-half tape width to provide a minimum twenty (20) mil thickness.

I. No raceway may be installed in a concrete slab or members except with the permission of the Structural Engineer and with the written consent of the Owner.

1. Conduits embedded in structural concrete slabs shall have an outside diameter less than one third of the thickness of the concrete slab and shall be installed entirely within the center one third of the concrete slab.
2. Raceways embedded in concrete slabs shall be spaced not less than eight (8") inches on centers and as widely spaced as possible where they converge at panels or junction boxes.
3. In no case will installation of raceways be permitted to interfere with the proper placement of principal reinforcement.
4. Raceways running parallel to slab supports, such as beams, columns, and structural walls, shall be installed not less than twelve (12") inches from such supporting elements.
5. To prevent displacement during concrete pour of lift slab, saddle supports for conduit, outlet boxes, junction boxes, inserts, etc., shall be secured with suitable adhesives.

J. Non-metallic raceway installation shall conform to the following:

1. All joints are to be made by the solvent cementing method using the material recommended by the raceway manufacturer. To insure good joints, components shall be cleaned prior to assembly.
2. Raceway cut-offs shall be square and made by handsaw or other approved means which does not deform the conduit. Raceway shall be reamed prior to solvent cementing to couplings, adapters, or fittings.
3. Electrical devices which are served by PVC raceways shall be grounded by means of a ground wire pulled in the raceway.
4. Bends shall be made by methods that do not deform or damage the conduit. The radii of field bends shall not be less than those established by the N.E.C.
5. Raceway expansion fittings shall be provided where necessary. The position of the expansion fitting shall be adjusted proportional to the temperature at installation.
6. Raceway supports shall be installed, in such a manner, to allow the PVC conduit to slide through the supports as the temperature changes.
7. Provide exterior underground conduit with metal detection strip.
8. Provide matching plastic fittings. Fittings shall meet the same standards and specifications as the conduit on which it is installed.
   a. Plastic conduit elbows may only be used for exterior underground applications or circuits beneath slabs on grade.
   b. For all runs over 300' in length and/or with more than (2) 90° elbows, provide galvanized rigid steel (GRS) radius bends and risers as conduits rise above grade or above floor slab, unless elbow is encased in concrete.

9. Joining and bending of conduit and installation of fittings shall be done only by methods recommended.
10. Provide conduit support spacing as recommended for the highest ambient temperature expected.
11. Provide interlocking conduit spacers for multiple runs of underground conduits installed in same trench.
12. Provide expansion couplings on long runs regardless of ambient temperatures. Determine amount of conduit expansion and contraction from published charts or tables.
13. Test workmanship by conducting a low-pressure air (3.0-5.0 psi) test after system is installed and cemented joints are set. Plug and block ends to prevent movement prior to pressurization. Check for leaks at all joints with a soap solution. Even low-pressure air can cause high thrust loads and caution must be observed. The test shall be observed by the architect, engineer or owner's representative, prior to backfill. All below grade conduit that could potentially drain water into electrical equipment (ie. Main electrical service located in basement below utility transformer) must be watertight.

K. Raceways in hung ceiling shall be run on and secured to slab or primary structural members of ceiling, not to lathing channels or T-bars, Z-bars, or other elements which are the direct supports of the ceiling panels. Secure conduit firmly to steel by clips and fittings designed for that purpose. Install as high as possible, but not less than 1'-0" above hung ceilings.

L. Exposed raceways shall be run parallel or at right angles with building lines.

M. Clear raceway of all obstructions and dirt prior to pulling in wires or cables. This shall be done with ball mandrel (diameter approximately 85% of conduit inside diameter) followed by close fitting wire brush and wad of felt, or similar material. This assembly may be pulled in together with, but ahead of, the cable being installed. All empty raceways shall be similarly cleaned. Clear any raceway which rejects ball mandrel.

3.3. OUTLET BOXES

A. Fit outlet boxes in finished ceilings or walls with appropriate covers, set flush with the finished surface. Where more than one switch or device is located at one point, use gang boxes and covers unless otherwise indicated. Sectional switch boxes or utility boxes will not be permitted. Provide Series "GW" (Steel City) tile box, or as accepted, or a four (4") inch square box with tile ring in masonry walls, which will not be plastered or furred. Where drywall material is utilized, provide plaster ring.

1. Provide outlet boxes of the type and size suitable for the specific application.
2. Where outlet boxes contain two (2) or more 277 volt devices, or where devices occur of different applied voltages, or where normal and emergency devices occur in same box, provide suitable barrier.
3. Install all wall mounted switch and receptacle boxes with bracing between two adjacent studs where rigid conduit is not used for circuiting. Box and receptacle shall not deflect on operation or insertion of plugs.

B. Install boxes and covers for wiring devices so that the wiring devices will be installed with a vertical orientation unless otherwise noted on the drawings.

C. The exact location of outlets and equipment is governed by structural conditions and obstructions, or other equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment. Verify final location of outlets, panels equipment, etc., with Architect.

D. Back-to-back outlets in the same wall, or "thru-wall" type boxes not permitted. Provide twelve (12") inch (minimum) spacing for outlets shown on opposite sides of a common wall to minimize sound transmission.

E. Provide twenty four (24") inch (minimum) horizontal spacing for outlets shown on opposite sides of a fire rated wall.

1. Provide listed fire putty pads around the each box to maintain fire rating, where aggregate area of boxes in wall exceeds maximum per code.

F. Install top of switch outlet boxes 48" above floor unless otherwise called for or required by wainscot, counter, etc. Install bottom of receptacle outlet boxes 16" above floor unless otherwise called for on drawings.

1. Adjust mounting heights to nearest masonry joint for minimum cutting in case of flush outlets.

3.4. JUNCTION AND PULL BOXES

A. Provide junction and pull boxes as indicated on the drawings and as required for the complete installation of the various electrical systems, and to facilitate proper pulling of wires and cables.

1. J-boxes and pull boxes shall be sized per electrical code minimum.
2. Boxes on empty conduit systems shall be sized as if containing conductors of #4 AWG.
3. Wiring systems required to have separate/independent raceways (See Section 3.2 above) shall also be provided with separate junction and pull boxes. These wiring systems may occupy the same outlet box only if a divider is installed between the wiring that is listed for this purpose.

B. Pull Box Spacing

1. Provide pull boxes so no individual conduit run contains more than the equivalent of four (4) quarter bends (360 degrees total).
2. Conduit Sizes 1-1/4" and Larger.
    a. Provide boxes to prevent cable or wire from being excessively twisted, stretched, or flexed during installation.
    b. Provide boxes for medium voltage cables so that maximum pulling tensions do not exceed cable manufacturer's recommendations.
    c. Provide support racks for boxes with multiple sets of conductors do not rest on any metal work inside box.
3. Conduit Sizes one (1") inch and smaller, low voltage wire and cable (maximum distances)
    a. 200 feet straight runs.
    b. 150 feet runs with one 90 degree bend or equivalent.
    c. 125 feet runs with two 90 degree bends or equivalent.
    d. 100 feet runs with three or four 90 degree bends or equivalent.

3.5. FLOOR BOXES

A. Prior to Concrete Pour

1. Firmly support boxes.
2. Adjust leveling screws to insure box covers are flush with finished floor.
3. Plug unused opening with proper fittings and seal joints with compound for exclusion of concrete and moisture.

B. After Concrete Pour

1. As soon as traffic is permitted on slab, remove any accumulation of water and foreign matter to avoid corrosion and rust.
2. Insure covers are flush with finished floor.
3. Install cover plates and accessories after floor finishing materials have been installed.

END OF SECTION 260533

SECTION 260553 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION OF WORK

A. A. Provide identification on all equipment, raceways, boxes and conductors.

PART 2 - PRODUCTS

2.1. NAMEPLATES

A. Nameplates shall be lamacoid plates with engraved upper-case letters and beveled edges.
    1. Stamped or embossed metal tags are not considered acceptable for this purpose.
B. Color:
    1. Normal-power equipment shall have white nameplates with black letters, enclosed by a black border.
    2. Equipment fed from the emergency electrical system, or otherwise designated on the plans for emergency use, shall have red nameplates with white letters, enclosed by a white border.
    3. Equipment designated as clean/isolated ground power shall have orange nameplates with black letters, enclosed by black border.
    4. Nameplates for short circuit ratings and calculations shall be yellow with black letters, enclosed by black border.
C. All nameplates shall be engraved and must be secured with rivets, brass or cadmium plate screws. The use of Dymo tape or the like is unacceptable.
D. Nameplate inscriptions shall bear the name and number of equipment to which they are attached as indicated on the Drawings. The engineer reserves the right to make modifications in the inscriptions as necessary.
    1. Inscription letters shall be 1/2" in size.

2.2. CABLE TAGS AND WIRE IDENTIFICATION LABELS

A. Cable tags shall be flameproof secured with nylon ties.
B. Wire markers shall be preprinted cloth tape type or approved equivalent.

2.3. IDENTIFICATION LABELS

A. Acceptable Manufacturers
    1. W.H. Brady Company (Style A)
    2. Thomas & Betts Company (T&B), Style A.
    3. Seaton
B. Plasticized Cloth
    1. Non-conductive.
    2. Waterproof.
    3. Capable of withstanding continuous temperatures of 235 degrees F and intermittent temperatures to 300 degrees F.
    4. Overcoating for protection against oil, solvents, chemicals, moisture, abrasion and dirt.
C. Heavy, thermo-resistant industrial grade adhesive, for adhesion of label to any surface without curling, peeling or falling off.
D. Label Designations, Nominal System Voltages Applied to the covers of all medium and low voltage pull, splice and junction boxes.
E. Machine printed.
    1. Letters shall be 3/8" in size.

PART 3 - EXECUTION

3.1. INSTALLATION

A. Service Entrance Equipment

1. Where electrical equipment (switchboard, panelboard, disconnect switch, etc.) is installed as service entrance equipment, contractor shall furnish and install a nameplate listing the following:

   a. Equipment Short-Circuit Current Rating in amperes (RMS SYM), as indicated on the drawings.
   b. Whether or not the equipment is fully or series-rated.
   c. Available Fault Current in amperes. Contractor shall perform available fault current calculation (as outlined in Section 260011) to obtain available fault at Service Equipment.
   d. Date fault current calculations were performed.

      i. Example:

EQUIPMENT FULLY-RATED AT 65,000 AMPERES RMS SYM AVAILABLE FAULT CURRENT: 45,203 AMPERES DATE CALCULATED: 2/24/2022

2. Contractor shall furnish and install another nameplate (in addition to above) at *each* service overcurrent protective device listing the following per NEC Article 110:

   a. Service Disconnect #
   b. Nominal system voltage
   c. Available Fault Current in amperes (see item 'c' above).
   d. Clearing time of service overcurrent protective device based on the aforementioned fault current
   e. Date the label was applied.

      i. Example:

SERVICE DISCONNECT 1 of 4 NOMINAL SYSTEM VOLTAGE: 208V AVAILABLE FAULT CURRENT: 45,203 AMPERES CLEARING TIME OF THIS DEVICE: 0.3S DATE CALCULATED: 2/24/2022

B. Switchboards/ Distribution Panelboards.

1. Furnish and install a nameplate for each switchboard or distribution panelboard. Nameplate shall be engraved with the following information:

   a. Top Line: Equipment identification as indicated on the Drawings.
   b. Middle Line: Specific device or equipment where feeder originates.
   c. Bottom Line: Equipment voltage, size, and phase as indicated on the drawings.
   d. Example:

SWITCHBOARD SWDP1 FED FROM UTILITY COMPANY TRANSFORMER 208/120V, 1200A, 3-PHASE

2. Nameplate shall be mounted at the top of the incoming section.
3. Each switch / circuit breaker shall be provided with an identifying nameplate.

   a. Main devices shall be identified as such. Where multiple mains are employed each switch shall be numbered. Inscription shall be "MAIN SWITCH" or "MAIN SWITCH NO. 1" et al.
   b. Branch/feeder devices shall be identified with either the load served or a number corresponding to the furnished circuit directory.

C. Panelboards and Load Centers.

1. Furnish and install a nameplate for each panelboard and load center. Nameplate shall be engraved with the following information:

   a. Top Line: Equipment identification as indicated on the Drawings.

b. Middle Line: Specific device or equipment where feeder originates.
c. Bottom Line: Equipment voltage, size, and phase as indicated on the drawings.
d. Example:

PANELBOARD LN1 FED FROM SWITCHBOARD SWDP1 IN ROOM #332 208/120V, 200A, 3-PHASE

2. Nameplate shall be mounted at the top of the panel.
3. After installations are complete, provide and mount under sturdy transparent shield in the directory frame of each panel door, a neat, accurate, and carefully typed directory properly identifying the lighting, receptacles, outlets, and equipment each overcurrent device controls.

a. Include on directory the panel or load center identification, the cable and raceway size of panel feeder, and the feeder origination point.

D. Disconnect Switches.

1. Furnish and install a nameplate for each disconnect switch engraved with the equipment designation which the disconnect serves and the panel and circuit the switch is fed from.

E. Disconnect Switches.

1. Furnish and install a nameplate for each disconnect switch engraved with the equipment designation which the disconnect serves.

a. Example:

AHU – 1 FED FROM PANEL LP-1 – 32

2. Nameplate shall be mounted at the top of the disconnect.

F. Motor Controllers.

1. Furnish and install a nameplate for each motor controller or combination motor controller for both individual motor controllers and those in a motor control center. Engraving must indicate the motor served and the type of service (e.g., AC-8-1st floor supply, EF-2 electric closet exhaust.)

G. Feeder Switches.

1. Furnish and install for each feeder switch including, but not limited to those in switchboards, switch and fuse panelboards, take-offs at bus ducts, motor control centers, multiple meter centers, etc., two (2) nameplates as follows:

a. The first nameplate must be white background with red lettering. Engrave with the words "REPLACE ONLY WITH _____ FUSE." Engrave with proper fuse trade name and ampere rating (i.e. Bussman LPS-R 100).
b. The second nameplate shall indicate the load served, the size and type of cable and raceway example:

i. LP-4, LP-5, LP-6
ii. 4#500 KCMILS-THW-CU-3-1/2"C

H. Remote Smoke Detector Lamps and Test Stations.

1. Furnish and install a nameplate on each remote smoke detector lamp and/or test station.
2. Engraving must indicate the location of the device to which the lamp is connected, as approved by the Engineer.

I. Switches.

1. Furnish and install a clear typed label on each faceplate for each switch indicating load served.

a. Example:

Conf. Can Lights

J. Receptacles.

1. Furnish and install a clear typed label on each faceplate for each receptacle indicating panel and circuit.
   a. Example:
   LP-1/32
2. Label shall be mounted at the top of the faceplate.

K. Pullboxes, Enclosures, and Cable Terminations.

1. Circuits rated over 40 Amp and all cables over 600V:
   a. Provide identification label with circuit numbers on enclosure cover.
   b. Furnish and install cable tags on each cable that enters a pullbox, enclosure, switchboard, and at terminations. Mark tags with type written inscription noting the load served, type and size of cable, and the overcurrent device protecting the cable.

L. Branch circuits:

1. Provide identification label with panel and circuit numbers on enclosure cover.
2. Identify each circuit with wire markers when enclosure label and wire colors do not provide enough information to identify each circuit without tracing.
3. Provide feeders and branch circuit home runs with plasticized wire marker indicating circuit number and power source. Provide feeders phase identification letter at each terminal point in addition to its circuit number.
4. 4 square box covers hidden above lay-in ceilings may be marked with indelible ink marker in lieu of using printed labels.

M. Fire Alarm Terminal Cabinets.

1. Furnish and install an approved nameplate on each fire alarm terminal cabinet.
2. Nameplates shall indicate floor and where multiple terminal cabinets are installed a prime designation for each cabinet (e.g. FATC-1A, FATC-1B).
3. Terminals shall be permanently identified in an approved manner.
4. Label all wiring.

N. Telecommunications System.

1. Each horizontal cable from a termination block or patch panel to a telecommunications outlet shall be labeled at both ends. Tags shall be consecutively numbered so that no two (2) cables have the same identification. In addition cable tag shall note the room number in which the data transmission outlet is located.
2. Each backbone cable shall have a flameproof tag attached at both ends of the tag. Tags shall be consecutively numbered so that no two (2) cables have the same identification. Additional inscriptions shall be provided as directed by the Owner.
3. Patch panel ports shall be consecutively numbered so that no two (2) ports have the same number.
4. Furnish and install a clear typed label on each faceplate for each outlet and jack indicating cable per ANSI/TIA/EIA/606A standards and project nomenclature. Label materials and finish shall match style, font, color, etc as any adjacent receptacles.
5. Label shall be mounted at the top of the faceplate.

O. Generator Control Panel.

1. Furnish and install a red nameplate for each generator control panel. Engraving shall indicate the generator controlled by the panel.

P. UPS & Computer Power Centers.

1. Furnish and install a black with lettering nameplate for each unit.

Q. Warning Signs

1. Provide electrical equipment and accessible wiring enclosures operating at voltage above 240 volts with self-sticking polyester sign with wording and size conforming to ANSI Standard Z35.1-1964 and OSHA 19.0.144iii(2) Specifications "Danger High Voltage" warning sign and voltage marker applied to front door or cover of device or enclosure.
2. Provide large equipment such as transformers and main distribution equipment with self-sticking polyester sign with wording and size conforming to ANSI Standard Z35.1-1964 and OSHA 19.0.144iii(2) Specifications indicating all electrical characteristics.

R. Boxes

1. Provide identification labels for all low voltage and medium voltage pull, splice and junction boxes in main feeder and subfeeder runs, indicating nominal system voltage.
2. Apply labels after painting of boxes, conduits, and surrounding areas have been completed.
3. Clean surfaces before applying labels; clean aluminum surfaces with solvent wipe.
4. Apply labels on cover and minimum of one (1) fixed side; one (1) label visible from floor where boxes are Installed exposed.

END OF SECTION 260553

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3. QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 PRODUCTS

2.1. GENERAL

A. Manufacturers

1. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
    a. Eaton Wiring Devices; (may be listed below and/or submitted as Eaton, Cooper, Arrow Hart, or Crouse-Hinds).
    b. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
    c. Leviton Mfg. Company Inc. (Leviton).
    d. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
2. All devices shall be from the same manufacturer.

B. Finishes

1. Color: Wiring device catalog numbers in Section Text do not designate device color.
    a. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing.
        i. Color shall be coordinated and verified with Architect and owner.
    b. Wiring Devices Connected to Emergency Power System: Red.
    c. Isolated Ground Devices: Orange.
    d. TVSS Devices: Blue.
    e. Controlled Devices: Green.

2.2. STRAIGHT BLADE RECEPTACLES

A. General Requirements for Convenience Receptacles

1. Unless otherwise modified below, all receptacles shall comply with the following:
2. Commercial / Common Areas: 125 V, 20 A
3. Residential / Dwelling Unit Areas: 125 V, 15 A
4. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
5. Multiple types of receptacles may be required of a single device (Ex.: a Hospital-Grade GFCI receptacle), as indicated on the plans and in the execution section below. Where such a device is required, it shall meet the requirements of all applicable sections below.
6. Products: Subject to compliance with requirements, provide one of the following:
    a. Refer to list of approved manufacturers in general section.
    b. Receptacle model/series(all manufacturers): 5361 (single), 5362 (duplex).
7. Residential/Dwelling Unit Area Products: Subject to compliance with requirements, provide one of the following:

a. Eaton; TR270.
b. Hubbell; RR15TR.
c. Leviton; T5320.
d. Pass & Seymour; 3232TR.

B. Controlled Receptacles

1. Controlled outlet(s) shall be marked with a "power symbol" in accordance with NEC 406.3.
2. Receptacles shall be split-wired (half controlled, half 'hot').
3. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5362CH.
b. Hubbell; BR20C1.
c. Leviton; 5362-S1.
d. Pass & Seymour; 5362CH.

C. GFCI Receptacles

1. Straight blade, feed or non-feed-through type.
2. Include indicator light that is lighted when device is tripped.
3. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; SGF20.
b. Hubbell; GFRST20.
c. Leviton; G5362.
d. Pass & Seymour; 2097.

4. Where devices are shown labeled as GFI on drawings provide GFCI receptacle (feed-through devices are not acceptable unless otherwise noted, or with written permission from the engineer).

a. Devices labeled as GFIP on the drawings may be protected as a feed-through device.
b. Multiple GFCI receptacles within dwelling units, where shown on the plans to be on the same circuit, may be protected with a single GFCI receptacle.

D. Weather-Resistant Receptacles

1. Receptacles shall UL-listed as weather-resistant.
2. Receptacles shall be identified with an "WR" on the receptacle face.
3. Products: Refer to General Requirements for Convenience Receptacles. WR receptacles shall be of same series.

E. Hospital Grade Receptacles

1. Receptacles shall be readily identified as "Hospital Grade" by use of a green dot visible on the receptacle face.
2. General Convenience Receptacles: Subject to compliance with requirements, provide one of the following:

a. Refer to list of approved manufacturers in general section.
b. Receptacle model/series (all manufacturers): 8310 (single), 8300 (duplex).

3. GFCI Receptacles: Subject to compliance with requirements, provide one of the following:

a. Cooper; SGFH20.
b. Hubbell; GFRST83.
c. Leviton; GFNT2-HG.
d. Pass & Seymour; 2097HG.

F. USB Receptacles

1. Convenience receptacle with USB A & C charging ports.
2. Two USB charging ports, minimum 5A, 5V, compatible with USB 2.0, 3.0, 3.1 devices.
3. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TR7756.
b. Hubbell; USB20AC5.
c. Leviton; T5833.
d. Pass & Seymour; TR20USBAC.

G. Isolated Ground Receptacles

1. IG receptacles shall be 3 wire grounding type NEMA No. 5-20R-IG.
2. Receptacle shall be constructed with Nylon face and base; .050 gauge brass nickel-plated backstrap with isolated ground design; riveted self-grounding clip; and .040 gauge solid brass, nickel-plated, triple-wipe contacts.
3. Products: Refer to General Requirements for Convenience Receptacles. IG receptacles shall be of same series.

H. Surge Suppression Receptacles

1. Surge Suppression receptacles shall be isolated ground, duplex receptacle design, and shall contain surge suppression device to protect appliances served by the receptacle.
2. Receptacles shall provide 13,000 Amps Maximum Surge Current Line to Neutral; 6,500 ampere Maximum Surge Current Line to Ground; and 6,500 ampere Max. Surge Current Neutral to Ground; each based on IEEE C62.41, * X 20 us waveform.
3. Receptacle shall be certified by UL 1449 to have maximum clamping voltage of 500 Volts Peak Line to Neutral, Line to Ground, and Neutral to Ground based on Class B, 6KV, 3KA impulse, and shall be suitable for ANSI/IEEE C62.41-1980 installation categories A and B.
4. Receptacle shall have an audible alarm.

I. Clock Outlets

1. Clock Outlets shall be equipped with recessed grounded receptacle mounted in a satin stainless steel plate.

J. Tamper-Resistant Receptacles

1. Tamper-Resistant Receptacles shall be safety type, "childproof," duplex, 3 wire, ground type.
2. Products: Refer to General Requirements for Convenience Receptacles. TR receptacles shall be of same series.

2.3. SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.
B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Catalog numbers in subparagraphs below are for 20-A devices; revise catalog numbers if 15-A devices are desired.
   b. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
   c. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
   d. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
   e. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 2221PL for 120 V and 277 V.
   b. Hubbell; HPL1221PL for 120 V and 277 V.
   c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
   d. Pass & Seymour; PS20AC1-PLR for 120 V.
2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cooper; 2221L.
   b. Hubbell; HBL1221L.
   c. Leviton; 1221-2L.
   d. Pass & Seymour; PS20AC1-L.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.4. WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices.
2. 2000 W; dimmers where required by load.

D. Dimmer Switches for LED fixtures: Modular; compatible with dimming drivers in fixture(s); if other than 0-10V dimming is provided, verify dimmer is compatible with driver for full range of dimming (100-10%).

