Eanes Independent School District - Purchasing Department
601 Camp Craft Road, Austin TX 78746
512.732.9036 - 512.732.9000 X20502 - purchasing@eanesisd.net

COMPETITIVE SEALED PROPOSAL (CSP)
Bridge Point Elementary HVAC Renovation
CSP # 201617-009

The Eanes Independent School District invites qualified firms to respond to a CSP for Bridge Point Elementary School HVAC Renovation. This Competitive Sealed Proposal can be reviewed and downloaded at the following website:

http://www.eanesisd.net/departments/business/purchasing

If you are an interested firm, please mail or hand deliver 2 copies of your response to 601 Camp Craft Road, Austin, Texas 78746 before or on Monday February 13, 2017 at 2:00 PM. Envelopes must be clearly marked:

CSP #201617-009 Bridge Point Elementary HVAC Renovation.

All potential bidders shall attend a **pre-bid meeting** at 2:00 PM on Tuesday February 7, 2017 at Bridge Point Elementary School located at 6401 Cedar Street, Austin, TX 78746. Meeting will take place in the conference room. Attendees should be prepared to check in with ID at the front desk.

Proposals will not be accepted after 2:00 PM Monday February 13, 2017

Proposals will be opened on Monday February 13, 2017 at 2:10 PM in the EISD Board Room located at 601 Camp Craft Road, Austin Texas 78746.

Awarded firm will be approved by the EISD Board at the Tuesday February 21, 2017 meeting.

Sincerely,

Sylvie Pouget
Purchasing Coordinator, Eanes ISD

EANES INDEPENDENT SCHOOL DISTRICT

PROJECT MANUAL FOR

BRIDGE POINT ELEMENTARY SCHOOL
HVAC RENOVATION
AUSTIN, TEXAS
CSP#201617-009

EANES INDEPENDENT SCHOOL DISTRICT
AUSTIN, TEXAS

EANES INDEPENDENT SCHOOL DISTRICT

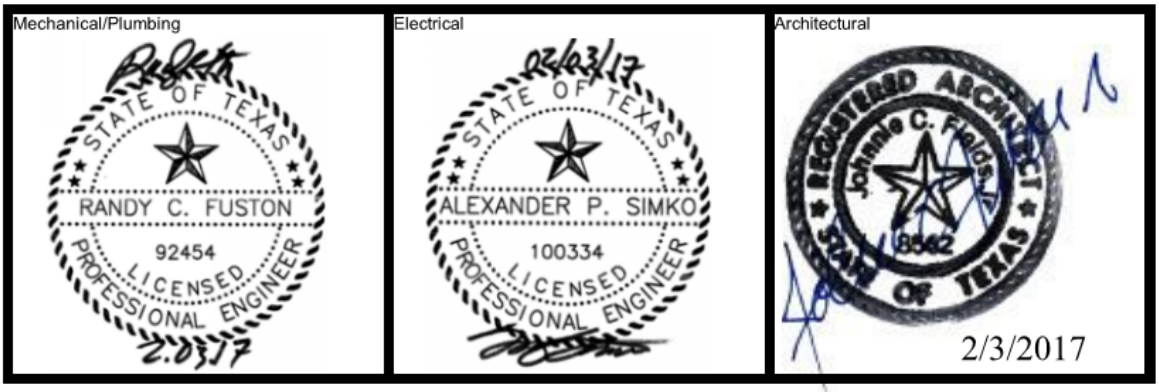
PROJECT MANUAL FOR
BRIDGE POINT ELEMENTARY SCHOOL
HVAC RENOVATION
CSP#201617-009

EANES INDEPENDENT SCHOOL DISTRICT
AUSTIN, TEXAS

MEP Engineer
MEP Engineering, Inc.
1120 S. Capital of Texas Highway
Building 1, Suite 150
Austin, Texas 78746
Ph: (512) 306-9650
Fax: (512) 306-9655

Architect
Fields and Associates
1101 S. Capital of Texas Highway
Building A, Suite 101
Austin, Texas 78646-1130
Ph: (512) 327-8444
Fax:512 259-7446

Date: February 3, 2017



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END OF SECTION

SECTION 00 02 00 - ADVERTISEMENT FOR COMPETITIVE SEALED PROPOSALS

Competitive sealed proposals will be received by the Eanes Independent School District until 2:00 PM Monday February 13, 2017, in the Eanes Administration Building located at 601 Camp Craft Road, Austin Texas 78746, in accordance with Tex., Local Gvmt. Code 271.025, for the following work:

Bridge Point Elementary School – HVAC Renovation
6401 Cedar Street, Austin, Texas 78746
Eanes Independent School District

In accordance with the Tex. Ed. Code as amended, EISD shall evaluate all proposals based on a combination of factors that the District determines provide the best value to the District, including: (a) price; (b) the proposer's experience and reputation; (c) the proposer's past performance and quality of work; (d) the proposer's personnel to be assigned to the project; and (e) the proposer's methodology.