2.5. OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 6111 for 120 V, 6117 for 277 V.
b. Hubbell; WS1277.
c. Leviton; ODS 10-ID.
d. Pass & Seymour; WS3000.
e. Steinel; IL WLS 1.
f. Watt Stopper (The); PW-101.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

B. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Hubbell; ATP1600WRP.
b. Leviton; ODWWV-IRW.
c. Pass & Seymour; WA1001.
d. Steinel; IL WLS 1
e. Watt Stopper (The); CX-100.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft..

2.6. SPECIAL PURPOSE DEVICES

A. Provide where indicated, specified or as required other appropriate NEMA configured devices appropriate for such equipment as thru-wall units manufactured by the same manufactures.

2.7. WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch-thick, satin-finished stainless steel.
3. Material for Finished Spaces: Vinyl, with color matching respective device.
4. Material for Unfinished Spaces: Galvanized steel.
5. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable in-use cover.
C. Damp-Location, Damp Location Cover Plates: NEMA 250, springl loaded and gasketed, die-cast aluminum.
D. Emergency Devices

1. Coverplates for devices fed from emergency power shall be denoted as such with a device plate engraved with the word "EMERGENCY" in red capital letters.

2.8. FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
B. Compartments: Barrier separates power from voice and data communication cabling.
C. Service Plate: solid brass with satin finish.
D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable.

2.9. SINGLE AND MULTIPLE STATION (120V) DETECTORS

A. Smoke Detectors:

1. Detector shall comply with the following:
   a. UL 217 (Standard for Sinlge and Muliple Station Smoke Alarms)
   b. Suitable for residential occupancies per NFPA 101
2. Detector shall be a dual-sensor (combination photoelectric and ionization detection) model.
3. Operate at 120V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device.
4. Auxiliary Relays: Provide as required.
5. Test Switch: Push to test; simulates smoke at rated obscuration.
6. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
7. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
8. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
9. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
10. Where indicated on plans, provide Audible (Sounder) and/or Visual Base(s) for detector(s).

B. Combination Smoke/Carbon Monoxide Detectors:

1. Same as above requirements for smoke detectors, except as modified below:
2. Smoke detection may be by a photoelectric sensor only.
3. Comply with UL 2034 (Standard for Single and Multiple Station Carbon Monoxide Alarms).

C. Duct Smoke Detectors:

1. Comply with UL268A.
2. Sensor: LED or infrared light source with matching silicon-cell receiver.
   a. Detector Sensitivity: Smoke obscuration between 2.5 and 3.5 percent/foot when tested according to UL 268A.
3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.
   a. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

D. Audible (Sounder) Bases:

1. Listed to UL 268, 464, & 2075.
2. Base shall include the following selectable tones (as required):
   a. Smoke: ANSI Temporal 3
   b. Carbon Monoxide: Temporal 4

E. Visible Base:

1. Shall include a 177-cd strobe.

PART 3 EXECUTION

3.1. INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the

boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Receptacle Types:

1. The following receptacle types shall be furnished in lieu of "standard" 120V, 15 or 20 amp receptacles at all of the following locations, regardless of plan designation:
    a. Refer to the National Electrical Code (NEC), for definitions of all locations listed below.
2. GFCI Receptacles:
    a. Within the following locations in dwelling units:
        i. Bathrooms
        ii. Garages
        iii. Crawl Spaces and Unfinished Areas of Basements
        iv. Above-counter receptacles in Kitchens
        v. Where located within 6'-0" of a sink.
        vi. Laundry Areaas
        vii. Where installed to serve a dishwasher.
    b. Bathrooms / Locker Rooms
    c. Kitchens (unless circuit is provided with GFCI protection at the circuit breaker)
    d. Rooftops
    e. Outdoors
    f. Where located within 6'-0" of a sink.
    g. Garages, Service Bays, etc.
    h. Unfinished areas.
3. Weather-Resistant Receptacles:
    a. In all damp or wet locations.
4. Hospital-Grade Receptacles:
    a. At all patient bed locations.
    b. All receptacles in operating rooms.
5. Tamper-Resistant Receptacles:
    a. All locations within the project shall have tamper-resistant receptacles
    b. Business Offices
    c. General Corridors
    d. Patient Sleeping Rooms
    e. Waiting Rooms
    f. Waiting Rooms/Areas
    g. Gymnasiums
    h. Auditoriums
    i. Exceptions:
        i. Receptacles located more than 7' above the floor.
        ii. Receptacles located behind an appliance that is not easily moved.

E. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Wall plates shall not support wiring devices. Provide wiring device with accessories as required to properly install devices and wall plates.
11. All devices shall be flush-mounted except as otherwise noted on the drawings.
12. Locations
    a. Comply with layout drawings for general location; contact Owner's Representative for questions about locations and mounting methods.
    b. Relocate outlets obviously placed in a location or manner not suitable to the room finish.
    c. Avoid placing outlets behind open doors.
    d. Align devices vertically and horizontally. Device plates shall be aligned vertically with tolerance of 1/16". All four edges of device plates shall be in contact with the wall surface.
13. Mounting Heights as indicated on the Drawings and according to ADA requirements.
14. Ganging of Switches - provide barriers between ganged 277 volt switches of different phases.
15. Power Outlets - install power outlets complete with back boxes, where installed in existing buildings or extensions of existing buildings. Coordinate phase connections for rotating equipment with connections in existing building.
16. Install device plates on all outlet boxes. Provide blank plates for all empty, spare and boxes for future devices.
17. Caulk around edges of outdoor device plates and boxes when rough wall surfaces prevent a raintight seal. Use caulking material as approved by the Architect/Engineer.
18. Emergency/normal power devices and/or 277V/120V devices are not to occupy the same box. Where same are shown on plans to be ganged, provide separate boxes immediately adjacent to each other.

F. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up.

G. Device Plates:

1. Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
2. Provide matching blank wall plates to cover outlet or junction boxes intended for future devices.
3. Provide matching blank wall plates with 4 port knock outs at all telephone, data, and tele/data outlet locations. Also provide with matching blankouts in each port.
4. Where wall plates for special devices are available only from manufacturer of device, provide designs and finishes equivalent to above specification.
5. Verify with Architect finish of any plate where it may be apparent a special finish or color should have been specified.

H. Switches

1. Where switches are indicated to be installed near doors, corner walls, etc., mount same not less than 2 inches and not more than 18 inches from trim. Verify exact locations with the Architect.
2. Carefully coordinate the location of switches to insure locations at the strike side of doors.
3. Furnish and install an engraved legend for each switch that controls exhaust fans, motors, equipment systems, etc., not located within sight of the controlling switch.

I. Dimmers:

1. Install dimmers within terms of their listing.

2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

J. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

K. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

3.2. IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
2. Switches: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3. FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.

B. Tests for Convenience Receptacles:

1. Test for correct wire terminations (no open ground, neutral, or hot).
2. Test for correct polarity (no hot/ground reverse or hot/neutral reverse).
3. Verify GFCI devices are operating properly.
4. Using the test plug, verify that the device and its outlet box are securely mounted.

A. Tests for receptacles in Patient Care Areas:

1. In addition to above tests, each receptacle shall be tested for proper retention force per NFPA 99.

B. Test Reports

1. For all receptacles in patient care areas, record test results/data for confirmation of physical integrity, continuity of grounding circuit, correct polarity, and retention force.

END OF SECTION 262726

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
    1. Wiring Diagrams: For power, signal, and control wiring.
C. Field quality-control reports.
D. Operation and maintenance data.

1.3. QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1. DISCONNECT SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Eaton (Cutler-Hammer)
    2. General Electric Company
    3. Siemens
    4. Square D
B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
C. Accessories:
    1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
    2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
    3. Lugs: Suitable for number, size, and conductor material.
    4. Service-Rated Switches: Labeled for use as service equipment.

2.2. FUSIBLE SWITCHES

A. Refer to disconnect switches for all requirements in addition to the following.
B. Switches shall be furnished with clips or bolt pads to accommodate indicated fuses.
C. Fuse holders shall be completely accessible from front of switch and fuses shall be installed so that the label may be easily read from the front and without removing the fuse.
D. Accessories:
    1. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

2.3. MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Eaton (Cutler-Hammer)
    2. General Electric Company
    3. Siemens
    4. Square D
B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A

and larger.

D. Electronic Trip Circuit Breakers (where indicated on drawings or elsewhere in this specification): Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I2t response.

E. Features and Accessories (where called for or required):

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.4. ARC ENERGY REDUCTION SYSTEMS

A. Manufacturer shall provide an approved means of Arc Energy Reduction on all overcurrent protective devices rated 1200A or higher, or demonstrate the overcurrent protective device has a clearing time of 0.07 seconds or less at the available arcing current.

B. Manufacturer shall provide documentation showing the method chosen [above] is set to operate at a value below the available arcing current.

2.5. ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.2. IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3. FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

SECTION 262913 – ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of enclosed controller.
B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
    1. Wiring Diagrams: For power, signal, and control wiring.
C. Field quality-control reports.
D. Operation and maintenance data.

1.3. QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1. MOTOR STARTERS

A. Provide motor starters rated in accordance with NEMA and as specified and shown on plans.
    1. Equivalents by: G.E., Cutler Hammer, or I.T.E. Siemens, Square D.
    2. Install starters in locations as shown on plans, installation shall be in strict accordance with NEC, and manufacturer's installation requirements.

B. MAGNETIC MOTOR STARTERS
    1. Provide 600 volt, 60 hertz AC across-the-line magnetic type rated in accordance with NEMA Standards and listed and labeled in accordance with UL Standard 508 Eleventh Edition.
    2. Enclosures shall be NEMA type required by starter location and environment.
    3. Starter shall have permanently affixed to inside of enclosure cover an easy to read wiring diagram, including alternate control variations and a warning sign indicating maximum current limiting fuse size that may be installed in disconnect switch which will limit fault current to starters withstand rating with 100,000 RMS fault current available at disconnect switch.
    4. Starter contacts shall be silver alloy double break replacement without removal of power wiring or starter from enclosure.
    5. Provide starter with solid state type overload relays on all phases. Overload thermal unit shall be one piece interchangeable construction. Overload relays shall provide phase loss and phase failure protection. Starter shall be inoperative with overload unit removed. Starters shall not be furnished to Electrical Contractor with jumper straps in overload units.
    6. Ampere rating for overload relays shall be selected by multiplying motor nameplate running amperes at connected voltage by .90 for motors with 1.0 service and by .95 for motors with 1.15 service factor. Use resulting amperes to enter manufacturer's overload selection tables. Keep record of thermal unit number and current range.
    7. Provide starter with internal wiring and control circuits prewired with only line, load, and external control circuit wiring connections required. When starter voltage exceeds 120 volts, provide 120 volt control circuit transformer with two Dual Element Fuses in transformer primary and one fuse in the secondary.
    8. Starter shall be suitable for addition of at least four electrical interlocks of any arrangement of normally open or closed contacts.
    9. Provide starter with the following accessories: auxiliary contacts, pilot light, and H.O.A. switch.
    10. Starter applications requiring disconnect switch at starter shall be combination type motor starters in lieu of separate devices.

C. COMBINATION MAGNETIC MOTOR STARTERS
    1. Provide 600 volt, 60 hertz AC across-the-line fusible or non-fusible as scheduled magnetic type rated in accordance with NEMA Standards and listed and labeled in accordance with UL Standard 508 Eleventh

Edition.
2. Starter NEMA enclosure type shall be type required for starter location and environment.
3. Starter shall have permanently affixed to inside of enclosure cover an easy to read wiring diagram, including alternate control variations and a warning sign indicating maximum current limiting fuse size that may be installed in disconnect switch which will limit fault current to starters withstand rating with 100,000 RMS fault current available at disconnect switch.
4. Starter contacts shall be silver alloy double break replacement without removal of power wiring or starter from enclosure.
5. Provide starter with solid state type overload relays on all phases. Overload thermal unit shall be one piece interchangeable construction. Overload relays shall provide phase loss and phase failure protection. Starter shall be inoperative with overload unit removed. Starters shall not be furnished to Electrical Contractor with jumper straps in overload units.
6. Ampere rating for overload relays shall be selected by multiplying motor nameplate running amperes at connected voltage by .90 for motors with 1.0 service and by .95 for motors with 1.15 service factor. Use resulting amperes to enter manufacturer's overload selection tables. Keep record of thermal unit number and current range.
7. Provide combination starter with internal wiring and control circuits prewired with only line, load, and external control circuit wiring connections required. When starter voltage exceeds 120 volts, provide 120 volt control circuit transformer with two Dual Element Fuses in transformer primary and one fuse in the secondary.
8. Starter shall be suitable for addition of at least four electrical interlocks of any arrangement of normally open or closed contacts.
9. Provide starter with the following accessories: auxiliary contacts, pilot light, and H.O.A. switch.
10. Where fusible CMS are called for fuse holders shall be high pressure suitable for use with dual element fuses or rejection type current limiting fuses where required.
11. Fuse holders shall be completely accessible from front of switch and fuses shall be installed so that the fuse type and size may be easily read from the front and without removing the fuse.
12. All fuse holders shall have rejection clips installed.
13. See plans for combination magnetic starters.

D. MANUAL MOTOR CONTROL (1 HP Maximum)

1. Provide 300 volt, 60 cycle, AC manually operated motor starting switch meeting current NEMA Standards with proper NEMA enclosure required by starter location and environment.
2. Starter shall have heavy silver alloy contacts with quick-make, quick-break mechanism manually operated by toggle switch.
3. Thermal unit shall be melting alloy type, resettable, one-piece interchangeable construction.
4. Provide starter with all accessories such as pilot light, H.O.A. or two speed switches required to provide control sequence shown on drawings or specified. Selector switches contact shall have same ampere rating as starter switch.

PART 3 EXECUTION

3.1. INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height, and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

B. Floor-Mounted Controllers: Install enclosed controllers on 4-inch nominal-thickness concrete base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in each fusible-switch enclosed controller.

E. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."

F. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

G. Comply with NECA 1.

3.2. IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.3. CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices[and facility's central control system]. Comply with requirements in Division 26 Section "Control-Voltage Electrical Power Cables."
B. Bundle, train, and support wiring in enclosures.
C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.4. FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.
E. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5. ADJUSTING

A. Set field-adjustable switches and overload-relay pickup and trip ranges.
B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Architect before increasing settings.

3.6. DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 262923 – VARIABLE FREQUENCY & SOFT START MOTOR CONTROLLERS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 260010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION

A. This specification is to cover a complete Adjustable Frequency motor Drive (AFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. The drive shall be designed specifically for variable torque applications. It is required that the drive manufacturer have an existing:
B. The drive and all necessary controls as herein specified shall be factory built and supplied by the drive manufacturer in an ISO 9000 approved environment The manufacturer shall have been engaged in the production of this type of equipment for a minimum of ten years. AFD's that are manufactured by a third party and "name branded" shall not be acceptable.

1.3. QUALITY ASSURANCE

A. Testing:

1. All printed circuit boards shall be completely tested and burned-in before being assembled into the completed AFD. The AFD shall then be subjected to a computerized systems test (cold), burn-in, and computerized systems test (hot). The burn-in shall be at 104 °F (40°C), at full rated load.
2. All testing and manufacturing procedures shall be ISO 9001 certified.

B. Failure Analysis:

1. AFD manufacturer shall have an analysis laboratory to evaluate the failure of any component. The failure analysis lab shall allow the manufacturer to perform complete electrical testing, x-ray of components, and decap or delaminate of components and analyze failures within the component.

C. Qualifications:

1. AFDs and options shall be UL listed as a complete assembly.
2. AFDs and options shall be cUL listed as a complete assembly.
3. AFD's and options shall be CE labeled as a component.

1.4. SUBMITTALS

A. Submittals shall include the following information:

1. Outline Dimensions
2. Weight
3. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion.
    a. The AFD manufacture shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the AFD manufacturer to ensure compliance with IEEE standard 519 (latest version), guide for Harmonic Control and Reactive Compensation for Static Power Converters. The acceptance of this calculation must be completed prior to AFD installation.
    b. Prior to installation, the AFD manufacturer shall provide the estimated total harmonic distortion (THD) caused by the AFDs. The results shall be based on a computer aided circuit simulation of the total actual system, with information obtained from the power provider and the user.
    c. If the voltage THD exceeds 5%, the AFD manufacturer is to provide the additional equipment required, at no cost to the owner, to reduce the voltage THD to this level.
    d. The AFD shall be acceptable for use with motor output wiring lengths up to 200 feet, when using a motor that complies with NEMA MG1, part 31. AFD's that do not meet this requirement must provide a tuned dv/dt output filter, factory mounted and wired, in the AFD enclosure.

1.5. WARRANTY

A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of manufacturer. The warranty shall include all parts, labor, travel time and expenses.

PART 2 PRODUCTS

2.1. ADJUSTABLE FREQUENCY DRIVES

A. Acceptable current technology AFD products are ABB ACH400 (Asea Brown Boveri), Eaton HV9000 , Graham VLT6000, or prior approved equal products

B. The adjustable frequency drives (AFDs) shall be solid state, with a Pulse Width Modulated (PWM) output. The AFD package as specified herein shall be enclosed in a NEMA 1 enclosure, completely assembled and tested by the manufacturer. The AFD shall employ a full wave rectifier (to prevent input line notching), Integral Line Reactor(s), Capacitors, and Insulated Gate Bipolar Transistors (IGBT's) as the output-switching device. The drive efficiency shall be 97% or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.

C. Specifications for the 3 HP to 400 HP at 480 volts and 2 to 100 HP at 240 volts:

1. Input 380/415/440/460/480 VAC +/- 10%, 3 phase, 48-63 Hz or input 200/208/220/230/240 VAC +/- 10%, 3 phase, 48-63 Hz. Undervoltage trip @ rated input -35%, Overvoltage trip @ rated input +35%.
2. Interrupt rating 65 kAIC, suitable for use on a circuit capable of delivering not more than 65,000 RMS symmetrical amps, 480 V maximum.
3. Output Frequency 0 to 250 Hz. Operation above 60 Hz shall require programming changes to prevent inadvertent high-speed operation.
4. Environmental operating conditions: 0 to 40°C, 0 to 3300 feet above sea level, less than 95% humidity, non-condensing. Drives shall be rated full capacity at actual operating conditions (temperature and elevation) where located on project and as applied or utilized.
5. Enclosure shall be rated NEMA 1 or NEMA 12 per the notes on equipment schedule.

D. All AFDs shall have the following standard features:

1. All AFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus. The keypad shall be removable, capable of remote mounting, and shall have it's own non-volatile memory. The keypad shall allow for uploading and downloading of parameter settings as an aid for start-up of multiple AFDs.
2. The keypad shall include Hand-Off-Auto membrane selections. When in "Hand", the AFD will be started and the speed will be controlled from the up/down arrows. When in "Off", the AFD will be stopped. When in "Auto", the AFD will start via an external contact closure and the AFD speed will be controlled via an external speed reference. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Auto" and "Hand" modes.
3. The AFD's shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time.
4. The AFD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
5. The AFD shall be capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to setpoint without safety tripping or component damage (flying start). The AFD shall also be capable of DC injection braking at start to stop a reverse spinning motor prior to ramp.
6. The AFD shall be equipped with an automatic extended control power ride-through circuit, which will utilize the inertia of the load to keep the drive powered. Typical control power ride-through for a fan load shall be 2 seconds minimum.
7. If the input reference (4-20mA or 2-10V) is lost, the AFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.
8. The customer terminal strip shall be isolated from the line and ground.
9. The drive shall employ current limit circuits to provide trip free operation:
   a. The Slow Current Regulation limit circuit shall be adjustable to 150% (minimum) of the AFD's normal duty current rating. This adjustment shall be made via the keypad, and shall be displayed in actual amps, and not as percent of full load.
   b. The Current Switch-off limit shall be fixed at 350% (minimum, instantaneous) of the AFD's normal duty current rating.
10. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute in every 10 minutes
11. The AFD shall have integral Input Reactor(s) with a minimum of 3% impedance in the form of AC or DC

reactors. DC reactors shall be located on both the positive and negative bus rails to reduce the harmonics to the power line and to increase the fundamental power factor.

12. The AFD shall be capable of sensing a loss of load (broken belt / no water in pump) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.
13. The AFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback or follower signal.

E. All AFDs to have the following adjustments:

1. Two (2) programmable critical frequency lockout ranges to prevent the AFD from operating the load continuously at an unstable speed.
2. PID Setpoint controller shall be standard in the drive, allowing a pressure or flow signal to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The auxiliary power supply shall have overload and over current protection. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus.
3. Two (2) programmable analog inputs shall accept a current or voltage signal for speed reference, or for reference and actual (feedback) signals for PID controller. Analog inputs shall include a filter; programmable from 0.01 to 10 seconds to remove any oscillation in the input signal. The minimum and maximum values (gain and offset) shall be adjustable within the range of 0 - 20 ma and 0 - 10 Volts. Additionally, the reference must be able to be scaled so that maximum reference can represent a frequency less than 60 Hz, without lowering the drive maximum frequency below 60 Hz. Process variables shall be modifiable by math functions such as multiplication and division between the two signals (fan tracking), high/low select, as well as inverted follower.
4. Five (5) programmable digital inputs for maximum flexibility in interfacing with external devices. One digital input is to be utilized as a customer safety connection point for fire, freeze, and smoke interlocks (Enable). Upon customer reset (reclosure of interlock) drive is to resume normal operation.
5. One (1) programmable analog output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
6. Two (2) programmable digital relay outputs. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; Continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable. Relays shall be capable of programmable on and off delay times.
7. Seven (7) programmable preset speeds.
8. Two independently adjustable accel and decel ramps. These ramp times shall be adjustable from 1 to 1800 seconds.
9. The AFD shall Ramp or Coast to a stop, as selected by the user.

F. The following operating information displays shall be standard on the AFD digital display. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of two operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

1. Output Frequency
2. Motor Speed (RPM, %, or Engineering units)
3. Motor Current
4. Calculated Motor Torque
5. Calculated Motor Power (kW)
6. DC Bus Voltage
7. Output Voltage
8. Heatsink Temperature (deg F)
9. Analog Input Values
10. Analog Output Value
11. Keypad Reference Values
12. Elapsed Time Meter (resettable)
13. kWh meter (resettable)
14. mWh meter
15. Digital input status
16. Digital output status

G. The AFD shall have the following protection circuits. In the case of a protective trip, the drive shall stop, and announce the fault condition in complete words (alphanumeric codes are not acceptable).

1. Overcurrent trip 350% instantaneous (170% RMS) of the AFD's variable torque current rating.
2. Overvoltage trip 130% of the AFD's rated voltage
3. Undervoltage trip 65% of the AFD's rated voltage
4. Overtemperature +90° C, Heatsink Temperature
5. Ground Fault either running or at start
6. Adaptable Electronic Motor Overload (I2t). The Electronic Motor Overload protection shall protect the motor based on speed, load curve, and external fan parameter. Circuits, which are not speed dependant, are unacceptable. The electronic motor overload protection shall be UL Listed for this function.

H. Speed Command Input shall be via:

1. Keypad.
2. Two Analog inputs, each capable of accepting a 0-20mA, 4-20mA, 0-10V, 2-10V signal.
3. Floating point input shall accept a three-wire input from a Dwyer Photohelic (or equivalent type) instrument.
4. Serial Communications

I. Serial Communications

1. The AFD shall have an RS-485 port as standard. The standard protocol shall be Modbus.
2. The AFD shall be able to communicate with PLC's, DCS's, and DDC's.
3. Serial communication capabilities shall include, but not be limited to, run-stop control; speed set adjustment, proportional/integral/derivative PID control (Set Point) adjustments, current limit, and accel/decel time adjustments. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, digital inputs and diagnostic warning and fault information. Additionally, remote (LAN) VFD fault reset shall be possible. A minimum of 15 field parameters shall be capable of being monitored.
4. The AFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. The serial communications interface shall allow for DO (relay) control and AO (analog) control without being tied to a VFD function. In addition, all drive digital and analog inputs shall be capable of being monitored by the DDC system.
5. The AFD shall have the capability of accepting fiber optic cables for connection to standard ABB fieldbus adapters. Communications between the drive and fieldbus adapters shall be at 1Mega Baud.
6. The AFD shall be connectable to a PC based software tool capable of operating, programming, monitoring the drive as well as diagnosing faults.

J. ADDITIONAL PROVIDED FEATURES

1. Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly. Bypass package must be factory built.

   a. Microprocessor based Bypass Controller - Manual or automatic (selectable) transfer to line power via contactors. A keypad to control the bypass controller is to be mounted on the enclosure door. The bypass keypad shall include a one line diagram and status LEDs to indicate the mode of operation, drive and bypass status and ready & enable conditions. When in the "Normal" mode, the bypass contactor is open and the drive output contactor is closed. In the "Test" position, the drive output contactor is open, in the "Bypass" position, the drive output contactor is open, and the bypass contactor is closed via Start/stop command. Start/stop via customer supplied maintained contact shall be 24V or 115V compatible and shall function in both the "Normal" and "Bypass" modes. The voltage tolerance of the bypass power supply shall be +30/-35% to eliminate the problem of contactor coil burnout. The design shall include single-phase protection in both the AFD and bypass modes.
   b. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, Drive or Bypass modes.
   c. Automatic / manual bypass operation shall be selectable in the standard microprocessor based bypass design.
   d. Door / cover interlocked disconnect switch which will disconnect all input power from the drive, bypass and all internally mounted options. The disconnect handle shall be through the door, and be padlock able in the "Off" position.
   e. Fast acting semi-conductor fuses exclusive to the AFD – fast acting semi-conductor fuses allow the AFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs, which have no such fuses, or that, incorporate fuses common to both the AFD and the bypass will not be accepted. In such designs, a fuse clearing failure would render the bypass unusable.

2. Sun shield. All exterior drives shall be provided with a sun shield.
3. Provide a disconnect for each VFD matching ampacity rating and enclosure NEMA requirements. The disconnect by be integral as an option to VFD in accordance with NEC disconnect requirements.

2.2. SOFT STARTERS

A. Soft start starters shall consist of a main disconnect switch, a mechanical contactor, a six-SCR full wave bridge solid state reduced voltage starter, a thermal overload relay factory assembled in a single enclosure, with ratings, features and accessories as specified below. The soft start shall be capable of controlling the starting inrush of a NEMA design B motor, and to reduce water hammer effects of the pumps when the motor is stopped.

B. Ratings and features:

1. Starter voltage as noted on electrical drawings
2. Enclosure type, NEMA 1 ventilated
3. Main AC line fused disconnect or circuit breaker mounted and wired, with a door interlock mechanism and padlocking means.
4. Starter shall include a full NEMA style, HP sized and rated series contactor, including contacts and coils, ahead of the solid state electronics. Contactor shall open on normal stop command, and if a shorted SCR is detected.
5. Starter shall be rated for a minimum of 350 percent current for 30 seconds.
6. Starter shall include adjustable thermal overload protection.
7. Starter shall include maintained contact H-O-A selector switch and red running pilot light.
8. Starter shall include an integral 120V control circuit transformer with primary and secondary fusing.
9. Starter shall be rated for full current operation at 40 degrees C ambient temperature.
10. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division-15 Controls sections. In addition to the interlock & switches specified above each soft start starter shall be provided with (4) four additional spare sets of auxiliary contacts, (2) two normally open & (2) two normally closed.

C. Protective features and adjustments:

1. SCR's shall be rated for 1600 PIV minimum.
2. Instantaneous overcurrent trip shall be included if current exceeds 900 percent FLA.
3. Metal Oxide Varistor (MOV) suppressors shall be provided.
4. Heat sink overtemperature switch shall be provided.
5. Starter shall include shorted SCR detection and lockout.
6. Starter shall not start if a phase loss condition is present.
7. Diagnostics shall include LED indicators for:
    a. 3 phase power present
    b. Shorted SCR detected
    c. Motor overload
    d. Instantaneous overcurrent
    e. Starter ready
    f. Starter on
    g. Power supply failure
8. A fault relay shall be included to trip the series contactor in the event of motor thermal overload, instantaneous overcurrent, or presence of a shorted SCR.
9. Adjustments shall include ramp time, current limit, jog voltage, jog time, and deceleration time.

D. Operational Features

1. On starting, the starter shall be capable of applying an adjustable "jog" voltage to the motor for an adjustable time to magnetize the motor, then automatically switch to a controlled current ramp mode to accelerate the load.
2. On stopping, the starter shall include an "anti-water hammer" circuit which is capable of accepting a 0-10V DC signal proportional to flow from the building automation system and controlling the voltage to the motor to obtain a smooth reduction in flow without excessive pipe movement or water hammer. As a backup, a linear voltage ramp deceleration mode shall be available.
3. Field Start-up and Service: Soft starter supplier shall provide authorized factory trained service personnel to do on-site start-up and adjustment for each soft start starter.

PART 3 – EXECUTION

3.1. INSTALLATION

A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.

B. Power wiring shall be completed by the electrical contractor. The contractor shall complete all wiring in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.

3.2. CIRCUITING

A. When PVC conduits are allowed for installation by other portions of the specification or drawings for application, shielded cables shall be utilized for all circuiting between VFD and load.

3.3. START-UP

A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.4. PRODUCT SUPPORT

A. Factory trained application engineering and service personnel that are thoroughly familiar with the drive products offered shall be locally available at both the specifying and installation locations.

3.5. WARRANTY

A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of manufacturer. The warranty shall include all parts, labor, travel time and expenses.

END OF SECTION 262923

END OF DIVISION 260000

TURNER SIXTH GRADE ACADEMY - BOILER REPLACEMENT

6425 RIVERVIEW AVE, KANSAS CITY, KS 66102

ABBREVIATIONS

[illegible]

FIRE SEALING NOTES

[illegible]

GENERAL ELECTRICAL NOTES

[illegible]

ELECTRICAL SYMBOL LEGEND

[illegible]

MECHANICAL AND PLUMBING SYMBOL LEGEND

[illegible]

SHEET INDEX

COORDINATION NOTES

[illegible]

GENERAL NOTES

[illegible]

DEMOLITION NOTES

[illegible]

GEN. MECHANICAL NOTES

[illegible]

GENERAL PLUMBING NOTES

[illegible]

GEN. RENOVATION NOTES

[illegible]

KEY PLAN

NTS

pkmr ENGINEERS

COVER SHEET

01/23/2025

24.487

ME0.1

TURNER SIXTH GRADE ACADEMY - BOILER REPLACEMENT

6425 RIVERVIEW AVE, KANSAS CITY, KS 66102

pkmr ENGINEERS
PEARSON KENT MCKINLEY RAAF ENGINEERS LLC
LENEXA, KS

HVAC PIPING MATERIAL SCHEDULE

SYSTEM	SIZE	[illegible]	MATERIAL	[illegible] FITTINGS	FIELD TEST	ALLOWABLE IN [illegible]	INSULATION TYPE	INSULATION THICKNESS
CONDENSATE DRAIN [illegible]	[illegible]	SCH. 40	CPVC	[illegible]	[illegible]	[illegible]	FIBERGLASS W/ ASJ	[illegible]
HEATING HOT WATER	[illegible]	SCH. 40	STEEL - [illegible]	[illegible]	[illegible]	[illegible]	FIBERGLASS W/ ASJ	[illegible]
HEATING HOT WATER	[illegible]	SCH. 40	STEEL - [illegible]	[illegible]	[illegible]	[illegible]	FIBERGLASS W/ ASJ	[illegible]
BOILER RELIEF	[illegible]	SCH. 40	STEEL - [illegible]	[illegible]	[illegible]	[illegible]	-	-

NOTES:
1. ALL INSULATION THICKNESSES SHALL MEET ASHRAE 90.1 - 2019 REQUIREMENTS AT A MINIMUM.
2. REFER TO SPECIFICATIONS FOR MORE DETAILED INFORMATION.

HIGH EFFICIENCY BOILER SCHEDULE

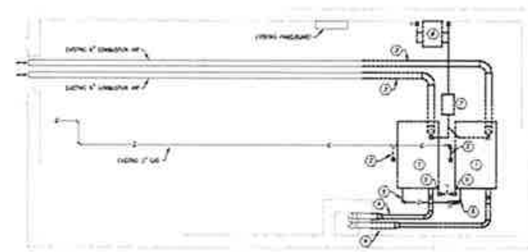
PLAN MARK	MANUFACTURER	CATALOG NUMBER	INPUT (MBH)	OUTPUT (MBH)	[illegible]	[illegible]	VENT SIZE	COMB. AIR SIZE	ELECTRICAL	REMARKS
B-1	LOCHINVAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	120V / 1PH	1,2,3,4,5
B-2	LOCHINVAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	120V / 1PH	1,2,3,4,5

REMARKS:
1. CONDENSING-TYPE BOILER.
2. BOILER TO BE ABLE TO FIT THROUGH A 34" DOOR.
3. PROVIDE MINIMUM 15:1 TURNDOWN RATIO.
4. FURNISH WITH ACCESSORIES TO TIE INTO EXISTING TRANE MODBUS BAS.
5. PROVIDE CONDENSATE NEUTRALIZATION KIT.

PUMP SCHEDULE

PLAN MARK	MANUFACTURER	MODEL NUMBER	GPM	HEAD (FT)	HP	MAX. RPM	ELECTRICAL	NOTES
P-1	BELL & GOSSETT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	460V / 3PH	1,2,3
P-2	BELL & GOSSETT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	460V / 3PH	1,2,3

REMARKS:
1. PROVIDE VFD.
2. FURNISH WITH ACCESSORIES TO TIE INTO EXISTING TRANE MODBUS BAS.
3. NEW PUMPS AND ASSOCIATED PIPING, ACCESSORIES, AND CONTROLS TO BE A PART OF BID ALTERNATE #1.



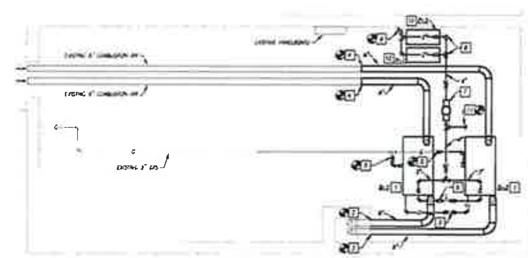
ME - DEMOLITION PLAN

GENERAL DEMOLITION NOTES

1. REFER TO GENERAL DEMOLITION NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.

DEMOLITION PLAN KEYED NOTES

1. REMOVE EXISTING BOILER. COORDINATE WITH OWNER FACILITIES TEAM TO SALVAGE BOILER PARTS.
2. REMOVE EXISTING 2" GAS PIPE. CAP AND PREPARE FOR RECONNECTION IN NEW WORK PLANS.
3. REMOVE 6" COMBUSTION AIR AS SHOWN. PREPARE FOR RECONNECTION IN NEW WORK PLANS.
4. REMOVE ALL EXISTING BOILER FLUE DUCTWORK UP TO THE CHIMNEY.
5. REMOVE ALL EXISTING CONDENSATE DRAIN PIPING.
6. REMOVE EXISTING 4" RETURN HOT WATER PIPING AS SHOWN. PREPARE EXISTING PIPING FOR RECONNECTION IN NEW WORK PLANS.
7. REMOVE EXISTING AIR SEPARATOR AND ALL ASSOCIATED HOT WATER PIPING BETWEEN THE BOILERS AND THE PUMPS.
8. REMOVE EXISTING PUMPS, HOT WATER SUPPLY PIPING, AND ASSOCIATED ACCESSORIES. CAP SUPPLY PIPING AT DROP AS SHOWN AND PREPARE FOR RECONNECTION IN NEW WORK PLANS. REMOVE EXISTING CHEMICAL FEED PIPING CONNECTION AND PREPARE FOR RECONNECTION IN NEW WORK PLANS.



ME - NEW WORK PLAN

GENERAL HVAC NOTES

1. REFER TO GENERAL NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.
2. ALL 90 DEGREE SUPPLY ELBOWS SHALL BE SMOOTH ROUND OR SQUARE WITH TURNING VANES.
3. DUCT SIZES SHOWN ON PLANS ARE INSIDE FREE AREA.

HVAC PLAN KEYED NOTES

1. MOUNT NEW BOILER ON EXISTING HOUSEKEEPING PAD. CONNECT BOILER TO EXISTING 120V/1PH CIRCUIT PREVIOUS BOILERS UTILIZED.
2. CONNECT NEW 6" FLUE PIPE TO EXISTING 6" FLUE PIPE IN THE CHIMNEY. MATERIAL SHALL BE STAINLESS STEEL VENT PIPE IN COMPLIANCE WITH UL-1738.
3. TERMINATE CONDENSATE AT EXISTING FLOOR DRAIN.
4. CONNECT NEW 6" COMBUSTION AIR PIPE TO EXISTING 6" COMBUSTION AIR PIPE. MATERIAL SHALL BE CPVC, ABS, OR PVC.
5. CONNECT NEW 2-1/2" NATURAL GAS PIPE TO EXISTING GAS. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. REFER TO DETAIL FOR FURTHER REQUIREMENTS.
6. CONNECT TWO NEW 3" HOT WATER RETURN LINES OFF OF EXISTING TEE AS SHOWN. EACH RESPECTIVE 3" HOT WATER RETURN TO SERVE EACH BOILER.
7. PROVIDE NEW AIR SEPARATOR - SPIROTHERM VSR FLANGED AIR SEPARATOR WITH 4" CONNECTIONS.
8. 3" HOT WATER SUPPLY PIPING DOWN TO CONNECT TO GROUND-MOUNTED END-SUCTION PUMP. REFER TO DETAIL FOR FURTHER REQUIREMENTS.
9. CONNECT 4" PIPES TO EXISTING HOT WATER SUPPLY PIPING.
10. MOUNT NEW PUMPS ON EXISTING HOUSEKEEPING PAD. EXTEND HOUSEKEEPING PAD TO HOUSE NEW FOOTPRINT. CONNECT TO EXISTING

BID ALTERNATE #1: PUMP REPLACEMENT
ALL WORK INCLUDING BUT NOT LIMITED TO REPLACING EXISTING P-1 AND P-2 AND ASSOCIATED PIPING, ACCESSORIES, AND CONTROLS AS SHOWN ON PLANS.

SHEET TITLE	ENLARGED PLANS
DATE	01/23/2025
PKMR PROJECT	24.487
SHEET NUMBER	ME0.2

DIVISION 23
TABLE OF CONTENTS

SECTION 230010 – MECHANICAL PROVISIONS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. All contract documents including drawings, alternates, addenda and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specification Sections, apply to work of this section. All preceding and following sections of this specification division are applicable to the Mechanical Contractor, all sub-contractors, and all material suppliers.

1.2. SCOPE OF WORK

A. This DIVISION requires the furnishing and installing of complete functioning Mechanical systems, and each element thereof, as specified or indicated on Drawings or reasonably inferred, including every article, device or accessory reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include materials, labor, supervision, supplies, equipment, transportation, and utilities.

B. In case of an inconsistency between the Drawings and Specifications or within either document, the better quality or the greater quantity of work shall be provided in accordance with the Architect or Engineer's interpretation.

C. Refer to Architectural, Structural and Electrical Drawings and all other contract documents and to relevant equipment drawings and shop drawings to determine the extent of clear spaces and make all offsets required to clear equipment, beams and other structural members to facilitate concealing piping and ductwork in the manner anticipated in the design.

1.3. SPECIFICATION FORM AND DEFINITIONS

A. The Engineer indicated in these specifications is Pearson Kent McKinley Raaf Engineers LLC. 13300 W 98th Street, Lenexa, KS 66215, PHONE 913-492-2400, EMAIL admin@pkmreng.com.

B. Contractor, wherever used in these specifications, shall mean the Company that enters into contract with the Owner to perform this section of work.

C. When a word, such as "proper", "satisfactory", "equivalent", and "as directed", is used, it requires the Architect-Engineer's review.

D. "PROVIDE" means to supply, purchase, transport, place, erect, connect, test, and turn over to Owner, complete and ready for regular operation, the particular Work referred to.

E. "INSTALL" means to join, unite, fasten, link, attach, set up, or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular Work referred to.

F. "FURNISH" means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application for the particular Work referred to.

G. "WIRING" means the inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such Work.

H. "CONDUIT" means the inclusion of all fittings, hangers, supports, sleeves, etc.

I. "AS DIRECTED" means as directed by the Architect/Engineer, or his representative.

J. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed above hung ceilings.

1.4. QUALIFICATIONS

A. The contractors responsible for work under this section shall have completed a job of similar scope and magnitude within the last 3 years. The contractors shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Unlicensed workers and general laborers shall be adequately supervised to insure competent and quality work and workmanship required by this contract and all other regulations, codes and practices. At all times the contractors shall comply with all applicable local, state and federal guidelines, practices and regulations. Contractor may be required to submit a statement of qualifications upon request before any final approval and selection. Failure to be able to comply with these requirements is suitable reason for rejection of a bid.

1.5. LOCAL CONDITIONS

A. The contractor shall visit the site and determine the existing local conditions affecting the work required. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

1.6. CONTRACT CHANGES

A. Changes or deviations from the contract documents; including those for extra or additional work must be

submitted in writing for review of Architect-Engineer. No verbal change orders will be recognized.

1.7. LOCATIONS AND INTERFERENCES

A. Locations of equipment, piping and other mechanical work are indicated diagrammatically by the mechanical drawings. The Contractor shall determine the exact locations on site, subject to structural conditions, work of other Contractors, and access requirements for installation and maintenance to approval of Architect-Engineer. Provide additional piping and ductwork offsets as required at no additional cost.
B. Study and become familiar with the contract drawings of other trades and in particular the general construction plans and details in order to obtain necessary information for figuring installation. Cooperate with other contractors and install work in such a way as to avoid interference with their work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Architect-Engineer.
C. Any pipe, ductwork, equipment, apparatus, appliance or other item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed, relocated and reconnected without extra cost. Damage to other work caused by this Contractor, the Subcontractor, or workers shall be restored as specified for new work.
D. Do not scale mechanical and electrical drawings for dimensions. Contractor shall accurately layout work from the dimensions indicted on the Architectural drawings unless they are found to be in error.

1.8. PERFORMANCE

A. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.
B. The Contractor warrants to the Owner and Architect-Engineer the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.

1.9. WARRANTY

A. The Contractor warrants to the Owner and Architect-Engineer that upon notice from them within a one year warranty period following date of acceptance, that all defects that have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense.
B. Warranty for all equipment shall take effect from the date of substantial completion regardless of the date equipment was installed.
C. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

1.10. ALTERNATES

A. Refer to General Requirements for descriptions of any alternates that may be included.

1.11. MATERIALS, EQUIPMENT AND SUBSTITUTIONS

A. The intent of these specifications is to allow ample opportunity for Contractor to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
B. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.
C. In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product is used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.
D. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.
E. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison.
F. If the Contractor wishes to incorporate products other than those named in the Base Bid Specifications they

shall submit a request for approval of equivalency in writing no later than (10) ten calendar days prior to bid date. Substitutions after this may be refused at Engineers option. Equivalents will ONLY be considered approved when listed by addendum.

G. In proposing a substitution prior to or subsequent to receipt of bids, include in such bid the cost of altering other elements of this project, including adjustments in mechanical or electrical service requirements necessary to accommodate such substitution.

H. Within 10 working days after bids are received, the apparent low bidder shall submit to the Architect-Engineer for approval, three copies of a list of all major items of equipment they intend to provide. Within 30 working days after award of Contract, Contractor shall submit shop drawings for equipment and materials to be incorporated in work, for Architect-Engineer review. Where 30-day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, Contractor shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

1.12. ELECTRONIC PLAN FILES

A. Electronic files of the contract documents may be available from the Engineer to successful bidders and manufacturers for a fee of $50 per sheet, $100 minimum and $25 email/shipping charge. A release of liability form will be required along with payment prior to release of files.

1.13. TEMPORARY USE OF PERMANENT HVAC UNITS

A. If the Contractor elects to use permanent equipment for temporary conditioning only that permanent equipment associated with the heating system shall be allowed for use as space conditioning during the construction period. The Mechanical Contractor shall take full responsibility for all permanent equipment used for temporary conditioning during the construction period and shall provide a total of two years warranty covering all parts and labor on all permanent equipment utilized for temporary conditioning. This warranty shall cover all piping, fittings, valves, pipe and equipment insulation, pumps, boilers, chillers, condensing units, cooling towers, air handling units, exhaust and relief air fans, ductwork, ductwork insulation, diffusers, temperature controls, all electric motors, starters, disconnect switches, fuses, wire and conduit. This warranty shall cover all required maintenance on the system with the exception of filter changes, and shall start on the date shown on the final completion certificate.

B. CAUTION: The Contractor is being warned that the Architect-Engineer will not accept dirty equipment caused by construction contamination.

1.14. OPENINGS, ACCESS PANELS AND SLEEVES

A. This Contractor shall include the installation of all boxes, access panels and sleeves for openings required to install this work, except structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. Contractor shall set and verify the location of sleeves that pass through beams, as shown on structural plans. All floor and wall penetrations shall be sealed to meet fire-rating requirements.

B. All penetrations through interior or exterior and rated or non-rated walls and floors shall be appropriately sealed prevent entry and movement of rodents and insects. Contractor shall coordinate their work with all other trades.

1.15. ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS

A. Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.

1.16. EXTENT OF CONTRACT WORK

A. Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of mechanical systems. In no case will claims for "Extra Work" be allowed for work about which Contractor could have been informed before bids were taken.

B. Electrical work required to install and control mechanical equipment, which is not shown on plans or specified under Division 26, shall be included in Contractor's base bid proposal. Mechanical systems and components are to be installed as a complete system, including all miscellaneous interlock (low voltage and minor line voltage power wiring such as control motors, limit switches, relays, etc), control wiring, safeties. Coordinate interlock to other systems such as fire alarm that interlock to mechanical systems and insure that provisions are made in equipment for connection of these systems. Coordinate with all other trades for specific needs and requirements based on submitted systems.

C. Contractor shall become familiar with equipment provided by other contractors that require mechanical

connections and controls.

D. All automatic temperature control devices shall be mounted as indicated in automatic temperature control section of specifications.

E. The cost of larger wiring, conduit, control and protective devices resulting from installation of equipment which was not used for basis of design as outlined in specifications shall be paid for by Mechanical Contractor at no cost to Owner or Architect-Engineer.

F. Contractor shall be responsible for providing supervision to Electrical Contractor to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

G. Furnish four complete sets of electrical wiring diagrams to Architect-Engineer to be included in the maintenance manuals and three complete sets to Electrical Contractor. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by Electrical Contractor shall be clearly indicated by notation and drawing symbols on wiring diagrams.

H. Contractor shall obtain complete electrical data on mechanical shop drawings and shall list this data on an approved form that shall be presented monthly or on request, to Electrical Contractor. Data shall be complete with wiring diagrams received to date and shall contain necessary data on electrical components of mechanical equipment such as HP, voltage, amperes, watts, locked rotor current to allow Electrical Contractor to order electrical equipment required in his contract.

1.17. WORK NOT INCLUDED IN CONTRACT

A. Consult Division 26 of specifications for work to be provided by Electrical Contractor in conjunction with installation of mechanical equipment.

1.18. CODES, RULES AND REGULATIONS

A. Provide Work in accordance with applicable codes, rules and regulations of Local and State, Federal Governments and other authorities having lawful jurisdiction.

B. Conform to latest editions and supplements of following codes, standards or recommended practices.

C. BUILDING CODES:

1. International Codes (Latest adopted version of applicable codes)

D. SAFETY CODES:

1. National Electrical Safety Code Handbook H30 - National Bureau of Standards.
2. Occupational Safety and Health Standard (OSHA) - Department of Labor.

E. NATIONAL FIRE CODES:

1.	NFPA No. 54	National Fuel Gas Code
2.	NFPA No. 70	National Electrical Code
3.	NFPA No. 89M	Clearances, Heat Producing Appliances
4.	NFPA No. 90A	Air Conditioning and Ventilating Systems
5.	NFPA No. 91	Standard for Exhaust Systems
6.	NFPA No. 101	Life Safety Code
7.	NFPA No. 204	Standard for Smoke and Heat Venting

F. UNDERWRITERS LABORATORIES INC:

1. All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

G. MISCELLANEOUS CODES:

1. ANSI A117.1 - Handicapped Accessibility
2. Applicable State Boiler Codes
3. Americans with Disabilities Act (ADA)

H. ENERGY EFFICIENCY REQUIREMENTS:

1. All mechanical systems and components shall be manufactured and installed in compliance with ASHRAE 90.1 – 2019 and latest adopted version of IECC.