Copies of Drawings, Specifications and other Contract Documents are on file at MEP Engineering, Inc., 1120 Capital of TX Hwy S., Building 1, Suite 150, Austin, Texas 78746 (512) 306-9650, for public inspection. Copies may be obtained by prospective proposers with a payment of $100.00 for each set.

All potential bidders shall attend a pre-bid meeting at 2:00 PM on Tuesday February 7, 2017 at Bridge Point Elementary School located at 6401 Cedar Street, Austin, TX 78746. Meeting will take place in the conference room. Attendees should be prepared to check in with ID at the front desk.

By submitting a proposal, each proposer agrees to waive any claim it has or may have against the Owner, the Engineer, and their respective employees arising out of or in connection with the administration, evaluation, or recommendation of any proposal; waiver of any requirements under the Bid Documents, or the Contract Documents, acceptance or rejection of any proposal; and award of the Contract.

The Contract will be awarded to the lowest and/or best qualified responsible proposer. The Owner reserves the right to accept any of the proposals submitted or to reject any or all proposals and to waive informalities and irregularities in the proposals and in the bidding.

The successful proposer shall be required to provide a Performance Bond and Payment Bond. The Bid Security will not be returned until these bonds are provided.

Attention is called to the fact that not less than those wages adopted by the Eanes ISD Board of Trustees will be paid on the project. All Contractors shall comply with prevailing wage rates in accordance with the civil statutes of the State of Texas.

SELECTION CRITERIA: In accordance with Texas Education Code as amended, Eanes Independent School District shall evaluate all proposals based on a combination of factors that the District determines provides the best value to the District including:

a. Price; 25%
b. Proposer's experience and reputation; 20%
c. Proposer's past performance and quality of work; 25%
d. Proposer's personnel to be assigned to the project; 15%
e. Proposer's prior experience with Eanes ISD; 10%
f. Attendance at the pre-proposal conference. 5%

The General Contractor shall be in the prime business as general or a mechanical contractor (with a Texas air conditioning license) and shall have been in business seven continuous years under the company submitting a proposal on this project. Specific related school experience is required. All Proposers shall visit the job site before submitting proposal.

The successful proposer shall be required to provide a Performance Bond and Payment Bond. The Bid Security will not be returned until these bonds are provided.

Proposals will be opened on Monday February 13, 2017 at 2:10 PM in the EISD Board Room located at 601 Camp Craft Road, Austin Texas 78746.

Awarded firm will be approved by the EISD Board at the Tuesday February 21, 2017 meeting.

A 5% bid bond is required. 100% performance and payment bonds will be required as stated in the Contract Documents.

Eanes Independent School District

By: Sylvie Pouget
Purchasing Coordinator

Eanes Independent School District - Purchasing Department
601 Camp Craft Road, Austin TX 78746
512.732.9036 - 512.732.9000 X20502 - purchasing@eanesisd.net

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Sincerely,

Sylvie Pouget
Purchasing Coordinator, Eanes ISD

SECTION 00 10 00 - INSTRUCTIONS TO PROPOSERS

1. BID SECURITY

The Proposer must submit a Cashier's Check, Certified Check or Bid Bond payable without recourse to the order of Eanes Independent School District, Austin, Texas, in the amount of Five percent (5%) of the largest total amount of their proposal. This is considered a guarantee that the Proposer will enter into a Contract and execute Payment and Performance bonds with ten (10) Days after notice of award.

If the Competitive Sealed Proposal is not accepted within Thirty (30) Days after the time set for the submission of the bids, or if the successful Proposer executes and delivers agreement, bonds, and insurance certificates, the Cashier's Check will be returned.

2. CONTRACT SURETY

The successful Proposer shall furnish One Hundred Percent (100%) bonds covering the faithful performance of the Contract and the payment of all obligations including mechanic's and material man's liens arising thereunder. The Owner shall have the right to approve any surety company, and the Proposer agrees to provide the Owner any information requested by the Owner regarding such company. Surety company to be on the Texas Education Agency’s list of acceptable surety companies.

3. BASIS OF PROPOSALS

The Contract between the Owner and the Contractor will be for the full amount of the Work (as defined in the Contract Documents). The payment and performance bonds for the Owner will be based on this figure.