1.19. STANDARDS

A. Drawings and specifications indicate minimum construction standard. Should any work indicated be sub-standard to any ordinances, laws, codes, rules or regulations bearing on work, Contractor shall promptly notify Architect-Engineer in writing before proceeding with work so that necessary changes can be made. However, if the Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and

regulations, Contractor shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

1.20. PERMITS/FEES

A. The Contractor shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules or regulations. Keep a written record of all permits and inspection certificates and submit two copies to Architect-Engineer with request for final inspection.
B. The Contractor shall include in their base bid any fees or charges by the local utility providers to establish new services to the structure. Coordinate with the utility suppliers to verify exactly which part of the work required for the new utility service, is to be performed by the contractor and which part will be supplied by the utility company.

PART 2 - PRODUCTS

2.1. Not Used

PART 3 - EXECUTION

3.1. SUBMITTALS

A. Contractor shall furnish submittals of all materials and equipment required by the specifications. Refer to each specification section for the submittals (if any) required for that section.
B. Submittal format shall be as indicated below. Submittals not meeting these requirements will be returned without action for re-submittal.
    1. Submittals shall be furnished in an Adobe PDF format.
    2. Submittals shall be per individual submittal section, as listed in the table of contents. All required submittals within that section shall be grouped together in a single submittal.
        a. Furnishing submittals by division or by individual item may result in delayed reviewing of the submittal(s) due to additional administrative time required to process the large size and/or quantity of files.
    3. Submittals shall have a cover page containing the following information: The project name, the applicable specification section and paragraph, the submittal date, and the Contractor's stamp (see below for requirements).
    4. Mark each submitted item as applicable with scheduled mark, name, etc. corresponding to the plans.
    5. Where generic catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fitting sizes, etc. that are to be provided. Each catalog sheet shall bear the equipment manufacturer's name and address.
    6. Where equipment submitted does not appear in base specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization.
    7. All submittals on materials and equipment listed by UL shall indicate UL approval on submittal.
C. Contractor review:
    1. Contractor shall check all submittals to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Architect-Engineer for their review. All submittals submitted to Architect-Engineer shall bear contractor's approval stamp that shall indicate that Contractor has reviewed submittals and that they meet specification and/or drawing requirements. Contractor's submittal review shall specifically check for but not be limited to the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return and drainage connections to building systems. All submittals not meeting Contractor's approval shall be returned to their supplier for re-submittal.
    2. No submittals will be considered for review by the Architect-Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of the Contractor's review.
    3. Before submitting shop drawings and material lists, verify that all equipment submitted is mutually compatible and suitable for the intended use. Verify that all equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.
D. Review Schedule:
    1. The shop drawing / submittal dates shall be at least as early as required to support the project schedule and shall also allow for two weeks Architect-Engineer review time plus a duplication of this time for re-submittal if required.
    2. Submittal of all shop drawings as soon as possible after permitting approval but before construction

starts is preferred.

3. Approval of shop drawings submitted prior to receipt of a permit for that respective scope of work should be considered conditional pending review/approval of the construction documents by the AHJ. Changes required to the submittal as a result of permitting comments received after architect's/engineer's review shall not be a justification for a change in price.
4. Any time delay caused by correcting and re-submitting submittals/shop drawings will be the Contractor's responsibility.

E. The Architect's-Engineer's checking and subsequent review of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect's-Engineer's attention to such deviations at the time of submission, and secured their written approval; nor shall it relieve the contractor from responsibility for errors in dimensions, details, size of members, or omissions of components for fittings; or for coordinating items with actual building conditions and adjacent work.

F. Any corrections or modifications made by the Architect-Engineer shall be deemed acceptable to the Contractor at no change in price unless written notice is received by the Architect-Engineer prior to the performance of any work incorporating such corrections or modifications.

G. Submittals that require re-submission shall have the items that were revised "flagged" or in some other manner marked to call attention to what has been changed.

H. Coordination

1. After shop drawings have been reviewed and approved by all parties, transmit a set of submittals to each other trade (eg Plumbing, Mechanical, Electrical, Controls, etc) that will interface with installation. Each other contractor shall review the submittal for coordination and return a stamped submittal indicating they have reviewed the submittal for coordination purposes.

3.2. SHOP DRAWINGS

A. Shop drawings shall meet all of the above requirements for submittals.

B. Contractor shall submit Adobe PDF sets of all fabrication drawings. Cost of drawing preparation, printing and distribution shall be paid for by the contractor and included in his base bid.

C. No work shall be fabricated until Architect-Engineer's review has been obtained.

D. Sheet metal shop drawings for duct fabrication shall be a minimum of 1/4" scale. Sheet metal shop drawings shall not be a reproduction of the contract document and shall show details of the following: Fabrication, assembly, and installation, including plans, elevations above finished floor, sections, components, and attachments to other work. Duct layout indicating pressure classifications and sizes on plans, fittings, reinforcement and spacing, seam and joint construction, penetrations through fire-rated and other partitions, hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.

3.3. OPERATING AND MAINTENANCE INSTRUCTIONS (O & M MANUALS)

A. Submit with shop drawings of equipment, four copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Equipment manufacturer shall prepare instructions.

B. Keep in safe place, keys and wrenches furnished with the equipment provided under this contract. Present to the Owner and obtain a receipt for them upon completion of project.

C. Prepare a complete brochure, covering systems and equipment provided and installed under this contract. Submit brochures to Architect-Engineer for review before delivery to Owner. Brochures shall contain following:

1. Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined above.
2. Record copy of all submittals indicating actual equipment installed indicating options, characteristics. Copies of submittals shall bear the stamps of all parties that reviewed submittals.
3. Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
4. Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of mechanical system.

D. Provide brochures bound in three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:

1. Project name and address.
2. Section of work covered by brochure, i.e., "Plumbing", etc.

3.4. RECORD DOCUMENTS

A. During construction, keep an accurate record of all deviations between the work as shown on Drawings and that which is actually installed. Keep this record set of prints at the job site for review by the Architect/Engineer.
B. Upon completion of the installation and acceptance by the owner, transfer all record drawing information to one neat and legible set of prints. Then deliver them to the Architect/Engineer for transmittal to the Owner.
C. Provide one copy of on high quality heavy weight presentation type paper. Blueprints or other media which fade shall not be used.
D. Provide one electronic scanned version of record documents in Adobe PDF format – PDFs may be submitted on electronic media (DVD, USB) or via an FTP or other file sharing site. Provide electronic copies in conjunction with hard copy documents.

3.5. CLEANING UP

A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc., resulting from the installation of his work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean.
B. Contractor shall clean up all ductwork and equipment at the completion of the project.
C. All equipment, cabinets and enclosures shall be thoroughly vacuumed clean prior to energizing equipment and at the completion of the project. Equipment shall be opened for observation by the Architect/Engineer as required.

3.6. WATERPROOFING

A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect/Engineer and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
B. If Contractor penetrates any walls or surfaces after they have been waterproofed, he shall restore the waterproof integrity of that surface as directed by the Architect/Engineer at his own expense

3.7. CUTTING AND PATCHING

A. Contractor shall do cutting and patching of building materials required for installation of work herein specified. Remove walls, ceilings and floors (or portions thereof) necessary to accomplish scope of work. Do not cut or drill through structural members including wall, floors, roofs, and supporting structure, without the Architect's and Structural Engineer's approval and in a manner approved by them.
B. Make openings in concrete with concrete hole saw or concrete drill. Use of star drill or air hammer for this work will not be permitted.
C. Patching shall be by the contractors of the particular trade involved, shall match the existing construction type, quality, finish and texture, and shall meet approval of Architect-Engineer. Damage to building finishes, caused by installation of mechanical work shall be repaired at Contractor's expense to approval of Architect-Engineer.

3.8. SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

A. Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundation and provide proper anchor bolts and isolation as shown, specified or required by manufacturers in installation instructions. Level, shim and grout equipment bases as recommended by manufacturer. Mount motors, align and adjust drive shafts and belts according to manufacturer's instructions.
B. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.
C. Floor or pad mounted equipment shall not be held in place solely by its own dead weight. Include anchor fastening in all cases.
D. Provide indoor floor or slab mounted equipment with 3-1/2" high concrete bases unless specified otherwise. Mechanical contractor shall form all pads; General contractor shall provide and place all concrete and reinforcing for said pads. Individual concrete pad shall be no less than 4" wider and 4" longer than equipment, and shall extend no less than 2" from each side of equipment. Provide welded wire mesh in pad and tie pad to underlying concrete substrate.
E. Provide outdoor slab mounted equipment with 6" thick concrete pad. Provide on an 8" based of crushed gravel or to match other concrete construction on the site. Provide ½" rebar on 12" centers each way. Elevate top of pad at least 2" above surrounding grade. Pad shall be a minimum of 18" wider and longer for large rooftop units and condensing unit and similar large equipment requiring service and maintenance. Smaller equipment shall be sized a minimum of 4" longer and wider unless specified or detailed otherwise. Mechanical contractor shall form all pads; General contractor shall provide and place all concrete and reinforcing for said pads.
F. Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with

suitable structural support, platform or carrier in accordance with best-recognized practice. Verify that structural members of buildings are adequate to support equipment and unless otherwise indicated on plans or specified, arrange for their inclusion and attachment to building structure. Provide hangers with vibration isolators.

G. Submit details of hangers, platforms and supports together with total weights of mounted equipment to Architect-Engineer for review before proceeding with fabrication or installation.

3.9. START-UP, CHANGEOVER, TRAINING AND OPERATIONAL CHECK

A. Contractor shall perform the initial start-up of the systems and equipment and shall provide necessary supervision and labor to make the first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including manufacturer's technicians, and the Owner's operating personnel shall be present during these operations.

B. Contractor shall be responsible for training Owner's operating personnel to operate and maintain the systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructors name, names of Owner's personnel attending and total hours of instruction given each individual.

C. All owner-training sessions shall be orderly and well organized and shall be video recorded digitally. At the end of the owner training, the "training" session recording shall be transmitted to the owner via DVD and shall become property of the owner.

3.10. FINAL CONSTRUCTION REVIEW

A. At final construction review, each respective Contractor and major subcontractors shall be present or shall be represented by a person of authority. Each Contractor shall demonstrate, as directed by the Architect-Engineer, that the work complies with the purpose and intent of the contract documents. Respective Contractor shall provide labor, services, instruments or tools necessary for such demonstrations and tests.

END OF SECTION 230010

SECTION 230011 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Provide documentation of all completed tests described herein and their results.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1. TESTING PROCEDURES FOR PIPING SYSTEMS

A. Test all lines and systems before they are insulated, painted or concealed by construction or backfilling. Provide fuel, water, electricity, materials, labor and equipment required for tests.
B. Where entire system cannot be tested before concealment, test system in sections. Verify that system components are rated for maximum test pressures to be applied. Where specified test pressures exceed component ratings, remove or isolate components from system during tests. Upon completion, each system shall be tested as an entire system.
C. Repair or replace defects, leaks and material failures revealed by tests and then retest until satisfactory. Make repairs with new materials.
D. All systems shall hold scheduled test pressures for specified time without loss of initial test pressure.
E. Upon completion of testing submit five copies of a typewritten report to A/E. Report shall list systems tested, test methods, test pressures, holding time and all failures with corrective action taken.
F. For test pressure schedules see piping material schedules.

3.2. TEST METHODS AND PRESSURES

A. Test methods and pressures shall be as follows:

1. Hydrostatic Test (Closed Systems):

   a. Hydrostatic test shall be performed using clean unused domestic water. Test pressures shall be as scheduled for system or 150% of operating pressure where not specified.

2. Hydrostatic Test (Open System):

   a. Test entire system with 10-foot head of water. Where system is tested in sections each joint in building except uppermost 10 feet of system shall be submitted to at least 10-foot head of water. Water shall be held in system for 15 minutes before inspection starts. System shall hold test pressure without leaks.

3. Pneumatic Test:

   a. Test entire system with compressed air. Systems operating above 25 PSI shall be tested at 75 PSI or 15% of operating pressure or whichever is greater.
   b. Allow at least 1 hour after test pressure has been applied before making initial test.
   c. Curing test, completely isolate entire system from compressor or other sources of air pressure.

4. Pressure Relief and Safety Valve:

   a. Before installation, test pressure temperature, and safety relief valves to confirm relief settings comply with specifications.
   b. Tag items that pass test with date of test, observed relief pressure setting and inspector's signature.
   c. Items installed in systems without test tag attached will be rejected.

3.3. MISCELLANEOUS CONTROL WIRING

A. All control wiring regardless of voltage shall be routed in a concealed manner.
B. All exterior control wiring shall be installed in conduit.
C. Wiring to thermostats and other wall mounted devices and sensors shall be routed in ¾" conduit to backboxes in walls and to an accessible ceiling or location.

D. All conduit and wiring shall be installed in accordance with Division 26.
E. Cabling and circuiting shall be plenum rated where required.
F. Refer to additional specifications where systems and controls are specified as DDC or similar.

3.4. CLEANING OF SYSTEMS AND EQUIPMENT

A. After pressure testing of systems and equipment and before operational test thoroughly clean interiors of piping and equipment. Clean equipment as recommended by equipment manufacturers. Where specific instructions are not provided clean equipment systems as follows:

3.5. MAINTENANCE OF SYSTEMS

A. Contractor shall be responsible for operation, maintenance and lubrication of equipment installed under this contract.
B. Keep a complete record of equipment maintenance and lubrication and submit two copies with request for final construction review.
C. Records shall indicate types of lubricants used and date or time when next maintenance or lubrication will need to be performed by Owner. Where special lubricants are required, Contractor shall provide Owner with a one year supply as determine by Equipment Manufacturer's recommendations.

3.6. PAINTING OF MATERIALS AND EQUIPMENT

A. Touch-up painting and refinishing of factory applied finishes shall be by Mechanical Contractor. Contractor shall be responsible for obtaining proper type of painting materials and color from equipment manufacturer.
B. Unless specified otherwise factory built equipment shall be factory painted. Paint shall be applied over surfaces only after they have been properly cleaned and coated with a corrosion resistant primer.
C. After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.
D. Where extensive refinishing is required equipment shall be completely repainted.

3.7. EQUIPMENT ANCHORS

A. Provide floor or foundation mounted equipment such as pumps, boilers, air handling units, etc. with Decatur Engineering Company concrete anchors.
B. Where equipment anchors cannot be installed during forming of floors or foundations anchor equipment with McCulloch Kwik-Bolt concrete anchors.
C. Anchors shall be proper type and size recommended by manufacturer for equipment to be anchored.

3.8. WELDING

A. Contractor shall be responsible for quality of welding and suitability of welding procedures. All welding shall be in accordance with American Welding Society Standard B3.0 and ANSI Standard B31.1.
B. Welded pipe joints shall be made by certified welding procedures and welders. Welding electrodes shall be type and material recommended by electrode manufacturer for materials to be welded. All pipe and fittings ends shall be beveled a minimum of 30 degrees prior to welding.
C. Only welders who have successfully passed welder qualifications tests in previous 12 months for type of welding required shall do welding. Each welder shall identify his work with a code marking before starting any welded pipe fabrication. Contractor shall submit three copies of a list of welders who will work on project listing welders' code, date and types of latest qualification test passed by each welder.
D. Welded joints shall be fusion welded in accordance with Level AR3 of American Welding Society Standard AWS D10.9 "Standard for Qualification of Welding Procedures and Welders for Pipe and Tubing". Welders qualified under National Certified Pipe Welding Bureau will be acceptable.
E. Bevel all piping and fittings in accordance with recognized standards by flame cutting or mechanical means. Align and position parts so that branches and fittings are set true. Make changes in direction of piping systems with factory made welding fittings. Make branch connections with welding tees or forged weldolets.

END OF SECTION 230011

SECTION 230013 – PROJECT COORDINATION

PART 1 GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.
4. Requests for Interpretation (RFIs).

B. Each related sub-contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.3. COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Delivery and processing of submittals.
2. Progress meetings.
3. Preinstallation conferences.
4. Project closeout activities.
5. Startup and adjustment of systems.

1.4. SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

   a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   b. Indicate required installation sequences.
   c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 40 inches. Format shall be PDF or

other electronic format to facilitate multiple user commenting and sharing easily.

3. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including project managers, superintendent and other personnel in attendance at Project site to the General Contractor and other major subcontractors. Identify individuals and their duties and responsibilities; list email addresses and telephone numbers. Update the list as required during the project if personnel change.

1.5. COORDINATION

A. Certain materials will be provided by other trades. Examine the Contract Documents and reviewed record Submittals to ascertain these general requirements. Contract Documents reflect a basis of design and may not reflect actual equipment or items being utilized.

B. Carefully check space requirements with other trades and the physical confines of the area to insure that all material can be installed in the spaces allotted thereto including finished suspended ceilings and the spaces within the existing building. Make modifications thereto as required and approved.

C. Transmit to other trades all information required for work to be provided under their respective Sections in ample time for installation.

D. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.

E. Obtain equipment submittal information for all pieces of equipment to be connected to from other trades that clearly indicates all connection requirements, locations, sizes, and similar requirements. Obtain this information in ample time to coordinate other trade submittals and equipment coordination. Where requirements differ from that on plans or differs from provisions made in the work, immediately notify the Architect/Engineer. Do not proceed with work that is incompatible with equipment provided.

F. Coordinate, project and schedule work with other trades in accordance with the construction sequence.

G. Coordinate with the local Utility Companies to their requirements for service connections and provide all necessary materials, labor and testing.

H. Coordinate with contractors for work under other Divisions of this specification for all work necessary to accomplish this contractor's work.

I. Conduct a coordination meeting after reviewing all other trade coordination drawings with other relevant trades. This meeting shall be held to prevent conflicts during construction. Each major relevant subcontractor shall attend this meeting. Report any potential conflicts or clearance problems to Architect/Engineer after meeting.

J. Adjust location of piping, ductwork, conduit, wiring, etc. to prevent interferences, both anticipated and encountered. Determine the exact route and location of each item prior to fabrication.

1. Right-of-Way:

a. Lines that pitch have the right-of-way over those that do not pitch. For example: steam, condensate, and plumbing drains normally have right-of way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.

b. Make offsets, transitions and changes in direction in raceways as required to maintain proper headroom in pitch of sloping lines whether or not indicated on the Drawings.

1.6. DRAWINGS AND FILES.

A. The Drawings show only the general run of MEP systems, equipment, fixtures, piping and ductwork and other components as well as approximate location of items such as outlets, switches, diffusers, lights, and equipment connections, etc. Coordinate all exact locations of items with other trades, architectural elevations, equipment requirements, owner requirements, ceilings, access, serviceability, etc. All such modifications and coordination shall be made without additional cost to the Owner. Any significant changes in location of items necessary in order to meet field conditions shall be brought to the immediate attention of the Architect/Engineer and receive his approval before such alterations are made

B. Wherever the work is of sufficient complexity, additional Detail Drawings to scale similar to that of the bidding Drawings, prepared on tracing medium of the same size as Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field. Attend meetings with other trades to review all documents.

C. When directed by the General Contractor for areas of necessary coordination provide 3D building modelling coordination files and documents with other trades. Transmit information electronically and attend meetings as directed by the G/C as well as take part in coordination activities and documentation. Contractor shall be

required to generate their own electronic files for this process.

1.7. PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. The Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Possible conflicts.
i. Compatibility problems.
j. Time schedules.
k. Manufacturer's written recommendations.
l. Warranty requirements.
m. Compatibility of materials.
n. Space and access limitations.
o. Regulations of authorities having jurisdiction.
p. Testing and inspecting requirements.
q. Installation procedures.
r. Coordination with other work.
s. Required performance results.
t. Protection of adjacent work.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

C. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contractor is on time, ahead or behind schedule, in relation to Construction Schedule. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time. Discuss impact of various contractor schedules upon other contractors and how to remedy impacts.

b. Review present and future needs of each contractor present, including the following:

i. Interface requirements.
ii. Sequence of operations.
iii. Status of submittals.
iv. Deliveries.
v. Off-site fabrication.
vi. Access.
vii. Quality and work standards.
viii. Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.8. REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI.

1. Submit Contractor's suggested solution(s) to RFI. If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
2. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 220013

SECTION 230505 – MECHANICAL DEMOLITION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 220500.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

A. This Section requires the selective removal and subsequent offsite disposal of the following:

1. Mechanical and electrical equipment, devices, piping, conduits, ductwork, insulation, lighting, etc in existing building indicated on drawings and as required to accommodate new construction.
2. Removal of MEP items in interior partitions as indicated on drawings.
3. Removal and protection of existing fixtures, materials, and equipment items indicated to be removed, salvaged, relocated, reinstalled, etc.

1.3. SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Schedule indicating proposed sequence of operations for selective demolition work to Architect for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.

1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
2. Coordinate with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed remodeled areas.

C. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Architect prior to start of work.

1.4. JOB CONDITIONS

A. Occupancy:

1. Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in such a manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.

B. Condition of Structures:

1. Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at time of Contractor's inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.
2. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed. Storage or sale of removed items on site will not be permitted.
3. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.
4. Provide protective measures as necessary and required to provide free and safe passage of Owner's personnel and general public to any occupied portions of building.
5. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
6. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
7. Construct temporary insulated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
8. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
9. Remove protections at completion of work.

C. Damages:

1. Promptly repair damages caused to adjacent facilities by demolition work.

D. Traffic:

1. Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

E. Flame Cutting:

1. Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

F. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

G. Maintain fire protection services during selective demolition operations.

H. Environmental Controls:

1. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing and/or approved regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1. PREPARATION

A. General:

1. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
2. Cease operations and notify Architect immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

A. Provide all necessary temporary supports of items and systems to remain that were supported from or otherwise affected by removal of other building components. Maintain integrity of all systems to remain and protect during the construction process.

B. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to any occupied portions of the building.

C. Where selective demolition occurs immediately adjacent to any occupied portions of the building, construct dust-proof partitions of minimum 4-inch studs, 5/8-inch drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with sound-deadening insulation as required by Architect.

1. Provide weatherproof closures for exterior openings resulting from demolition work.

D. Locate, identify, stub off, and disconnect utility services that are not indicated to remain. Provide bypass connections as necessary to maintain continuity of service to any occupied areas of building. Provide minimum of 72 hours advance notice to Architect if shutdown of service is necessary during changeover.

3.2. DEMOLITION

A. General:

1. Demolish components in small sections. Cut systems at junctures with system components to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
3. Provide services for effective air and water pollution controls as required.
4. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of

approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter.

5. Completely fill elevated slabs and existing structures, walls, slabs etc areas and voids resulting from demolition work. Provide patching of existing structure, walls, slabs etc with like materials for a like new appearance and maintain all ratings and integrity of same.

B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to architect in written accurate detail. Pending receipt of directive from Architect, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3. SALVAGED MATERIALS

A. Salvaged Items: Where indicated on Drawings as "Salvage - Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain a receipt.

3.4. DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish, and other materials resulting from demolition operations from building site. Transport and legally dispose off site.
B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
C. Burning of removed materials is not permitted on Project site.

3.5. CLEANUP AND REPAIR

A. General:

1. Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 230505

SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

PART 2 - PRODUCTS

2.1. MOTORS

A. Motors shall be installed in strict accordance with rules set forth by NEC and equipment manufacturer.
B. ELECTRIC MOTORS (1/2 HP and Larger)

1. Provide equipment requiring electric motors with NEMA Standard motors. Shop drawings, submitted and equipment provided with electric motors shall include motor manufacturer, horsepower, voltage, full load amperes, NEMA design type, insulation class, shaft bearing type, mounting base type, and enclosure type. To greatest extent possible motors for this project shall be by one manufacturer.
2. Motors shall conform to current NEMA Standard MG1. Motor shall operate successfully without derating under the following conditions.
3. 40 degrees C (104°F) maximum ambient temperature, 3,300 Ft. maximum altitude, voltage variations of plus or minus 10% of nameplate rating, frequency variations of plus or minus 5% of nameplate rating, combined voltage and frequency variation of plus or minus 10% total as long as frequency does not exceed plus or minus 5%.
4. Motors shall meet or exceed locked rotor (Starting) and breakdown (maximum) torques specified for the NEMA design rating. Lock rotor currents shall not exceed NEMA maximum values for motor NEMA design rating.
5. Motor service factors shall be 1.15 for open dripproof motors and 1.00 for totally enclosed motors.
6. Unless indicated otherwise, motor insulation may be manufacturers standard for Class A, B or F provided that maximum permissible temperature for insulation is not exceeded when motor is operating at its service factor load in a 40 Degrees C (104°F) ambient.
7. Motor frame/HP relationship shall conform to current NEMA Standard for "T" frames. Motors shall have antifriction ball or roller bearings sized for average life of at least 100,000 hours under normal v-belt loading conditions. Bearings shall be AFBMA Standard and shield mounted ball bearings of ample capacity for motor rating. Bearing housing shall have provisions for adding new lubricant and draining out old lubricant without major motor disassembly. Bearing housing shall have seals to protect bearing from entrance of foreign matter and to prevent leakage of bearing lubricant.
8. Conduit box mounting shall rotate to allow conduit entrance from top, bottom or either side. Conduit holes shall conform to NEC Standards.
9. Motor leads shall have same insulation class as motor windings. Leads shall be marked throughout entire length for easy identification and terminated with brass or copper terminal lugs. Motor shall have permanently attached nameplate with electrical characteristics and wiring connection diagram.
10. Motor bolts, screws and other external hardware shall be treated with a corrosion resistant plating. Motor enclosure shall be prime painted with corrosion resisting metal primer and finished with a durable machinery enamel paint.
11. Unless indicted otherwise motors shall be rated for continuous operation at rated voltage, three phase, 60 hertz. Motors shall be T-frame squirrel cage induction. Type NEMA design B with Class B insulation. Motors shall be dripproof totally enclosed or explosion-proof as required by motor environment.

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION 230513

SECTION 230514 – MOTOR CONTROL AND EQUIPMENT DISCONNECTS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 220010.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of disconnect to be furnished.
B. Dimensional Drawings: For each respective type and size of disconnect.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

A. Equivalents by: G.E., Cutler Hammer, or I.T.E. Siemens, Square D.

2.2. DISCONNECT SWITCHES

A. Provide heavy-duty horsepower rated Safety Switches rated in accordance with NEMA enclosed Switch Standard KS 1-1969 and L98 Standard.
B. Enclosure shall be NEMA type and material required by switch location and environment. Enclosure door shall latch with means for padlocking and cover interlock with defeater to prevent opening door when switch is energized or closing switch with door open. Switch shall have an embossed nameplate permanently attached to door front with switch rating, short circuit interrupting capacity and application information.
C. Line terminals shall be permanently marked and shielded. Contact shall be tin plated, equipped with arch chutes and have movable contacts visible in off position with door open. Wiring terminals shall be pressure type suitable for copper or aluminum wire. Switching mechanism shall be quick-make, quick-break spring driven anti-tease mechanism and shall be integral part of box. All current carrying parts shall be plated.
D. Fuse holders shall be high pressure suitable for use with dual element fuses or rejection type current limiting fuses where required. Fuse holders shall be completely accessible from front of switch and fuses shall be installed so that the label may be easily read from the front and without removing the fuse.

2.3. MOTOR STARTERS - GENERAL

A. Provide motor starters rated in accordance with NEMA and as specified and shown on plans.

2.4. MAGNETIC MOTOR STARTERS

A. Provide 600 volt, 60 hertz AC across-the-line magnetic type rated in accordance with NEMA Standards and listed and labeled in accordance with UL Standard 508 Eleventh Edition.
B. Enclosures shall be NEMA type required by starter location and environment.
C. Starter shall have permanently affixed to inside of enclosure cover an easy to read wiring diagram, including alternate control variations and a warning sign indicating maximum current limiting fuse size that may be installed in disconnect switch which will limit fault current to starters withstand rating with 100,000 RMS fault current available at disconnect switch.
D. Starter contacts shall be silver alloy double break replacement without removal of power wiring or starter from enclosure.
E. Provide starter with solid state type overload relays on all phases. Overload thermal unit shall be one piece interchangeable construction. Overload relays shall provide phase loss and phase failure protection. Starter shall be inoperative with overload unit removed. Starters shall not be furnished to Electrical Contractor with jumper straps in overload units.
F. Ampere rating for overload relays shall be selected by multiplying motor nameplate running amperes at connected voltage by .90 for motors with 1.0 service and by .95 for motors with 1.15 service factor. Use resulting amperes to enter manufacturer's overload selection tables. Keep record of thermal unit number and current range.
G. Provide starter with internal wiring and control circuits prewired with only line, load, and external control circuit wiring connections required. When starter voltage exceeds 120 volts, provide 120 volt control circuit transformer with two Dual Element Fuses in transformer primary and one fuse in the secondary.
H. Provide each starter with two auxiliary contacts. Starter shall be suitable for addition of at least an additional two electrical interlocks of any arrangement of normally open or closed contacts.
I. Provide starter with the following accessories: auxiliary contacts, pilot light, and H.O.A. switch.
J. Starter applications requiring disconnect switch at starter shall be combination type motor starters in lieu of separate devices.

2.5. COMBINATION MAGNETIC MOTOR STARTERS

1. Provide 600 volt, 60 hertz AC across-the-line fusible or non-fusible as scheduled magnetic type rated in accordance with NEMA Standards and listed and labeled in accordance with UL Standard 508 Eleventh Edition.
2. Starter NEMA enclosure type shall be type required for starter location and environment.
3. Combination starter shall be a factory assembled unit with internal wiring and control circuits prewired with only line, load, and external control circuit wiring connections required.
4. Where fusible CMS are called for fuse holders shall be high pressure suitable for use with dual element fuses or rejection type current limiting fuses where required.
5. Fuse holders shall be completely accessible from front of switch and fuses shall be installed so that the fuse type and size may be easily read from the front and without removing the fuse.
6. See plans for combination magnetic starters.

PART 3 EXECUTION

3.1. INSTALLATION

A. All fuse holders shall have rejection clips installed.
B. Mount starter enclosure rigidly and with proper alignment on building structure or steel supports with operating switches not more than 6 feet above finished floor unless otherwise required. Use steel supports fabricated from standard rolled structural steel shapes or framing channel to provide one-inch separation between enclosure and building wall for vertical flow of air.
C. Furnish and install a nameplate for each starter/switch engraved with the equipment designation which the disconnect serves.
D. All starters/disconnect switches as specified shall be installed in strict accordance with rules set forth by NEC.
E. Install starters in locations as shown on plans, installation shall be in strict accordance with NEC, and manufacturer's installation requirements.

END OF SECTION 230514

SECTION 230515 – VARIABLE FREQUENCY CONTROLLERS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. DESCRIPTION

A. This specification is to cover a complete Adjustable Frequency motor Drive (AFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. The drive shall be designed specifically for variable torque applications. It is required that the drive manufacturer have an existing:

1. Sales representative exclusively for HVAC products, with expertise in HVAC systems and controls.
2. An independent service organization.

B. The drive and all necessary controls as herein specified shall be factory built and supplied by the drive manufacturer in an ISO 9000 approved environment The manufacturer shall have been engaged in the production of this type of equipment for a minimum of ten years. AFD's that are manufactured by a third party and "name branded" shall not be acceptable.

1.3. QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronic Engineers (IEEE)
   a. Standard 519-1992, IEEE Guide for Harmonic Content and Control.
2. Underwriters laboratories
   a. UL508C
3. National Electrical Manufacturer's Association (NEMA)
   a. ICS 7.0, AC Adjustable Speed Drives
4. IEC 16800 Parts 1 and 2

B. Testing:

1. All printed circuit boards shall be completely tested and burned-in before being assembled into the completed AFD. The AFD shall then be subjected to a computerized systems test (cold), burn-in, and computerized systems test (hot). The burn-in shall be at 104 °F (40°C), at full rated load.
2. All testing and manufacturing procedures shall be ISO 9001 certified.

C. Failure Analysis:

1. AFD manufacturer shall have an analysis laboratory to evaluate the failure of any component. The failure analysis lab shall allow the manufacturer to perform complete electrical testing, x-ray of components, and decap or delaminate of components and analyze failures within the component.

D. Qualifications:

1. AFDs and options shall be UL listed as a complete assembly.
2. AFDs and options shall be cUL listed as a complete assembly.
3. AFD's and options shall be CE labeled as a component.

1.4. SUBMITTALS

A. Submittals shall include the following information:

1. Outline Dimensions
2. Weight
3. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion.
   a. The AFD manufacture shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as

required by the AFD manufacturer to ensure compliance with IEEE standard 519 (latest version), guide for Harmonic Control and Reactive Compensation for Static Power Converters. The acceptance of this calculation must be completed prior to AFD installation.

b. Prior to installation, the AFD manufacturer shall provide the estimated total harmonic distortion (THD) caused by the AFDs. The results shall be based on a computer aided circuit simulation of the total actual system, with information obtained from the power provider and the user.

c. If the voltage THD exceeds 5%, the AFD manufacturer is to provide the additional equipment required, at no cost to the owner, to reduce the voltage THD to this level.

d. The AFD shall be acceptable for use with motor output wiring lengths up to 320 feet, when using a motor that complies with NEMA MG1, part 31. AFD's with motor output wiring lengths greater than 164 feet shall reduce drive carrier hz to 2.5hz. AFD's that do not meet this requirement must provide a tuned dv/dt output filter, factory mounted and wired, in the AFD enclosure.

1.5. WARRANTY

A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of manufacturer. The warranty shall include all parts, labor, travel time and expenses.

PART 2 - PRODUCTS

2.1. ACCEPTABLE PRODUCTS

A. Acceptable current technology AFD products are ABB ACH400 (Asea Brown Boveri), Eaton HV9000, Graham VLT6000, Yaskawa Z1000, or prior approved equal products.

2.2. ADJUSTABLE FREQUENCY DRIVES

A. The adjustable frequency drives (AFDs) shall be solid state, with a Pulse Width Modulated (PWM) output. The AFD package as specified herein shall be enclosed in a NEMA 1 enclosure, completely assembled and tested by the manufacturer. The AFD shall employ a full wave rectifier (to prevent input line notching), Integral Line Reactor(s), Capacitors, and Insulated Gate Bipolar Transistors (IGBT's) as the output-switching device. The drive efficiency shall be 97% or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.

B. Specifications for the 3 HP to 400 HP at 480 volts and 2 to 100 HP at 240 volts:

1. Input 380/415/440/460/480 VAC +/- 10%, 3 phase, 48-63 Hz or input 200/208/220/230/240 VAC +/- 10%, 3 phase, 48-63 Hz. Undervoltage trip @ rated input -35%, Overvoltage trip @ rated input +35%.
2. Interrupt rating 100 kAIC, suitable for use on a circuit capable of delivering not more than 65,000 RMS symmetrical amps, 480 V maximum.
3. Output Frequency 0 to 250 Hz. Operation above 60 Hz shall require programming changes to prevent inadvertent high-speed operation.
4. Environmental operating conditions: 0 to 40°C, 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.
5. Enclosure shall be rated NEMA 1 or NEMA 12 per the notes on equipment schedule.

C. All AFDs shall have the following standard features:

1. All AFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus. The keypad shall be removable, capable of remote mounting, and shall have it's own non-volatile memory. The keypad shall allow for uploading and downloading of parameter settings as an aid for start-up of multiple AFDs.
2. The keypad shall include Hand-Off-Auto membrane selections. When in "Hand", the AFD will be started and the speed will be controlled from the up/down arrows. When in "Off", the AFD will be stopped. When in "Auto", the AFD will start via an external contact closure and the AFD speed will be controlled via an external speed reference. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Auto" and "Hand" modes.
3. The AFD's shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time.
4. The AFD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
5. The AFD shall be capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to setpoint without safety tripping or component damage (flying start). The AFD shall also

be capable of DC injection braking at start to stop a reverse spinning motor prior to ramp.

6. The AFD shall be equipped with an automatic extended control power ride-through circuit, which will utilize the inertia of the load to keep the drive powered. Typical control power ride-through for a fan load shall be 2 seconds minimum.
7. If the input reference (4-20mA or 2-10V) is lost, the AFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.
8. The customer terminal strip shall be isolated from the line and ground.
9. The drive shall employ current limit circuits to provide trip free operation:
    a. The Slow Current Regulation limit circuit shall be adjustable to 150% (minimum) of the AFD's normal duty current rating. This adjustment shall be made via the keypad, and shall be displayed in actual amps, and not as percent of full load.
    b. The Current Switch-off limit shall be fixed at 350% (minimum, instantaneous) of the AFD's normal duty current rating.
10. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute in every 10 minutes
11. The AFD shall have integral Input Reactor(s) with a minimum of 3% impedance in the form of AC or DC reactors. DC reactors shall be located on both the positive and negative bus rails to reduce the harmonics to the power line and to increase the fundamental power factor.
12. The AFD shall be capable of sensing a loss of load (broken belt / no water in pump) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.
13. The AFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback or follower signal.

D. All AFDs to have the following adjustments:

1. Two (2) programmable critical frequency lockout ranges to prevent the AFD from operating the load continuously at an unstable speed.
2. PID Setpoint controller shall be standard in the drive, allowing a pressure or flow signal to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The auxiliary power supply shall have overload and over current protection. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus.
3. Two (2) programmable analog inputs shall accept a current or voltage signal for speed reference, or for reference and actual (feedback) signals for PID controller. Analog inputs shall include a filter; programmable from 0.01 to 10 seconds to remove any oscillation in the input signal. The minimum and maximum values (gain and offset) shall be adjustable within the range of 0 - 20 ma and 0 - 10 Volts. Additionally, the reference must be able to be scaled so that maximum reference can represent a frequency less than 60 Hz, without lowering the drive maximum frequency below 60 Hz. Process variables shall be modifiable by math functions such as multiplication and division between the two signals (fan tracking), high/low select, as well as inverted follower.
4. Five (5) programmable digital inputs for maximum flexibility in interfacing with external devices. One digital input is to be utilized as a customer safety connection point for fire, freeze, and smoke interlocks (Enable). Upon customer reset (reclosure of interlock) drive is to resume normal operation.
5. One (1) programmable analog output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
6. Two (2) programmable digital relay outputs. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; Continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable. Relays shall be capable of programmable on and off delay times.
7. Seven (7) programmable preset speeds.
8. Two independently adjustable accel and decel ramps. These ramp times shall be adjustable from 1 to 1800 seconds.
9. The AFD shall Ramp or Coast to a stop, as selected by the user.

E. The following operating information displays shall be standard on the AFD digital display. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of two operating values from the list below shall be capable of being displayed at all times. The display shall be in complete

English words (alpha-numeric codes are not acceptable):

1. Output Frequency
2. Motor Speed (RPM, %, or Engineering units)
3. Motor Current
4. Calculated Motor Torque
5. Calculated Motor Power (kW)
6. DC Bus Voltage
7. Output Voltage
8. Heatsink Temperature (^{0}F)
9. Analog Input Values
10. Analog Output Value
11. Keypad Reference Values
12. Elapsed Time Meter (resettable)
13. kWh meter (resettable)
14. mWh meter
15. Digital input status
16. Digital output status

F. The AFD shall have the following protection circuits. In the case of a protective trip, the drive shall stop, and announce the fault condition in complete words (alphanumeric codes are not acceptable).

1. Overcurrent trip 350% instantaneous (170% RMS) of the AFD's variable torque current rating.
2. Overvoltage trip 130% of the AFD's rated voltage
3. Undervoltage trip 65% of the AFD's rated voltage
4. Overtemperature +90° C, Heatsink Temperature
5. Ground Fault either running or at start
6. Adaptable Electronic Motor Overload (I2t). The Electronic Motor Overload protection shall protect the motor based on speed, load curve, and external fan parameter. Circuits, which are not speed dependant, are unacceptable. The electronic motor overload protection shall be UL Listed for this function.

G. Speed Command Input shall be via:

1. Keypad.
2. Two Analog inputs, each capable of accepting a 0-20mA, 4-20mA, 0-10V, 2-10V signal.
3. Floating point input shall accept a three-wire input from a Dwyer Photohelic (or equivalent type) instrument.
4. Serial Communications

H. Serial Communications

1. The AFD shall have an RS-485 port as standard. The standard protocol shall be Modbus.
2. The AFD shall be able to communicate with PLC's, DCS's, and DDC's.
3. Serial communication capabilities shall include, but not be limited to, run-stop control; speed set adjustment, proportional/integral/derivative PID control (Set Point) adjustments, current limit, and accel/decel time adjustments. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, digital inputs and diagnostic warning and fault information. Additionally, remote (LAN) VFD fault reset shall be possible. A minimum of 15 field parameters shall be capable of being monitored.
4. The AFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. The serial communications interface shall allow for DO (relay) control and AO (analog) control without being tied to a VFD function. In addition, all drive digital and analog inputs shall be capable of being monitored by the DDC system.
5. The AFD shall have the capability of accepting fiber optic cables for connection to standard ABB fieldbus adapters. Communications between the drive and fieldbus adapters shall be at 1Mega Baud.
6. The AFD shall be connectable to a PC based software tool capable of operating, programming, monitoring the drive as well as diagnosing faults.

I. OPTIONAL FEATURES – [Select as necessary] Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly. Bypass package must be factory built.

1. Microprocessor based Bypass Controller - Manual or automatic (selectable) transfer to line power via contactors. A keypad to control the bypass controller is to be mounted on the enclosure door. The bypass keypad shall include a one line diagram and status LEDs to indicate the mode of operation,

drive and bypass status and ready & enable conditions. When in the "Normal" mode, the bypass contactor is open and the drive output contactor is closed. In the "Test" position, the drive output contactor is open, in the "Bypass" position, the drive output contactor is open, and the bypass contactor is closed via Start/stop command. Start/stop via customer supplied maintained contact shall be 24V or 115V compatible and shall function in both the "Normal" and "Bypass" modes. The voltage tolerance of the bypass power supply shall be +30/-35% to eliminate the problem of contactor coil burnout. The design shall include single-phase protection in both the AFD and bypass modes.

a. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, Drive or Bypass modes.
b. Automatic / manual bypass operation shall be selectable in the standard microprocessor based bypass design.
c. Door / cover interlocked disconnect switch which will disconnect all input power from the drive, bypass and all internally mounted options. The disconnect handle shall be through the door, and be padlock able in the "Off" position.
d. Circuit Breaker or Fast acting semi-conductor fuses exclusive to the AFD – circuit breaker or fast acting semi-conductor fuses allow the AFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs, which have no such circuit breaker or fuses, or that, incorporate fuses common to both the AFD and the bypass will not be accepted. In such designs, a fuse clearing failure would render the bypass unusable.

PART 3 - EXECUTION

3.1. INSTALLATION

A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.
B. Power wiring shall be completed by the electrical contractor. The contractor shall complete all wiring in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.
C. When the AC drive is applied to a motor that has motor leads exceeding 100 feet, the manufacturer shall supply an output filter (LC) on the load side of the drive which reduces voltage spikes at the motor to comply with NEMA motor standards.

3.2. INSPECTION

A. Verify that the location is ready to receive work and the dimensions are as indicated. Do not install controller until the building environment can be maintained within the service conditions required by the manufacturer.
B. Before and during installation, the AC drive shall be protected from site contaminants.

3.3. START-UP

A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.4. PRODUCT SUPPORT

A. Factory trained application engineering and service personnel that are thoroughly familiar with the drive products offered shall be locally available at both the specifying and installation locations.

3.5. WARRANTY

A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of manufacturer. The warranty shall include all parts, labor, travel time and expenses.

END OF SECTION 230515

SECTION 230523 – VALVES

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. EQUIVALENTS

A. Equivalent valves shall be used only from the following specified valve manufacturers and listed on current comparison charts by Apollo, Viega, Hammond, Hays, Milwaukee, Muessco, Nibco, Rockwell-Nordstrom, Stockham, and Watts.

1.3. SUBMITTALS

A. Product Data: For each type of valve indicated.

1.4. QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1. GENERAL REQUIREMENTS FOR VALVES

A. Plumbing valve applications specified in this Section are limited to NPS 12 (DN 300).
B. Refer to valve schedule articles for applications of valves.
C. Caution: Revise pressure ratings and insert temperature ratings in valve articles if valves with higher ratings are required.
D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
E. Valve Sizes: Same as upstream piping unless otherwise indicated.
F. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller[except plug valves.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

G. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

H. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.
4. Grooved: With grooved ends to copper-tube dimensions or similar to AWWA C606.
5. Press-Connect Ends: With press ends according to ASTM F3226.

2.2. VALVES

A. BALL VALVES

1. Ball valves shall be scheduled as type "BLV" valves. Valve specifications by type number shall be as follows:
2. Provide ball handle with extension or offset as required to clear piping insulation.

a. BLV-1:

i. 2-1/2" valves and smaller, Hammond #8501 (screwed) or 8511 (solder) series bronze two piece large port ball valve 600 PSI-WOG/150 PSI-WSP reinforced TFE seats, chrome plate brass ball (tunnel or drilled design), silicon bronze stem vinyl-

covered steel lever handle. Stainless steel ball and stem shall be provided for steam applications.

ii. 2-1/2" zero lead ball valves and smaller, Viega press-connect end valves approved for use with copper tubing conforming to ASTM B88 or B75. When pressing onto B88 copper tube, types K, L, and M may be used. Tempers O60 and O50, known as "soft copper", are limited to nominal sizes 1/2" to 1-1/4". Temper H58, known as "hard copper", may be used with nominal sizes 1/2" to 4". Valves shall conform to IAPMO Z1157, NSF 61-372, NSF U.P. Code and listed by NSF to Commercial Hot water. Temperature range 0-250 F and max CWP 300. Ball valve shall be equipped with a full port, 316 stainless steel ball, blowout-proof Eco Brass® stem, reinforced PTFE seats, lockable metal handle, 2-piece zero lead bronze body with integral press ends.

iii. 2-1/2 - 4" zero lead valves, Viega press-connect end valves approved for use with copper tubing conforming to ASTM B88 or B75. When pressing onto B88 copper tube, types K, L, and M may be used. Tempers O60 and O50, known as "soft copper", are limited to nominal sizes 1/2" to 1-1/4". Temper H58, known as "hard copper", may be used with nominal sizes 1/2" to 4". Valves shall conform to IAPMO Z1157, NSF 61-372, NSF U.P. Code and listed by NSF to Commercial Hot water. Temperature range 0-250 F and max CWP 300. Ball valve shall be equipped with a full port, 316 stainless steel ball, blowout-proof Eco Brass® stem, reinforced PTFE seats, lockable metal handle, 2-piece zero lead bronze body with integral press ends.

b. BLV-2: Ball valve shall be flexible lip seat to assure positive shut off (in both directions) and self compensates for wear. Material - fiberglass reinforced teflon, single piece. Self-adjusting, low friction teflon box ring stem seals pre-loaded by Belleville washers. Two-piece carbon steel body. Four bolt design with locking fasteners for vibration resistance and joint integrity, one piece teflon body seal. Valve shall be rated for 250 PSI steam service. 316 stainless steel ball and stem. Provide with insulated handle. Neles Jamesbury Model 21-2236MT. Equivalent by Worchester. MCF Series 56-HT.

B. GLOBE VALVES

1. Globe valves shall be scheduled as type "GLV" valves. Valve specifications by type number shall be as follows:

a. GLV-1: 2-1/2" valves and smaller, Hammond #IB413T (screwed) or IB423 (solder) bronze globe valve, 300 PSI-WOG/150 PSI-WSP union bonnet, Teflon disc, malleable iron handwheel.