4. DOCUMENTS

Copies of Drawings, Specifications and other Contract Documents are on file at MEP Engineering Inc., 1120 Capital of Texas Highway South, Building 1, Suite 150, Austin, Texas 78746 (512) 306-9650 for public inspection. This Competitive Sealed Proposal can be reviewed and downloaded at the following website:
http://www.eanesisd.net/departments/business/purchasing

Copies may be obtained by prospective proposers with a payment of $50.00 for each set. Proposer shall return the documents in good condition within three (3) days from the Bid Opening date. Additional copies may be obtained for the cost of reproduction.

5. PROPOSALS - See “Invitation for Competitive Sealed Proposal” for time, date and location for Opening of Proposals.

All Proposals shall be submitted on forms prepared by the Engineer and shall be subject to all requirements of the Contract Documents and any Addenda.

Proposals shall be filled out in their entirety. DO NOT USE bound Proposals; separate copies are available from the Engineer. Include Bid Bond, Suspension and Debarment Certification, and Felony Conviction Notice.

The Owner does not obligate itself to accept the lowest or any bid. EISD reserves the rights to award the Contract to any Proposer at any time within thirty days after the opening of the proposals, to reject any or all proposals, and to waive objection to any informality in the submission of proposals.

The Contractor shall submit with their Proposal a completed copy of Contractor's Qualification Statement, AIA Document A-305-1986. The Document shall be submitted in a separate sealed envelope. Copies of the Document will be furnished upon request by the Engineer to each Proposer.

All Proposals and Contractor's Qualification Statement shall be enclosed in a sealed opaque envelope marked with the Project, Name of Proposer, and Date and Time of Opening.

6. DISCREPANCIES

Any discrepancies between the Drawings and Specifications or errors must be reported to the Engineer for interpretation.

The Engineer will at all times endeavor to explain and interpret all discrepancies, but does not bind itself for any interpretation not in writing.

In the event of discrepancies which have not been interpreted in writing or conflicts within the Contract Documents, including drawings and specifications, the Proposer shall consider that the greater value or quantity shall apply and the submitted Competitive Sealed Proposal shall reflect this fact.

7. SUBSTITUTION AND SUBMISSION OF MATERIALS

Any reference in the Specifications to materials, products, fixtures, etc., shall not be construed as limiting competition in any manner; however, only the Engineer shall have the authority to determine whether a material is equal. No substitution will be allowed unless authorized in writing by the Engineer.

Where a definite material is specified, it is to set a standard, unless so noted that NO substitution allowed.

When several acceptable brands or manufacturers are named, the first named is the one used in designing the job. Manufacturers of products not named in the Specifications will be required to show evidence satisfactory to the Engineer, that their product is equal in construction, similar in design, and will serve the intended purpose as the item specifically named.

8. TIME OF COMPLETION

Bridge Point Elementary School must be Substantially Complete on or before August 4, 2017. Each Proposer shall stipulate on his Proposal Form that he will substantially complete the work on or before August 4, 2017. The date for Substantial Completion (as defined in the Contract Documents) must make allowance for anticipated work days which will be lost due to inclement weather because no extension of contract time shall be allowed for inclement weather days, Final Completion (as defined in the Contract Documents) must be on or before August 18, 2017. This Contract shall be subject to Liquidated Damages as hereinafter specified.

The Owner intends to begin moving furniture and personnel into the school on August 5, 2017. The contractors work after August 4, 2017 shall be limited to Final Clean and punch items only. Final Clean shall be as defined in 01 11 00 Summary of Work. All new and existing systems shall be operational. Substantial completion shall be defined as all work substantially complete, operating and functioning and the building and systems suitable for owner use. Final completion shall mean all systems are operational, the building is useable by the owner and all deficiencies (punch list items) generated by the substantial completion are complete.

9. LIQUIDATED DAMAGES

The General Contractor shall be Substantially Complete and have all Final Cleaning done by August 18, 2017, subject however, only to extensions of time approved by the Engineer under provisions of Paragraph 8.3.1 of the General Conditions. To include: For each day the work remains in an incomplete or unfinished condition such that the owner cannot move in on August 5, 2017, including any extensions of time granted by the Engineer, the Contractor agrees to his liability for Liquidated Damages for each day Completion exceeds such allotted time, Saturdays, Sundays and holidays included. The agreed measure of Liquidated Damages for each day in excess of the time allotted for completion shall be in accordance with the following schedule:

The agreed measure of liquidated damages per day shall be

Damages Estimated.