C. PLUG VALVES

1. Plug valves shall be scheduled as type "PLV" valves. Valve specifications by type number shall be as follows:

a. PLV-1: 1" valves and smaller Hays 7400 series iron body gas cock, 175 PSI-WOG bronze plug washer and nut, screwed ends.

b. PLV-2: 1-1/4" through 4" valves, Rockwell-Nordstrom Fig. 142, semi-steel lubricated plug valve, 175 PSI-WOG coated plug, two bolt cover, and short pattern screwed ends. Provide complete with standard pattern cast handle.

D. GATE VALVES

1. Gate valves shall be scheduled as type "GTV" valves. Valve specifications by type number shall be as follows:

a. GTV-1: 2" and smaller Hammond #IB640 (screwed) or IB635 (solder) ASTM B 62 bronze body and bonnet with malleable iron handwheel, 200 PSI-WOG/125 PSI-WSP.

b. GTV-2: 2 ½" and larger Hammond #IR1140 HI, flanged, bolted bonnet, O.S. & Y., ASTM 126 iron body, bronze trimmed, 200 PSI-WOG/125 PSI-WSP.

E. CHECK VALVES

1. Check valves shall be scheduled as type "SCV" valves. Valve specifications by type number shall be as follows:

a. SCV-1:

i. 2" valves and smaller Hammond #IB940 (screwed) or IB912 (solder) bronze check valve, 200 PSI-WOG/125 PSI-WSP, Teflon or bronze disc and seat ring.

ii. 2" valves and smaller Viega ZL bronze check valve with integral press-connect ends approved for use with copper tubing conforming to ASTM B88 or B75. When pressing onto B88 copper tube, types K, L, and M may be used. Tempers O60 and O50, known as "soft copper", are limited to nominal sizes 1/2" to 1-1/4". Temper H58, known as "hard copper", may be used with nominal sizes 1/2" to 4". Valves shall conform to MSS SP-80 and NSF 61-372, 400 PSI-WOG, Temperature range 0-200 F, max operating pressure 200psi. Valve shall have integral leak feature in body of valve to detect unpressed connections during pressure testing process.

b. SCV-2: 2-1/2" and larger Hammond #IR1124 HI flanged, ASTM 126 iron body, bronze trimmed, 200PSI-WOG/125 PSI-WSP.

F. BUTTERFLY VALVES

1. Butterfly valves shall be scheduled as Type "BFV" valves. Valve specifications by type number shall be as follows:

a. BFV-1: Size 3" and larger Hammond #6211-01 (lever) or 6211-03 (gear) ASTM A 126 cast iron drilled and tapped full lug body, 200 PSI-WOG 12" and smaller, 150 PSI-WOG 14" and larger, extended neck, bronze disc, stainless steel stem, field-replaceable EPDM or (buna for oil or lubricated service) sleeve and stem seals.

b. BFV-2: Butterfly valves shall be installed as stop valves in locations indicated on drawings in lines 2-1/2" through 8".

i. Butterfly valve shall be flexible lip seat to assure positive shut off (in both directions) and self compensates for wear.

ii. Materials – fiberglass reinforced teflon, single piece. Eccentric disc and offset shaft to prevent pivoting on seat and reduce wear. One piece single diameter shaft. Material – 316 stainless steel.

iii. Positive shaft retention. Chevron teflon packing. Body insert to protect seat from abrasion and erosion. Insert also allows for seat removal without disassembly of shaft and disc. Pinning of shaft to disc to minimize shear stress and prevent through leakage. Stainless backed teflon shaft bearings to provide high corrosion resistance and are self lubricating. No metal-to-metal moving parts. Full lug type body rated for ANSI Class 150. Material – carbon steel. Provide with fully enclosed gear operator, factory lubricated with pointer. Neles Jamesbury Model 815L-11-2136MT. Equivalent by Posiseal. Watts Model QF.

G. PRESSURE INDEPENDENT CONTROL VALVES

1. PICV: Pressure Independent Control Valves shall be scheduled as Type "PICV" valves
2. NPS 2" and Smaller: Valve shall have flows of 65 GPM or less, forged brass body rated at no less than 375 PSI cold working pressure with a maximum close-off of 58 psi. Body shall be brass alloy NPT threaded.
3. NPS 2-1/2" through 6": Valve shall allow for flows up to 800 GPM with cast or ductile iron body rated for ANSI 125/150 or 250/300 working pressure with a maximum close-off rating of 116 psi. Body is to be compatible with ANSI 125/150 or 250/300 flanges.
4. Flow Regulator shall utilize a stainless-steel spring and stem for all sizes.
5. Design flow rate shall be in line field adjustable without the need for special tools or instruments.
6. Valve shall meet an ANSI Class IV leakage rating.
7. Accuracy: The control valves shall accurately control the flow from 0 to 100% rated flow with a valve body flow accuracy of +/- 10% over the full recommended differential pressure range, and +/- 5% from a differential pressure range of 5 to 50 PSI.
8. The actuators used for valves 2" and less shall have an IP54 rating or greater. The actuators for valves 2 ½" and up shall be IP66 rated (or equivalent). Modulating actuators shall provide analog position feedback.
9. Actuator shall be factory mounted on the valve by the manufacturer. The actuator will be tagged by the manufacturer with the GPM setting and the equipment it is to be installed on. Maximum flow can be readjusted on the valve manually without the use of tools or electronic equipment. If flow setting is changed from the factory preset the actuator will not need to be reset.
10. All pressure independent control valves shall include two P/T ports.
11. Lengths of straight pipe preceding or following the valve shall not be required for proper operation.
12. Calibrated Balancing Valves and Automatic Flow-Control Valves shall not be used on equipment where pressure independent control valves are installed.

13. Equivalent valves by:

    a. Armstrong
    b. Belimo
    c. Bell and Gossett
    d. Bray
    e. Danfoss
    f. Griswold Controls
    g. Hays
    h. Honeywell
    i. IMI Hydronic Engineering Inc.
    j. Oventrop
    k. Siemens
    l. Victaulic

2.3. VALVE SCHEDULE

SYSTEM	SIZE	STOP	CHECK	BALANCE
Hot Water	½" - 2-1/2"	BLV-1	SCV-1	BAV-1
Hot Water	3"-6"	BFV-1	SCV-2	BAV-1
Pumped Condensate	½"-1-1/2"	--	SCV-1	--

PART 3 – EXECUTION

3.1. VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
B. Locate valves for easy access and provide separate support where necessary.
C. Install valves in horizontal piping with stem at or above center of pipe.
D. Install valves in position to allow full stem movement.
E. Install chainwheels on operators for butterfly and gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 66 inchesabove finished floor.

    1. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.2. INSTALLATION

A. Install necessary valves within piping systems to provide required flow control, to allow isolation for inspection, maintenance and repair of each piece of equipment or fixture, and on each main and branch service loop.
B. Each valve shall be installed so that it is easily accessible for operation, visual inspection, and maintenance and wherever possible, gate, check and ball valves shall be installed on a horizontal run with the handle upright and within 15 degrees of vertical. Butterfly valves shall be installed with the stem in the horizontal position and the handle at 90 degrees from vertical.
C. Valves installed in piping systems shall be compatible with system maximum test pressure, pipe materials, pipe joining method, and fluid or gas conveyed in system.
D. Valves 2-1/2" and smaller shall have soldered or screwed end connections as required by piping materials unless otherwise specified or shown on drawings. Install union connection in the line within two feet of each screw end valve unless valve can be otherwise easily removed from line. Valves 3" and over shall have flange end connections.
E. Non-rising stem valves shall not be installed at any point in the piping systems. With permission of Architect-Engineer non-rising stem valve may be installed at particular points where space is restricted.
F. Provide butterfly valves 6" and smaller with 10 position lever handle for on-off application and infinite position handle for throttling applications. Provide butterfly valves 8" and up with fully enclosed all weather gear operators.
G. Install globe valves with pressure on top of disc except that must be completely drained for inspection, maintenance or to prevent freezing shall be installed with stem in horizontal position to insure complete drainage of pipelines.
H. Gate valves shall not be installed in pipelines where intended for throttling service or where piping is subject to vibration as part of normal operating conditions.
I. Valves shall be designed for repacking under pressure when fully opened and backseated.

J. Balancing valves installed by means of sweating or soldering shall have their interiors removed before installation and reinstalled upon dissipation of the heat associated with installation. Using a wet rag in lieu of removing the valve interior as a means of heat dissipation during installation is not acceptable.

3.3. ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 230523

SECTION 230548 – MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of vibration isolation product to be used.

PART 2 - PRODUCTS

2.1. GENERAL

A. Equivalents by Amber-Booth Company, Mason Industries, Peabody Noise Control (Kinetics).

2.2. VIBRATION ISOLATION

A. Furnish and install vibration isolation devices for rotating or reciprocating mechanical equipment and piping systems attached thereto.
B. Work shall include all material and labor required for installation of the resilient mounting and suspension systems, adjusting each mounting system, and measurement of isolator system performance when so requested by the Architect-Engineer. Specific mounting arrangements for each item of mechanical equipment shall be as described herein and as indicated by schedules and details on the drawings.
C. All vibration isolation equipment, including steel framing and reinforcing for concrete inertia bases and including steel rail bases, shall be furnished by one of the following manufacturers: A single manufacturer for all vibration isolation equipment will be required except as specifically approved in writing by the Architect-Engineer or by his specific approval of shop drawings.
D. The Contractor and the vibration isolation manufacturer or his regularly designated and factory authorized representative shall perform the following tasks in addition to the supply and installation of isolation equipment:
E. Obtain from the Architect-Engineer the approved manufacturer's name, model number, and other necessary identifying data for each item of mechanical and electrical equipment to be resiliently mounted. Coordinate all resilient mounting systems with the exact equipment to be furnished in regard to physical size, isolator locations, weight, rotating speed, etc. Direct contact and cooperation between the vibration isolation device fabricator and the equipment manufacturer will be required.
F. Obtain all necessary data in regard to piping systems which are to be resiliently supported so that proper isolators can be selected. Select piping system isolators for proper isolators can be selected. Select piping system isolators for proper coordination with the physical arrangement of pipe lines and with the physical characteristics of the building.
G. Submit shop drawings as required by other portions of this specification. These drawings shall include specification information as follows:

    1. Manufacturer's model number for each isolator, the machine or pipeline to which it is to be applied, and the number of isolators to be furnished for each machine or pipeline.
    2. For steel spring mounts or hangers - free height, deflected height, solid height, isolator loading, and diameter of spring coil.
    3. For elastomer or glass fiber isolators - free height, deflected height, and isolator loading.
    4. Dimensional and weight data for concrete inertia bases, steel and rail bases, and details of isolator attachment.

H. Provide on-the-job supervision as required during installation of resiliently mounted equipment and piping to assure that all vibration isolators are installed in strict accordance with normally accepted practices for critical environments.
I. Replace at no extra cost to the Owner any isolators which do not produce the required deflection, are improperly loaded above or below their operating height, or which in any way do not produce the required isolation.
J. The vibration isolation systems described herein and identified by type letter designations shall be applied to specific classifications of mechanical and electrical equipment as indicated in this specification.
K. TYPE A ISOLATION

    a. The equipment shall be rigidly mounted on a large reinforced concrete inertia block which has length and width dimensions approximately 20% greater than the supported equipment. The inertia block and equipment shall be supported by steel spring vibration isolators. Brackets

for the spring isolators shall be located off the sides of the inertia block with the tops of the springs near the vertical center of gravity of the equipment and inertia block; or if the center of gravity is higher than the top of the inertia block, the tops of the springs shall be at the top of the inertia base. The spring isolators shall rest on curbs or pedestals if necessary. There shall be a 2 inch minimum space between the bottom of the inertia base and the top of the housekeeping pad or floor slab when a housekeeping pad is not indicated on the drawings.

b. Concrete inertia bases shall be formed by a welded steel channel frame which incorporates prelocated equipment anchor bolts, and minimum 1/2 inch diameter reinforcing bars on minimum 8 inch centers each way welded in place. Concrete shall be standard 150-160 lb./cu. ft. structural concrete. The base thickness shall be determined by the weight requirements but it shall be a minimum of 8% of the longest span between isolators or 6 inches, whichever is greater. For centrifugal and axial fans and centrifugal pumps the inertia base shall have a minimum weight equal to that of the isolated equipment. For reciprocating equipment the inertia base shall have a minimum weight equal to twice the weight of the equipment.

c. Springs shall be of the free standing unhoused type. Horizontal spring stiffness shall not be less than 0.8 of vertical stiffness. Springs shall be selected for reasonably uniform deflection taking into consideration any difference in machine weight at each supporting point, but deflection of each spring shall not be less than that specified for each classification of mechanical equipment. The spring deflection from the point of rated deflection to the point at which the spring is solid shall not be less than 1/2 of the rated static deflection. The yield point of the steel used in the springs shall be sufficiently great so that the springs may be compressed to shorted turns without danger of spring failure. At least two layers of ribbed waffle pattern neoprene pads or equivalent glass fiber pads shall be installed under the base plate of each spring isolator. Springs shall have leveling bolts and proper means for bolting to the machines. To prevent corrosion, springs for outdoor installation shall be galvanized or otherwise coated as approved by the Architect-Engineer.

PART 3 - EXECUTION

3.1. GENERAL

A. Cooperate with all other Contractors engaged in this project so that the installation of vibration isolation devices will proceed in a manner that is in the best interests of the Owner.

B. Notify the Architect-Engineer of any project conditions which affect vibration isolation system installation or performance and which are found to be different from conditions indicated by the drawings or described by the specifications. Should vibration isolation system installation proceed without such notifications any remedial work required to achieve proper isolator performance shall be accomplished by the Contractor at no additional cost to the Owner.

C. Be alert for possible "short-circuiting" of vibration isolation systems by piping supports, electrical connections, temperature control connections, drain lines, building construction, etc., and notify the involved contractor as to these problems or potential problems. Where such situations cannot be easily resolved, notify the Architect-Engineer so that preventive or remedial action can take place on a timely basis. Any remedial measures required shall be undertaken by the Contractor responsible at no additional cost to the Owner.

3.2. RESILIENT MOUNTINGS FOR SPECIFIC CLASSIFICATIONS OF EQUIPMENT

Equipment	Power(HP) or as Noted	Rotating Speed RPM	Mounting Type	Inertia Base*	Static Deflection**
Pumps all except In-The-Line Type	--	1750	A	2	1.5"

* Minimum inertia base weight expressed as multiple of weight of supported equipment.

** Minimum static deflection of isolators specified for mounting type indicated.

3.3. ISOLATION OF PIPING SYSTEMS

A. All piping which connects to resiliently mounted equipment shall be suspended with resilient hangers or supported by floor mounted isolators for a distance of 100 pipe diameters from the connected machine or within the mechanical equipment room whichever is the greater distance. The first three supports from the connected machine shall have the same static deflection as indicated for the machine; the next two supports shall have static deflection at least equal to one-half of the static deflection indicated for the machine mounting, and remaining pipe supports shall provide static deflection of 0.35 inches minimum. These remaining isolators may be elastomer.

B. Steel spring hangers shall be as specified for Type D isolation except that a scale shall be attached to the

hanger housing to indicate deflection. Elastomer hangers shall be as specified for Type E isolation. Floor mounts shall be free standing steel spring isolators as specified for Type A isolation where static deflection in excess of 0.35 inches is required. Floor mounts, where static deflection of 0.35 inches or less is required, shall be double deflection neoprene-in-shear as specified for Type C isolation.

C. Vertical pipe risers shall be resiliently mounted, preferably with each riser anchored near the center of the run. The risers shall be supported at the anchor points with steel spring or double deflection neoprene-in-shear isolators which provide static deflection of at least 0.35 inches. Isolators for the remainder of each run shall be steel spring type specifically designed to control load shifting due to pipe expansion and contraction. At least 0.35 inches deflection shall be maintained under all conditions.

D. Flexible neoprene connectors shall be used to connect all piping to all isolated equipment except equipment for which flexible connectors are not permitted by code. For this application provide swing connectors changing direction a minimum of 3 times before joining isolated equipment. Swing connections should be made within approximately 6 feet of the isolated equipment. Connectors shall be manufactured of multiple plys of nylon tire cord fabric and neoprene both molded and cured in hydraulic presses. No steel wire or rings shall be used as pressure reinforcement. Connectors up to and including 2" diameter may have threaded ends. Connectors 2-1/2 inches and larger shall be manufactured with floating steel flanges. All connections shall be rated a minimum of 150 psi at 220 degrees F. All flanged equipment shall be directly connected to neoprene elbows in the size range 2-1/2 inches through 6 inches or any larger available size if the piping makes a 90 degree turn at the equipment. All straight through connections shall be made with either flanged or screwed connectors properly pre-extended as recommended by the manufacturer to prevent additional elongation under pressure. Sizes 12 inches and larger operating at pressures above 100 psi shall employ control cables with end fittings isolated from the anchoring plates by means of 1/2 inch thick bridge bearing neoprene washer bushing designed for a maximum of 1000 psi. Elbows shall be Mason-Flex type MFNEC, straight connectors Mason-Flex type MFTFU or MFTNC, and control cables assemblies type ACC, all as manufactured by Mason Industries, Inc.

E. Drain connections from isolated equipment to floor drains shall be at least 1" free from drain or use rubber hose.

3.4. ISOLATION OF FRACTIONAL HORSEPOWER EQUIPMENT

A. All fractional horsepower fans, pumps, etc., which are mounted on or suspended from floors that are on-grade shall be isolated with neoprene-in-shear isolators furnished by the vibration isolation supplier except where such isolators are furnished as an integral part of the machine.

END OF SECTION 230548

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1. SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2. SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1. EQUIPMENT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware. Black letters on white background.
B. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
C. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
D. Fasteners: Stainless-steel rivets or self-tapping screws.
E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
F. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
G. Install or permanently fasten labels on each major item of mechanical equipment.
H. Locate equipment labels where accessible and visible.

2.2. VALVE IDENTIFICATION

A. Mark all valves with Seton No. 300-BL brass identification tags with system legend, valve number and size stamped on tag. Lettering shall be black ½" high. Tags shall be minimum 2" in diameter and attached to valve with Seton No. 16 brass jack chain.
B. Prepare four copies of typewritten list of valve tags. List shall be typed in upper case and contain tag number, valve size, type, function and location. Frame one list under glass and mount near operating instruction in main equipment rooms.

2.3. PIPING IDENTIFICATION

A. Colors and wording shall be of standard pipe markers as available from Seaton or equal. Submit for approval list of colors and wording prior to purchase of pipe markers.
B. Pipe marker nomenclature/colors shall meet applicable ANSI Standard and OSHA requirements. Pipe markers with letters and flow direction arrows
C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

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

END OF SECTION 230553

SECTION 230593 – SYSTEM TESTING & BALANCING

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. TESTING AND BALANCING CONTRACTORS

A. Testing and balancing (TAB) of the building air and hydronic systems will be to be completed near the end of construction. The Mechanical Contractor has responsibility to cooperate with, make adjustments for, and provide any equipment necessary for the TAB contractor to complete the job.

PART 2 - PRODUCTS

A. Not Used

PART 3 - EXECUTION

3.1. SCOPE OF WORK

A. The Contractor shall procure the services of an independent air balance and testing contractor, approved by the A/E, which specializes in the balancing and testing of heating, ventilating and air conditioning systems, to balance, adjust, and test air moving equipment and air distribution and exhaust systems and all water flow circuits. All work by this contractor shall be done under engineer employed by them. All instruments used by this contractor shall be accurately calibrated and maintained in good working order. If requested the tests shall be conducted in the presence of the A/E responsible for the project and/or his representative. The testing and balancing contractor shall be certified by NEBB or AABC and all work shall be performed in accordance with these organizations' published procedure manuals.
B. The balancing contractor shall prepare a certified report of all tests performed. The report shall be written on standard forms prepared by NEBB or AABC or facsimiles thereof. The balancing contractor shall submit 3 copies of this report to the Mechanical Contractor who shall submit them to the A/E for review and distribution.
C. Air balance and testing shall not begin until systems have been completed and are in full working order. All heating, ventilation, and air conditioning systems and equipment shall be in full operation during each working day of testing and balancing.

3.2. SYSTEM PREPARATION FOR TESTING AND BALANCING

A. Prior to requesting testing and balancing contractor to perform their work the installing contractor shall make all necessary inspections and adjustments to insure that systems are completely installed and operating in accordance with the manufacturer's recommendations and the contract documents.
B. The following checks shall be performed on each system installed under this contract. A report sheet shall be prepared for each system indicating checks made, corrective action taken where required, date, and name of person making inspection. Submit one copy to testing and balancing contractor and two to A/E. Testing and balancing contractor will not begin until checklist has been received and reviewed.

3.3. TEMPERATURE CONTROLS CONTRACTOR COORDINATION

A. The temperature control contractor shall have a technical representative present with the balancing contractor on the first day of balancing for a minimum of four hours of active balancing and temperature controls coordination.
B. For the remainder of the balancing the temperature contractor may either have a technical representative present, or may furnish the balancer with the latest DDC software and all required interface devices. This includes instructions and coordination in the use of all interface devices, including laptop computers. There shall be no charge to the balancing contractor for the use of these interface devices and they shall be returned to the temperature controls contractor at the end of the balancing process.

3.4. BOILERS:

A. Verify cleaning and start-up was in accordance with manufacturers recommendations and that all safety and operating controls have been tested, adjusted and set for proper operation. Submit start-up log with report.
B. Confirm that flow and temperature measurements devices have been provided.
C. The Mechanical Contractor shall make changes in pulleys, belts, dampers, etc., as required by the test and balance contractor, at no additional cost to the Owner.
D. The Mechanical Contractor shall install new filters in the air handlers and clean all strainers in the water system just prior to the beginning of the testing and balancing.

E. The control manufacturer or his representative shall assist the test and balance contractor in setting automatic dampers, valves, etc., as required.

3.5. HYDRONIC TESTING AND BALANCE

A. GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

1. 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.
2. Prepare schematic diagrams of systems' "as-built" piping layouts.
3. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
    a. Open all manual valves for maximum flow.
    b. Check makeup water-station pressure gage for adequate pressure for highest vent.
    c. Check flow-control valves for specified sequence of operation, and set at indicated flow.
    d. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
    e. Set system controls so automatic valves are wide open to heat exchangers.
    f. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
    g. Check air vents for a forceful liquid flow exiting from vents when manually operated.
4. Confirm pump shaft alignment, grouting and fastening of pump base.
5. Verify that all pump vibration isolators are properly adjusted and that flexible connections are properly restrained and aligned.
6. Check pump bearing for proper lubrication and condition.
7. Verify pump rotation and impeller size.
8. Confirm that total system has been hydrostatically tested, flushed, filled, vented and water treated as required.
9. Confirm that all strainer baskets are in place, clean and are the proper type.
10. Verify that all pressure reducing and control valves are operating properly.
11. Confirm that all expansion tanks are installed and contain proper air charge.
12. Verify that access to all balancing valves and flow stations in walls and ceilings have been provided.
13. Inspect and clean all coils and correct fin damage.
14. Confirm that fittings have been provided for flow and temperature measurements at all coils, heat exchangers and pumps.
15. Verify that all piping connections to 3-way valves and coils are proper for flow direction as indicated by manufacturer and temperature control contractor.

B. PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

1. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
    a. 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.
        i. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Engineer and comply with requirements in Division 23 Section "Hydronic Pumps."
    b. 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.
        i. Monitor motor performance during procedures and do not operate motors in overload conditions.
    c. 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.
    d. Report flow rates that are not within plus or minus 10 percent of design.

2. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
3. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
4. Set calibrated balancing valves, if installed, at calculated presettings.
5. Measure flow at all stations and adjust, where necessary, to obtain first balance.
    a. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
6. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
7. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
    a. Determine the balancing station with the highest percentage over indicated flow.
    b. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
    c. Record settings and mark balancing devices.
8. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
9. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
10. Check settings and operation of each safety valve. Record settings.

C. PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

1. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

D. PROCEDURES FOR HEAT-TRANSFER COILS

1. Measure, adjust, and record the following data for each water coil:
    a. Entering- and leaving-water temperature.
    b. Water flow rate.
    c. Water pressure drop.
    d. Dry-bulb temperature of entering and leaving air.
    e. Wet-bulb temperature of entering and leaving air for cooling coils.
    f. Airflow.
    g. Air pressure drop.
2. Measure, adjust, and record the following data for each steam coil:
    a. Dry-bulb temperature of entering and leaving air.
    b. Airflow.
    c. Air pressure drop.
    d. Inlet steam pressure.

3.6. PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7. PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

3.8. TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Heating-Water Flow Rate: Plus or minus 10 percent.

3.9. REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10. FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curve
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.

3.11. ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

3.12. AIR AND WATER BALANCE CONSTRUCTION COORDINATION

A. During installation of the mechanical systems the testing and balancing contractor shall make no less than (3) inspection visits to the project site. Proper placement and installation of all control and balancing devices shall be verified by these inspections. The mechanical contractor shall make all corrections in control and balancing device locations as requested by the TAB contractor. Following each inspection visit the TAB contractor shall report to the A/E all items noted, action taken, and progress of control device installation. The last inspection and balancing shall be performed in the presence of a professional engineer active in the design of mechanical building systems.

END OF SECTION 230593

SECTION 230719 – PIPING INSULATION

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section Includes:

1. Insulation Materials:
    a. Cellular glass.
    b. Flexible elastomeric.
    c. Mineral fiber.
    d. Polyolefin.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied jackets.
8. Tapes.

B. SUBMITTALS

1. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
2. LEED Submittal:
    a. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
3. Shop Drawings:
    a. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
    b. Detail attachment and covering of heat tracing inside insulation.
    c. Detail insulation application at pipe expansion joints for each type of insulation.
    d. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
    e. Detail removable insulation at piping specialties, equipment connections, and access panels.
    f. Detail application of field-applied jackets.
    g. Detail application at linkages of control devices.
    h. Detail field application for each equipment type.
4. Qualification Data: For qualified Installer.
5. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. QUALITY ASSURANCE

1. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
2. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
    a. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

b. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

3. Products shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or polybrominated diphenyl ether fire retardants.

1.3. DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.4. COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
C. Coordinate installation and testing of heat tracing.

1.5. SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 PRODUCTS

2.1. INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.2. PIPING AND EQUIPMENT INSULATION

A. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Cell-U-Foam Corporation; Ultra-CUF.
b. Pittsburgh Corning Corporation; Foamglas Super K.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. If retaining both types of insulation in first two subparagraphs below, indicate where each type applies in insulation system schedules.
6. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
7. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
8. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

B. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

C. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000(Pipe Insulation.
c. Manson Insulation Inc.; Alley-K.
d. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F and Type IV, 1000 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article .

D. Mineral-Fiber Pipe and Tank Insulation: Fiberglass bonded with a thermosetting resin. Semi-rigid blanket material with factory-applied [ASJ] [FSK] [PSK] jacket, complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Compressive Strength; per ASTM C 165, not less than 25 PSF (1.2 kPa) at 10% deformation. Thermal conductivity (k value) at 100 deg. F (38 deg. C) is 0.25 Btu x in. /h x sq. ft. x deg. F (0.036 W/m x C). Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Subject to compliance with requirements, provide:

a. Knauf Insulation; Kwik-Flex Pipe and Tank Insulation. Basis of Design Product.

2.3. INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.4. ADHESIVES

A. Military Specification referenced in this article is the only standard available when this Section was updated. MIL-A-3316C was last updated in October 1987.
B. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

1. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5. MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 200 deg F.
3. Solids Content: 63 percent by volume and 73 percent by weight.
4. Color: White.

2.6. SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7. FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. ASJ+ SSL+: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing, interleaving with an outer polymer film leaving no paper exposed, and pressure-sensitive, acrylic-based adhesive covered by removable protective strip; complying with ASTM C 1136, Type I, II, III, IV, VII, VIII, and X
4. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

2.8. FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for equipment and pipe.

2.9. FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
B. Although other thicknesses for PVC jackets are available, a flame-spread index of 25 and a smoke-developed index of 50 apply only to thicknesses of 30 mils (0.8 mm) and less.
C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Division 01 Section "Product Requirements."
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

1. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Division 01 Section "Product Requirements."
2. Factory cut and rolled to size.
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Among the three moisture barriers in first subparagraph below, 1-mil (0.025-mm) barrier provides the least protection against galvanic corrosion, 3-mil (0.075-mm) barrier offers better protection, and Polysurlyn barrier offers the best protection. For most indoor applications, 1-mil (0.025-mm) barrier is adequate. For outdoor applications, select either 3-mil (0.075-mm) or Polysurlyn barrier.
5. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
6. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper].
7. Factory-Fabricated Fitting Covers:

a. Same material, finish, and thickness as jacket.
b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
c. Tee covers.
d. Flange and union covers.
e. End caps.
f. Beveled collars.
g. Valve covers.
h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10. TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.

1. Width: 3 inches.
2. Film Thickness: [4 mils] [6 mils].
3. Adhesive Thickness: 1.5 mils.
4. Elongation at Break: 145 percent.

5. Tensile Strength: 55 lbf/inch in width.

2.11. SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.12. INSULATION SCHEDULE

A. See plans for piping and insulation schedule. Other insulation requirements are scheduled below:

INSULATION SERVICE	TYPE	THICKNESS	JACKET
Strainers	MF	½"	
Pump Casings	FE	1"	
Air Separators	MF	½"	ASJ-SSL
MF - Mineral-Fiber	CG - Cellular Glass	FE - Flexible Elastomeric	

*Provide a minimum of .016" thick aluminum jacket with band clamps and aluminum fitting covers over all pipe insulation located on the exterior of the building.

PART 3 – EXECUTION

3.1. EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3. GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment 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 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. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
G. Keep insulation materials dry during application and finishing.
H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.
J. 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.

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

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

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

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

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

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

Q. Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration of insulation or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.

3.4. EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.

6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 incheso.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

3.5. GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. 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.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6. CALCIUM SILICATE INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation same as pipe insulation.

3.7. CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below ambient services, 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 Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8. 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. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9. MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire bands, or SSL (self sealing lap) closure system without deforming insulation material.
2. Where vapor retarder jackets are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant. If the ASJ jacket is equipped with SSL closure system, use it to seal the longitudinal seam.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. 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 Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on 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.

3.10. FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap

seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.11. FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.12. FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

E. Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this specification for a period of one year after date of final acceptance or through one heating season and one cooling season, whichever is longer shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at Mechanical Contractors expense at no cost to owner.

END OF SECTION 230719

SECTION 230923 – AUTOMATIC TEMPERATURE CONTROLS

PART 1 GENERAL

1.1. SUBMITTALS

A. Product Data: For each control device indicated.
B. Shop Drawings:

1. Schematic flow diagrams.
2. Power, signal, and control wiring diagrams.
3. Details of control panel faces.
4. Damper schedule.
5. Valve schedule.
6. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
7. Control System Software: Schematic diagrams, written descriptions, and points list and screen graphics.

C. Software and firmware operational documentation.
D. Field quality-control test reports.
E. Operation and maintenance data.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2. CONTROL SYSTEM

A. Manufacturers:

1. Automated Logic Corporation.
2. Delta Controls Inc.
3. Distech Controls
4. Honeywell International Inc.
5. Invensys Building Systems.
6. Johnson Controls, Inc.; Controls Group.
7. Siemens Building Technologies, Inc. - APOGEE
8. Staefa Control System Inc.

B. Control system and components shall be backward compatible and utilize and support open protocols. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

C. Control system and components shall be backward compatible and utilize and support open protocols. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3. DDC EQUIPMENT

A. Operator Workstation: PC-based microcomputer with minimum configuration as follows:

1. Motherboard: With min 6 USB 3.0 ports, Gigabit Ethernet.
2. Processor: Intel Core i5, 3.5GHz, quad core minimum..
3. Random-Access Memory: 8 GB min.
4. Graphics: Video adapter, with hdmi, vga as required to mate to monitor.
5. Monitor: 23 inches, LED.
6. Keyboard: Standard keyboard with number pad, USB.
7. Hard-Disk Drive: 500 GB min solid state.
8. Mouse: USB standard type.
9. Uninterruptible Power Supply: 2 kVa.
10. Operating System: Microsoft Windows 7 Professional or 10 Professional.

B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

a. Global communications.
b. Discrete/digital, analog, and pulse I/O.
c. Monitoring, controlling, or addressing data points.
d. Software applications, scheduling, and alarm processing.
e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

a. Global communications.
b. Discrete/digital, analog, and pulse I/O.
c. Monitoring, controlling, or addressing data points.

3. Local operator interface provides for download from or upload to operator workstation.

D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4. UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.

2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform automatic system diagnostics; monitor system and report failures.
3. Enclosure: Dustproof rated for operation at 32 to 120 deg F.

2.5. ANALOG CONTROLLERS

1. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
2. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.
3. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
    a. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

2.6. ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
B. Accuracy: Plus or minus 0.5 deg F at calibration point.
C. Wire: Twisted, shielded-pair cable.
D. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
E. Averaging Elements in Ducts: 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
F. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
G. Room Sensor Cover Construction: Manufacturer's standard locking covers.
H. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
I. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
J. RTDs and Transmitters:
    1. Accuracy: Plus or minus 0.2 percent at calibration point.
    2. Wire: Twisted, shielded-pair cable.
    3. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
    4. Averaging Elements in Ducts: use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
    5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
    6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
    7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
    8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
K. Humidity Sensors: Bulk polymer sensor element.
    1. Accuracy: [5] [2] percent full range with linear output.
    2. Room Sensor Range: 20 to 80 percent relative humidity.
    3. Room Sensor Cover Construction: Manufacturer's standard locking covers.
    4. First five subparagraphs below are optional features.
    5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
    6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120 deg F.
    7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
L. Pressure Transmitters/Transducers:
    1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
    2. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
    3. Output: 4 to 20 mA.
    4. Building Static-Pressure Range: 0- to 0.25-inch wg.
    5. Duct Static-Pressure Range: 0- to 5-inch wg.
    6. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
    7. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service;

minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.

8. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
9. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.

2.7. STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.
C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.8. GAS DETECTION EQUIPMENT

A. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output;, for wall mounting.
B. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.9. ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Valves: Size for torque required for valve close off at maximum pump differential pressure.
2. Dampers: Size for running torque.
3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
6. Power Requirements (Two-Position Spring Return): 24-V ac.
7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
9. Temperature Rating: Minus 22 to plus 122 deg F.
10. Limit Switch: Provide one 120v rated limit switch integral or added accessory for each actuator.

2.10. CONTROL VALVES

A. Manufacturers:

1. Danfoss Inc.; Air Conditioning & Refrigeration Div.
2. Hayward Industrial Products, Inc.
3. Magnatrol Valve Corporation.
4. Neles-Jamesbury.
5. Parker Hannifin Corporation; Skinner Valve Division.
6. Sauter Controls Corporation.

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
C. Hydronic system globe valves shall have the following characteristics:

1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and

screwed ends with backseating capacity repackable under pressure.

2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
    a. Retain one or both subparagraphs below.
    b. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
    c. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Sizing: 3-psig maximum pressure drop at design flow rate or the following:
    a. Two Position: Line size.
    b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
    c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
    1. Disc Type: Elastomer-coated ductile iron.
    2. Sizing: 1-psig maximum pressure drop at design flow rate.

PART 3 EXECUTION

3.1. INSTALLATION

A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install adjustable devices 48 inches above the floor.
B. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
C. Install guards on thermostats in the following locations:
    1. Entrances.
    2. Public areas.
    3. Where indicated.
D. Install automatic dampers according to Division 23 Section "Air Duct Accessories."
E. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
F. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."
G. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
H. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.
I. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

3.2. PANEL AND DEVICE LOCATIONS

A. Coordinate all control cabinets and other wall mounted controllers with other trades.
B. Panels and cabinets shall be located in mechanical spaces and other ancillary use spaces such as storage rooms. These locations shall be submitted and approved as part of the submittal process.
C. Do not locate control cabinets in spaces dedicated to other uses such as IT closets, data rooms, chases, etc without prior approval.

3.3. ELECTRICAL POWER WIRING PROVISIONS

A. Provide a 20A/1P 120 or 277 volt circuit from the nearest panelboard related to the work for miscellaneous HVAC control system power. Contractor may provide multiple circuits at their option. Utilize spare circuit breakers or provide new when one is not available.
B. Coordinate with mechanical equipment specifics and contractors proposed method of control power provisions. All work shall comply with Division 26 requirements and latest adopted version of the National

Electric Code.

C. Provide all necessary line voltage wiring and connections for control equipment, power supplies, dampers, actuators, and other items requiring line voltage power. This work shall be coordinated with other trades and shall be in conformance with other portions of this contract and requirements.

3.4. ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."

1. Install exposed cable in raceway, including mechanical rooms, at wall mounted control cabinets and any location control wiring would be exposed to view or damage. Exposed raceway in finished spaces shall be wiremold or similar appearing material and painted if required by the finish of the room.
2. Install concealed cable in walls and other non-accessible spaces in raceway. Wall mounted devices shall be provided with backbox and conduit.
3. Install cable in accessible plenums as plenum rated and properly supported.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.5. FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

3.6. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.
8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
9. Check DDC system as follows:

a. Verify that DDC controller power supply is from emergency power supply, if applicable.

b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
c. Verify that spare I/O capacity has been provided.
d. Verify that DDC controllers are protected from power supply surges.

10. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.7. DEMONSTRATION

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

3.8. TRAINING

1. Provide a minimum of 4 classroom training sessions, 4 hours each, for personnel designated by the Owner.
2. Train the designated staff of Owner's representative and Owner to enable them to proficiently operate the system; create, modify and delete programming; add, remove and modify physical points for the system; add additional panels when required.
3. Provide one copy of training material per student.
4. The instructors shall be factory-trained instructors experienced in presenting this material.
5. Classroom training shall be done using a network of working controllers representative of the installed hardware or at the customers site.
6. At such time acceptable performance of the system hardware and software has been established, the Temperature Control Contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent Temperature Control Contractor's representative familiar with the system's software, hardware and accessories.
7. The Temperature Control Contractor shall give instruction to the Owner's personnel on the operation of all equipment within the building and describe its intended use with respect to the programmed functions specified. Operator orientation of the system shall include, but not be limited to, the overall operational program, equipment functions (both individually and as part of the total integrated system), commands, system generation, advisories, and appropriate operator intervention required in responding to the system's operation.
8. The Temperature Control Contractor shall give web based access with temporary log-in and password to design engineer for the period of one year from substantial completion.

3.9. TESTING AND BALANCING COORDINATION

1. The temperature control contractor shall have a technical representative present with the balancing contractor on the first day of balancing for a minimum of four hours of active balancing and temperature controls coordination.
2. For the remainder of the balancing the temperature contractor may either have a technical representative present, or may furnish the balancer with the latest DDC software and all required interface devices. This includes instructions and coordination in the use of all interface devices, including laptop computers. There shall be no charge to the balancing contractor for the use of these interface devices and they shall be returned to the temperature controls contractor at the end of the balancing process.

END OF SECTION 230923

SECTION 232000 – HVAC PIPING

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type of product to be used.

PART 2 - PRODUCTS

2.1. PIPING AND FITTING MATERIALS

A. Piping used throughout project shall conform to the following specifications. Piping shall be plainly marked with manufacturers name and weight. See piping material schedule on the drawings for materials to be used for each piping system.

1. Carbon Steel Pipe (1/8" thru 2"):

a. Pipe:

i. Provide seamless carbon steel conforming to ASTM specification A-106.
ii. Pipe joints shall be threaded conforming to ANSI Standard B2.1.

b. Carbon Steel Welding Fittings:

i. Provide carbon low alloy seamless steel welding fittings conforming to current ANSI Standard B16.9 and ASTM Specification A234.

c. Grooved Joint Fittings:

i. Provide ductile iron fittings conforming to ASTM A536, Grade 65-45-12; or factory-fabricated from ASTM A53 steel pipe.

d. Branch Connection Welding Fittings:

i. Provide carbon steel weldolet fittings conforming to ANSI Standards B16.9, B16.11, B31.1.0 and ASTM specification A105, Grade 11.

e. Branch Connection, Welding to Screwed Fitting:

i. Provide carbon steel threadolet fitting conforming to ANSI Standards B16.9, B16.11, B31.1, and ASTM Specification A105, Grade 11.

f. Carbon Steel Flanges:

i. Provide carbon steel flanges conforming to ASTM Specification A181, Grade 1, and ANSI Standard B16.5.

g. Malleable Iron Screwed Fittings:

i. Provide screwed malleable iron fittings conforming to ANSI Standard B16.3, and ASTM Specification A-47 grade 32510.

h. Cast Iron Screwed Fittings:

i. Provide screwed cast iron fittings conforming to ANSI Standard B16.4, B2.1, and ASTM Specification A-126, Class A.

i. Roll Grooved Pipe Couplings:

i. Provide Victaulic Installation-Ready Style 107N (rigid) couplings with Grade "EHP" gasket (EPDM compound) in mechanical areas. Provide Victaulic Installation-Ready Style #177 or approved equal style (flexible) couplings with Grade "EHP" or "E" gasket in other areas. Provide with ductile iron housing and nuts and bolts.
ii. UL classified in accordance with NSF-61 for potable water service. The system shall meet the low-lead requirements of NSF-372.

2. Carbon Steel Pipe (2-1/2" and above):

a. Pipe:
   i. Provide electric resistance welded carbon steel pipe conforming to ASTM Specification A-53.
   ii. Pipe ends shall be beveled for welding.

b. Carbon Steel Welding Fittings:
   i. Provide carbon low alloy seamless steel welding fittings conforming to current ANSI Standard B16.9 and ASTM Specification A234.

c. Branch Connection Welding Fittings:
   i. Provide carbon steel weldolet fittings conforming to ANSI Standards B16.9, B16.11, B31.1.0 and ASTM specification A105, Grade 11.

d. Branch Connection, Welding to Screwed Fitting:
   i. Provide carbon steel threadolet fitting conforming to ANSI Standards B16.9, B16.11, B31.1, and ASTM Specification A105, Grade 11.

e. Carbon Steel Flanges:
   i. Provide carbon steel flanges conforming to ASTM Specification A181, Grade 1, and ANSI Standard B16.5.

f. Malleable Iron Screwed Fittings:
   i. Provide screwed malleable iron fittings conforming to ANSI Standard B16.3, and ASTM Specification A-47 grade 32510.

g. Cast Iron Screwed Fittings:
   i. Provide screwed cast iron fittings conforming to ANSI Standard B16.4, B2.1, and ASTM Specification A-126, Class A.

h. Grooved Joint Fittings:
   i. Provide ductile iron fittings conforming to ASTM A536, Grade 65-45-12; or factory-fabricated from ASTM A53 steel pipe.

i. Pipe Flange Gaskets:
   i. Provide 1/16" thick asbestos free gaskets full face or ring type as required. Gaskets shall be factory cut.
   ii. Gaskets by Durable Mfg. Co. or Garlock Company.

j. Roll Grooved Pipe Couplings:
   i. Provide Victaulic Installation-Ready Style 107N couplings with Grade "EHP" gasket (EPDM compound) in mechanical areas. Provide Victaulic Installation-Ready Style #177 or approved equal style (flexible) couplings with Grade "EHP" or "E" gasket in other areas. Provide with ductile iron housing and nuts and bolts.
   ii. UL classified in accordance with NSF-61 for potable water service. The system shall meet the low-lead requirements of NSF-372.

k. Steel Press fittings: Provide fittings for press style joints by Viega, Merit or Nibco.

3. Polyethylene Pipe Natural Gas Piping:
   a. Provide polyethylene pipe for gas service conforming to ASTM D-1248. Pipe shall be UV stabilized.
   b. SDR of 11.
   c. Pipe by Driscopipe or equal.

4. Polyvinyl Chloride Drain Waste Pipe:
   a. Pipe:
      i. Provide Schedule 40 polyvinyl chloride solid core plastic drain waste and vent pipe conforming to ASTM D2665. Joints shall be properly cleaned, primed and glued where scheduled.

ii. Polyvinyl Chloride (PVC) Pipe & Fittings Cell Class 12454 B. ASTM D 2241 SDR-26
iii. Pipe by Charlotte, Genova, Crestline or equal.

b. PVC Fittings:

- PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.
- Joints shall be of a push-on type with a bell-end grooved to receive a synthetic rubber gasket when scheduled. Solvent welded joints are not allowed outside the building. The joint shall be made in accordance with ASTM D 3212.

ii. Equivalents: Spears, Lasco or equal.

5. Polyethylene Pipe GSHP Piping:

a. Provide polyethylene pipe for ground source heat pump service. Pipe shall be UV stabilized.
b. SDR 11 160 psi water at 73°F (standard) or SDR 9 200 psi water at 73°F (special order) for deep installations or high static pressures.
c. DriscoPlex™ 5300 Climate Guard® pipe, molded fittings and fabricated fittings are manufactured from high-density, high molecular weight PE 3408 polyethylene compound that meets or exceeds ASTM D 3350 cell classification 345464C, and is listed by the Plastic Pipe Institute in PPI TR-4 with HDB ratings of 1600 psi (11.04 MPa) at 73°F (23°C) and 800 psi (5.52 MPa) at 140°F (60°C). DriscoPlex™ 5300 Climate Guard® pipe is manufactured in accordance with ASTM D 3035. Molded fittings are manufactured in accordance with ASTM D 3261 (butt outlet) and ASTM D 2683 (socket outlet).
d. Secure Joining DriscoPlex™ 5300 Climate Guard® pipe and fittings are quickly joined by socket, butt or saddle heat fusion, electrofusion, or mechanical fittings. Climate Guard® 5300 mechanical connection fittings are available for joining to other materials or to itself. Suitable electrofusion fittings may also be used.
e. Provide Pre-Fused Polyethylene U-Bend with anchor wings for anchoring bottom of loop.

2.2. PIPING FITTINGS

A. Piping fitting used throughout project shall be proper type for installation method used and shall be compatible with piping system material. Fittings listed in piping material schedule shall conform to the following specifications:

1. Roll Grooved Pipe Couplings:

a. Provide Victaulic style #07 or approved equal style (zero flex) couplings with Grade "E" gasket (EPDM compound) in mechanical areas. Provide Victaulic style #77 or approved equal style (flexible) couplings with Grade "E" gasket in other areas. Provide with ductile iron housing and nuts and bolts.
b. Equivalent by Grinnell.

PART 3 - EXECUTION

3.1. PIPING INSTALLATION

A. Piping systems materials and installation shall conform to the following standards and codes.

1. System: Heating and Air Conditioning Piping

a. Code: ANSI Standard B31.1.0 "Power Piping"

B. No piping containing water shall be located in areas subject to freezing temperatures, including: unheated attics, unheated plenums, chases wall spaces or cavities within exterior walls, under slabs, or in concrete.
C. Pipe sizes indicated on plans and as specified refer to nominal size in inches, unless otherwise indicated. Pipes are sized to nearest ½". In no case shall piping smaller than size specified be used.
D. Contractor shall provide and be responsible for proper location of pipe sleeves, hangers, supports, and inserts. Install hangers, supports, inserts, etc., as recommended by manufacturer and as specified and detailed on drawings.
E. Verify construction types and provide proper hangers, inserts and supports for construction used. Install inserts, hangers and supports in accordance with manufacturers load ratings and provide for thermal expansion of piping without exceeding allowable stress on piping or supports. Provide solid type hangers and supports where pipe travel exceeds manufacturer's recommendations for fixed hanger and supports.
F. Install piping parallel with building lines and parallel with other piping to obtain a neat and orderly appearance of piping system. Secure piping with approved anchors and provide guides where required to insure proper

direction of piping expansion. Piping shall be installed so that allowable stress for piping, valves and fittings used are not exceeded during normal operation or testing of piping system.

G. Install piping so that systems can be completely drained. Provide piping systems with valve drain connections at all low pipe and ahead of all sectionalizing valves whether shown on plans or not. Drain lines shall be ¾".

H. Drain valves on closed piping systems such as chilled water system shall have lock shields and plugged or capped outlets to protect system from inadvertent drainage.

I. Pitch all piping and where possible make connections from horizontal piping so that air can be properly vented from system. Provide air vents as specified at all system high points and at drop in piping in direction of flow. Use eccentric reducers where necessary to avoid air pockets in horizontal piping.

J. Provide unions or flanged joints in each pipe line preceding connections to equipment to allow removal for repair or replacement. Provide all screwed and control valves with unions adjacent to each piping connection. Provide screwed end valves with union adjacent to valve unless valve can be otherwise easily removed from line.

K. Fittings pressures and temperature ratings shall be equal to or exceed maximum operating temperature and working pressure of piping system. No mitered or field fabricated pipe fittings will be permitted.

L. All pipe threads shall meet ANSI Standard B2.1 for taper pipe threads. Lubricate pipe threads with Teflon thread sealant and lubricating compound applied full strength. Powdered or made-up compound will not be permitted. Pipe thread compound shall be applied only to male pipe threads.

M. Brazed socket type joints shall be made with suitable brazing alloys. Minimum socket depth shall be sufficient for intended service. Brazing alloy shall be end fed into socket, and shall fill completely annular clearance between socket and pipe or tube. Brazed joints depending solely upon a fillet rather than a socket type joint will not be acceptable.

N. Soft soldered socket type joints shall be made with sill-floss or 95-5 tin-antimony solder as required by temperature and pressure rating of piping system. Soldered socket-type joints shall be limited to systems containing non-flammable and non-toxic fluids. Soldered socket-type joints shall not be used on piping systems subject to shock vibration. Soldered joints depending solely upon a fillet rather than a socket-type joint will not be acceptable.

O. Make changes in piping size and direction with approved factory made fittings. Provide fittings suitable for at least 125 PSI working pressure or of pressure rating required for maximum working pressure of system whichever is greater.

3.2. PIPING SUPPORTS, ANCHORS, SLEEVES AND SEALS

A. Furnish proper type and size pipe sleeves to General Contractor for installation in concrete or masonry walls or floors. Sleeves are not required for supply and waste piping through wall supporting plumbing fixtures or for cast iron soil pipe passing through concrete slab or grade except where penetrating a membrane waterproof floor.

B. Mechanical Contractor shall supervise installation of sleeves to insure proper location and installation.

C. Each sleeve shall be continuous through wall floor or roof and shall be cut flush on each side except where indicated otherwise. Sleeves shall not be installed in structural member except where indicated or approved.

D. Sleeves passing through above grade floors subject to flooding such as toilet rooms, bathrooms, equipment rooms and kitchens shall be cast iron with integral flanges and shall extend 1 inch above finished floor. Size sleeves for and seal space between pipe sleeve with Thunderline Link-Seal.

E. Provide steel pipe sleeves in bearing walls and masonry walls. Opening in non-bearing walls, floors and ceilings may be 20 gauge galvanized pipe sleeves or openings cut with concrete core drill.

F. Pipe insulation shall run continuous through pipe sleeves with ¼" minimum clearance between insulation and pipe sleeve. Provide metal jackets over insulated pipes passing through fire walls, floors and smoke partitions. Jacket shall be 0.018 stainless steel extending 12 inches on either side of barrier and secured to insulation with 3/8" wide band. Seal annular space between jacket and pipe sleeves with Thunderline High Temperature Link Seal.

G. Pipe wall penetrations exposed to view shall have tight fitting escutcheons or flanges to cover all voids around openings.

H. All below grade and exterior wall penetrations shall be installed in a pipe sleeve and sealed between the pipe and pipe sleeve with Thunderline High Temperature Link Seal or similar compressed link type system.

I. Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around cables with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.

J. Equivalent by Dow, Chemelex, 3M.

3.3. PIPE HANGERS AND SUPPORTS

A. Provide and be responsible for locations of piping hangers, supports and inserts, etc., required for installation of piping under this contract. Design of hangers and supports shall conform to current issue of Manufacturers Standardization Society Specification (MSS) SP-58.

B. Pipe hangers shall be capable of supporting piping in all conditions of operation. They shall allow free expansion and contraction of piping, and prevent excessive stress resulting from transferred weight being induced into pipe or connected equipment. Support horizontal or vertical pipes at locations of least vertical movement.
C. Where horizontal piping movements are such that hanger rod angularity from vertical is greater than 4 degrees from cold to hot position of pipe, offset hanger, pipe, and structural attachments to that rod is vertical in hot position.
D. Hangers shall not become disengaged by movements of supported pipe.
E. Provide sufficient hangers to adequately support piping system at specified spacing, at changes in piping direction and at concentrated loads. Hangers shall provide for vertical adjustment to maintain pitch required for proper drainage, and for longitudinal travel due to expansion and contraction of piping. Fasten hangers to building structural members wherever practicable.
F. Unless indicated otherwise on drawings support horizontal steel piping as follows:

PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1-1/4"	3/8"	8 Ft.
1-1/2" to 2"	3/8"	10 Ft.
2-1/2" to 3-1/2"	½"	12 Ft.
4" and 5"	5/8"	15 Ft.

G. Unless indicated otherwise on drawings support horizontal copper tubing as follows:

NOM. TUBING SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1"	3/8"	6 Ft.
1-1/4" to 1-1/2"	3/8"	8 Ft.
2"	3/8"	9 Ft.
2-1/2"	½"	9 Ft.
3" and 4"	½"	10 Ft.

H. Support horizontal cast iron soil pipe with two hangers for each section located close to each hub.
I. Support vertical cast iron soil pipe at every floor, steel and copper tubing at every other floor except where indicated otherwise on drawings.
J. Provide continuous threaded hanger rods wherever possible. No chain, wire, or perforated straps shall be used.
K. Hanger rods shall be subject to tensile loading only, where lateral or axial pipe movement occurs provide suitable linkage to permit swing. Provide pipe support channels with galvanized finish for concealed locations and painted finish for exposed locations. Submit design for multiple pipe supports indicating pipe sizes, service and support detail to Architect-Engineer for review prior to fabrication.
L. Provide Grinnell pipe hangers for vertical pipe risers as follows:

PIPE MATERIAL	PIPE SIZE	HANGER FIG. NO.
Steel	¾" thru 20"	261

M. Provide Grinnell Fig. 194, 195 or 199 steel wall brackets for piping suspended or supported from walls. Brackets shall be prime coated carbon steel.
N. Mount hangers for insulated piping on outside of pipe insulation sized to allow for full thickness of pipe insulation.
O. Provide Grinnell Fig. 167 insulation protection shields sized so that line compressive load does not exceed one-third of insulation compressive strength. Shield shall be galvanized steel and support lower 180 degrees of pipe insulation on copper tubing. Provide wood block at each pipe hanger in thickness of insulation. Insulation vapor barrier jacket shall overlap wood block to maintain vapor barrier.
P. Structural attachments for pipe hangers shall be as follows:
Q. Concrete Structure: Provide Grinnell Fig. No. 285 cast in concrete insert for loads up to 400 lbs. and Grinnell Fig. 281 wedge cast in type concrete insert for loads up to 1200 lbs.
R. Provide Grinnell pipe hangers for horizontal single pipe runs as follows:

PIPE MATERIALS	PIPE SIZE	HANGER FIG. NO.
Steel	3/8" thru 4"	65

S. Provide Fee and Mason Fig. 600 channel trapeze pipe hangers for horizontal multiple pipe runs with pipe clamps or pipe rollers as follows:

PIPE MATERIALS	PIPE SIZE	CLAMP NO.	ROLLER NO.
Steel	3/8" thru 6"	8500	8010

*Copper Plated

T. Pipe supports for horizontal piping mounted on pipe racks or stanchions shall be Advanced Thermal Systems low friction graphite slide supports or equivalent by Elcen or Grinnell. Where racks and supports are not detailed on drawings submit detailed support drawings to Architect-Engineer for review prior to fabrication.

U. Provide Fee and Mason Fig. 404 vibration control hangers at locations where piping vibrations would be transmitted to building structure by conventional hangers. Apply hangers within their load supporting range.

V. Provide Elcen Fig. 50 pipe saddle with adjuster to support piping from floor. Provide complete with pedestal type floor stand.

W. Provide necessary structural steel and attachment accessories for installations of pipe hangers and supports. Where heavy piping loads are to be attached to building structure verify structural loading with Architect-Engineer prior to installations.

X. Equivalent hangers and supports by Auto-Grip, Basic Engineer, Bee Line, Elcen, Fee & Mason, Fluorocarbon Company, Unistrut or Super Strut Inc.

A. Provide premanufactured pipe support for piping located on flat roofs, unless otherwise indicated on drawings. Support will be of modular designs with roller bearings and guide saddles for straight piping runs longer than 50' and Unistrut type clamp/support type for other shorter runs. Maximum pipe support spacing shall be 10' for steel piping. Copper piping and refrigerant piping shall be supported at shorter distances. Piping near equipment connections shall be supported within 3' of units. System supports shall be compatible with roofing materials and shall be provided with plates, pads, etc to spread weight and wear on roof surface. Provide pipe supports from Miro Industries, B-Line, or approved equivalent.

END OF SECTION 232000

SECTION 232016 – HVAC PIPING SPECIALTIES

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

PART 2 - PRODUCTS

2.1. INSULATING UNIONS AND FLANGES

A. Provide insulating unions and flanges conforming to following specifications and plainly and permanently marked with manufacturers name and pressure class rating. Unions and flanges shall be as follows:

1. Steel pipe to steel pipe screwed end:

   a. Provide Stockham malleable iron No. 693-1/2 insulating union with high dielectric strength insulating sleeve and gasket.

2. Steel pipe to steel pipe flanged end:

   a. Provide two weld neck flanges of proper pressure rating insulated on both sides with Central or Klingerit Flange Insulation Kit.

3. Iron or steel pipe to copper pipe:

   a. Provide Epco Dielectric union or flange with screwed or solder joint as required. Union shall have 250 PSI rating and flange 175 PSI rating at 190 degrees F.

2.2. UNIONS

A. Provide unions or flanged joint in each line preceding connections to equipment or valves requiring maintenance.
B. Provide Stockham brass seat unions of material and pressure rating required by piping system.
C. Where piping systems of dissimilar materials are jointed together provide proper insulating union as specified under this specification.
D. Equivalent unions by Fairbanks or Grinnell.

2.3. STRAINERS

A. Install strainers upstream from automatic control valves, steam traps and pumps. Where strainers are an integral part of these items or incorporated in accessory equipment directly upstream, individual line strainers will not be required. Strainers shall be same size as piping. Provide strainers with proper isolation and blow down valves to allow basket removal for cleaning.
B. General: Provide Zum "Y" type self-cleaning strainers with FIPT blow-off outlet, flanged or screwed end with pressure rating as required by piping system. Provide strainers with removable stainless steel screens with perforations as follows:

Service	¼" to 2"	2-1/2" to 8"
Air	.0027"	.005"
Fuel Oil	.005	1/16"
Water	.005	1/16"

C. Equivalent strainers by Armstrong, Dunham Bush, Musseco, Paget or Yarway.

2.4. FLEXIBLE PUMP CONNECTIONS

A. Resistoflex Model R6904, multiple arch contour molded virgin fine powder/paste extrusion grade of Teflon TFE62, ASTM D-1457, Type III Teflon bellows with stainless steel reinforcing rings, 150# ASA drilled, adjustable control units have complete insulating grommets, and published dynamic pressure/temperature rating. Dupont TFE T62 Fluoroflex T-1001.

2.5. GAS PRESSURE REGULATORS

A. Provide gas pressure regulators with internal relief and low pressure cut-off as manufactured by Fisher Controls or Equimeter. Units shall be of size capable of capacities and pressures as shown on plans. Verify

capacities and pressures with each piece of equipment served.

2.6. TRIPLE DUTY VALVES

A. Provide Bell & Gossett in-line triple duty valves in locations shown on plans. Valves shall be capable of providing flow balancing, flow check and positive shut-off. Valve shall have memory bank valve plug.
B. Equivalent valve by Armstrong, Taco, Amtrol, Mueller, American Wheatley.

2.7. AIR SEPARATORS/ELIMINATORS

A. Provide where shown on plans Spirotherm VSR400FA automatic air separator/ eliminator. Unit shall incorporate a combination separator and piston air elimination valve.

2.8. EXPANSION FITTINGS

A. Provide Advanced Thermal Systems, Inc. Series "TP2" thermal expansion joints. Joint shall have integral internal and external guides and designed for packing under full line pressure. Designed for 150 psi.

2.9. THERMOMETERS AND GAUGES

A. Provide thermometers and wells and pressure test plugs as hereinafter specified and shown on the plans so that proper testing and balancing and trouble shooting can be accomplished.
B. THERMOMETERS

1. Thermometers shall be red reading mercury type having scale length of not less than 9", and scale divisions of 2 degrees F, or less similar and approved equal to Moeller Instrument Company, Inc., Style AJ. Range shall be as specified or as required for the duty. Thermometers and wells must be of at least the quality and design specified. If it complies with these specifications, equipment manufactured by one of the following manufacturers will be acceptable: Moeller, Trerice or Weksler.
2. Install thermometers at eye level (5'-0") at easily readable locations.

C. GAUGES

1. Gauges shall be bourdon tube with minimum 4-1/2" dial and die cast aluminum case with black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube brazed at socket and tip. The accuracy of the gauge shall be within ½ percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure, compound, and differential pressure gauges shall have suitable scale ranges, shall be submitted and are subject to the review of the Engineer. Graduations shall be one pound or less on all gauges where this is standard for the required range.
2. Gauges shall have ¼" IPS connections and shall be Moeller "Vantage" gauges with Case Style No. 2, or approved equal. If it complies with these specifications, equipment manufactured by one of the following manufacturers will be acceptable: Ashcroft, Marsh, Trerice, Moeller, Weksler, Taylor, Weiss, or Midwest.
3. Install a Sisco ¼" or ½" NPT fitting (Test Plug) of solid brass at desired indicated locations. Test plug shall be capable of receiving either a pressure or temperature probe 1/8" o.d. Dual seal core shall be neoprene for temperature to 200°F and shall be rated zero leakage from vacuum to 1000 psig.
4. Contractor shall also furnish the following: (2) two 2 ½" test gauges with appropriate adapters for test plugs, (2) two 5" stem pocket testing thermometers for 0° to 125°F range and (2) two for 0° to 220°F range.
5. Install gauges vertically.

D. INSTALLATION

1. Thermometers shall be installed as hereinafter specified. Where thermometer is scheduled, a thermometer well shall be provided.
2. All thermometer wells shall be constructed of brass or stainless steel and where installed in insulated piping shall have at least 2-1/2" lagging extension. Gauges shall be installed as hereinafter specified.
3. Gauge cocks shall be polished brass A10 ¼" tee handle type with threaded ends. 125 psi rated.
4. Provide gauge cock with ¼" pipe nipple for connection to gauge cock.
5. Pressure temperature ratings of each well shall be suitable for the system in which it is installed in accordance with specifications and as indicated on the drawings. All wells shall be filled with Silicon and be complete with caps and chains.
6. Thermometers shall have the temperature ranges as required for the intended application and shall be installed as scheduled.

E. THERMOMETER & TEST GAUGE COCK INSTALLATION SCHEDULE

	Thermometer &	Press Gauge &	Pete's Plug

SERVICE	Well	Gauge Cock	
Hot water entering and leaving boiler	X	X	
Suction & discharge flange of each pump			X

END OF SECTION 232016

SECTION 232123 – HYDRONIC PUMPS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Reference Section 230010.
B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. SUBMITTALS

A. Product Data: For each type and size of pump specified. Include certified performance curves with operating points plotted on curves, and rated capacities of selected models, furnished specialties, and accessories.
B. Shop Drawings: Diagram power, signal, and control wiring.
C. Operation and maintenance data.

1.3. WARRANTY

A. Provide a full parts warranty for one year from start-up.
B. Provide five-year warranty for motors.

PART 2 - PRODUCTS

2.1. HVAC PUMPS

A. GENERAL REQUIREMENTS

1. Furnish and install where shown on plans hot water and chilled water circulating pumps of the in-line and end suction centrifugal design as indicated in pump schedule on the drawings.
2. Equivalents by Bell & Gossett, Grundfos, Taco, Armstrong, Amtrol.

B. END SUCTION PUMPS

1. Pumps shall be base-mounted, single-stage, and end suction design with true back pull-out, capable of being serviced without disturbing piping connections.
2. Pump volute shall be Class 30 cast iron with integrally-cast pedestal support. The impeller shall be cast bronze, enclosed-type, dynamically balanced, keyed to the shaft and secured by a locking capscrew.
3. The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat of at least 98% alumina oxide content, and carbon seal ring, suitable for continuous operation at 225 deg. F. A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.
4. Pumps shall be rated for minimum of 175 psi working pressure. Casings shall have gauge ports at nozzles and vent and drain ports at top and bottom of casing.
5. Pump bearing housing assembly shall have heavy-duty regreaseable ball bearings, replaceable without disturbing piping connections and have foot support at coupling end.
6. Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area. A flexible-type coupler, capable of absorbing torsional vibration, shall be employed between the pump and motor, and it shall be equipped with a suitable coupling guard as required. Contractor to level and grout each unit according to manufacturer's instructions.
7. The motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the plans. Motor shall be totally-enclosed fan cooled (TEFC). Motor shall be NEMA MG1-31 rated for inverter duty, corona free operation at 3.5X rated voltage for insulation. Pump and motor shall be factory aligned, and shall be realigned by Contractor after installation. Motors shall be selected non-overloading.
8. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.
9. The contractor shall check and regulate each unit for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for Owner's reference.

PART 3 EXECUTION

3.1. PUMP INSTALLATION

A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
C. Install continuous-thread hanger rods and spring hangers of sufficient size to support pump weight.
D. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and spring hangers of sufficient size to support pump weight.
E. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.
F. 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.
G. 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.

3.2. ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and 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.

3.3. CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to machine to allow service and maintenance.
C. Connect piping to pumps. Install valves that are 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 triple-duty valve on discharge side of pumps.
F. Install suction diffuser and shutoff valve on suction side of 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, at integral pressure-gage tapping, or install single gage with multiple input selector valve.
I. Ground equipment according to Division 26.
J. Connect wiring according to Division 26.

END OF SECTION 232123

SECTION 235216 – CONDENSING BOILERS

PART 1 GENERAL

1.1. SUMMARY

A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for generating hot water.

1.2. SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: Power, signal, and control wiring.
C. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
D. Source quality-control test reports.
E. Field quality-control test reports.
F. Operation and maintenance data.
G. Warranty: Special warranty specified in this Section.

1.3. 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. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.4. WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Fire-Tube Condensing Boilers:
      a. Leakage and Materials: 10 years from date of Substantial Completion.
      b. Heat Exchanger Damaged by Thermal Stress and Corrosion: Nonprorated 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   1. Fulton Boiler Works, Inc.
   2. AERCO International.
   3. Lochinvar Corporation.
   4. Laars

2.2. MANUFACTURED UNITS

A. Description: Factory-fabricated, -assembled, and -tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water heating service only.
B. Heat Exchanger: Nonferrous, corrosion-resistant combustion chamber.
C. Pressure Vessel: Carbon steel with welded heads and tube connections.
D. Burner: Natural gas, forced draft.
E. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and postpurge the

combustion chamber.

1. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
    a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

F. Gas Train: Combination gas valve with manual shutoff and pressure regulator.
G. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
H. Casing:
    1. Jacket: Sheet metal, with snap-in or interlocking closures.
    2. Control Compartment Enclosures: NEMA 250, Type 1A.
    3. Finish: Baked-enamel or Powder-coated protective finish.
    4. Insulation: Minimum 2-inch- thick, insulation surrounding the heat exchanger.
    5. Combustion-Air Connections: Inlet and vent duct collars.
    6. Mounting base to secure boiler.
        a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" when mounting base is anchored to building structure.

2.3. TRIM

A. Include devices sized to comply with ANSI B31.1, "Power Piping". Include all necessary items for state boiler codes.
B. Aquastat Controllers: Operating and high limit.
C. Safety Relief Valve: ASME rated.
D. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
E. Boiler Air Vent: Automatic.
F. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.
G. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.
H. pH neutralization kit: Provide all accessories and piping to neutralize combustion drainage products before entering the sanitary system.

2.4. CONTROLS

A. Refer to Division 23 Section "Instrumentation and Control for HVAC."
B. The control system shall have an electronic display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The boiler shall be equipped with; a high limit temperature control certified to UL353, ASME certified pressure relief valve, outlet water temperature sensor, inlet water temperature sensor, a UL 353 certified flue temperature sensor, low water flow protection and built-in freeze protection. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.
C. The boiler shall feature control with an LCD display with Soft Keys, password security, pump delay with freeze protection, pump exercise. The boiler shall have the capability to accept a 0-10 VDC input connection for BMS control of modulation or setpoint and enable/disable of the boiler, and a 0-10VDC output of boiler modulation rate. The boiler shall have a built-in cascading sequencer with modulation logic options of "lead lag" or "efficiency optimized". Both modulation logic options should be capable of rotation while maintaining modulation of up to eight boilers without utilization of an external controller. Supply voltage shall be 120 volt / 60 hertz / single phase.
D. The boiler shall be equipped with two terminal strips for electrical connection. A low voltage connection board with data points for safety and operating controls, i.e., Auxiliary Relay, Auxiliary Proving Switch, Alarm Contacts, Runtime Contacts, Manual Reset Low Water Cutoff, Flow Switch, High and Low Gas Pressure Switches, Tank Thermostat, Tank Sensor, Building Management System Signal, Modbus Control Contacts and Cascade Control Circuit.
E. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms. Refer to drawings for additional requirements.
    1. Hardwired Points:

a. Monitoring: On/off status, common trouble alarm.
b. Control: On/off operation, hot water supply temperature set-point adjustment.

2. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

2.5. ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.
B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

1. Wiring shall be numbered and color-coded to match wiring diagram.
2. Install factory wiring outside of an enclosure in a metal raceway.
3. Field power interface shall be to wire lugs. Furnish with disconnect switch. .
4. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
5. Provide each motor with overcurrent protection.

2.6. VENTING KITS

A. Kit: Complete system, UL-1738 listed, pipe, condensate trap and dilution tank, and sealant.
B. Combustion-Air Intake: Complete system, stainless steel, pipe, and sealant.

2.7. SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 EXECUTION

3.1. BOILER INSTALLATION

A. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.
B. Vibration Isolation: Elastomeric isolation pads or mounts with a minimum static deflection of 0.25 inch. Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
C. Install gas-fired boilers according to NFPA 54.
D. Assemble and install boiler trim.
E. Install electrical devices furnished with boiler but not specified to be factory mounted.
F. Install control wiring to field-mounted electrical devices.
G. Emergency Power Off - Provide an emergency power off mushroom switch at the boiler room entrance to shutdown boilers, in the event of an emergency, when the switch is thrown. Switch shall be red and shall be labeled with a red and white phenolic plastic sign with white letters on red background, reading "Emergency Boiler Shutdown".

3.2. CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to boiler to allow service and maintenance.
C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
D. Install pH neutralization tank, devices and pipe to combustion drainage. Extend to floor drain after neutralization.
E. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 23 Section "Common Work Results for HVAC."
F. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
G. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

H. Install piping from safety relief valves to nearest floor drain.
I. Boiler Venting:

1. Install flue venting kit and combustion-air intake.
2. Vent system with a termination of both the vent and combustion air. The flue shall be UL1738 listed Stainless Steel sealed vent material. A separate pipe shall supply combustion air directly to the boiler from the outside. The air inlet pipe may be PVC, CPVC, ABS, Galvanized, or Stainless Steel sealed pipe. The air inlet must terminate on the sidewall or roof with the manufacturer's specified air inlet cap. The boiler's total combined air intake length shall not exceed 100 equivalent feet. The boiler's total combined exhaust venting length shall not exceed 100 equivalent feet. Foam Core pipe is not an approved material for exhaust piping. All piping shall be installed per manufacturers recommendations.
3. Connect full size to boiler connections.

J. Ground equipment according to Division 26 Section "Grounding."
K. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3. FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.
D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.4. DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Video training sessions.

END OF SECTION 235216

END OF DIVISION 230000