Total Value Delayed	Damages Per Calendar Day
0 to $10,000.00	50.00
$10,000.01 to $50,000.00	100.00
$50,000.01 to $100,000.00	200.00
$100,000.01 to $500,000.00	300.00
$500,000.01 to $1,000,000.00	400.00
$1,000,000.01 to $5,000,000.00	500.00
$5,000,000.01 to $10,000,000.00	1,000.00
$10,000,000 to $20,000,000	2,000.00
over $20,000,000	2,500.00

It is understood that the Liquidated Damages as herein set out are not to be construed in any sense as a penalty but as a fair estimate of damages agreed to by the parties in the event that Final Completion is not timely. It is further understood that time is of the essence.

10. INDEX OF DRAWINGS

The following is the Index of Drawings for this Project:

Bridge Point Elementary School

COVERSHEET	Sheet CVR
ARCHITECTURAL	Sheet A1- A2
MECHANICAL	Sheet M0.1 – M6.2
ELECTRICAL	Sheet E0.1 – E4.5

11. LABOR WAGE SCALE

Provisions of the contract will require the successful Proposer to comply with all state laws, including the provisions of Article 5150a, Vernon's Texas Civil Statutes, concerning prevailing rates, hourly rates, prevailing rates for legal holiday and overtime work, required payment of such rates and record keeping. As required to be paid by contractor and each sub-contractor are as listed.

The Contractor shall forfeit as penalty to the State, County, City and County, Town, District or other political subdivision on whose behalf this contract is made or awarded ten dollars ($10.00) for each laborer, workman or mechanic employed, for each calendar day, or portion thereof, such laborer, workman or mechanic is paid less than

the said stipulated rates for any work done under said contract, by him, or by any subcontractor under him.

The Eanes Independent School District shall require the submission of certified payrolls with each application for payment. The certified payrolls are to cover the same time period as the application for payment.

The Eanes Independent School District shall conduct random employee interviews across various trades at job site with no warning.

Wage rates issued herein shall remain in effect for the duration of this contract. The adopted wage rate follows:

EANES INDEPENDENT SCHOOL DISTRICT ADOPTED MINIMUM PREVAILING WAGE RATE

HOURLY WAGE RATES FOR BUILDING CONSTRUCTION CRAFTS

Eanes ISD Prevailing Wages
2016-2017

Standard Occupational Classification (SOC)	SOC Title	Eanes ISD Proposed Rates 2015
#47-1011	First-Line Supervisors of Construction Trades	26.72
#47-2011	Boilermakers	25.60
#47-2021	Brickmasons and Blockmasons	17.74
#47-2022	Stonemasons	17.14
#47-2031	Carpenters	17.29
#47-2041	Carpet Installers	15.70
#47-2042	Floor Layers, Except Carpet, Wood, and Hard Tiles	14.86
#47-2043	Floor Sanders and Finishers	14.68
#47-2044	Tile and Marble Setters	15.00
#47-2051	Cement Masons and Concrete Finishers	13.78
#47-2053	Terrazzo Workers and Finishers	15.20
#47-2061	Construction Laborers	12.27
#47-2071	Paving, Surfacing, and Tamping Equipment Operators	14.75
#47-2072	Pile-Driver Operators	20.36
#47-2073	Operating Engineers and Other Construction Equipme	16.79
#47-2081	Drywall and Ceiling Tile Installers	15.66
#47-2082	Tapers	18.14
#47-2111	Electricians	21.84
#47-2121	Glaziers	17.17
#47-2131	Insulation Workers, Floor, Ceiling, and Wall	15.36
#47-2132	Insulation Workers, Mechanical	16.43
#47-2141	Painters, Construction and Maintenance	13.79
#47-2142	Paperhangers	15.05
#47-2151	Pipelayers	19.93
#47-2152	Plumbers, Pipefitters, and Steamfitters	22.45
#47-2161	Plasterers and Stucco Masons	16.24
#47-2171	Reinforcing Iron and Rebar Workers	16.38
#47-2181	Roofers	17.87
#47-2211	Sheet Metal Workers	20.26
#47-2221	Structural Iron and Steel Workers	11.41
#47-3011	Helpers--Brickmasons, Blockmasons, Stonemasons, an	12.53
#47-3012	Helpers--Carpenters	13.72
#47-3013	Helpers--Electricians	12.39
#47-3014	Helpers--Painters, Paperhangers, Plasterers, and S	11.49
#47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and St	12.14
#47-3016	Helpers--Roofers	13.41
#47-3019	Helpers, Construction Trades, All Other	20.86
#47-4011	Construction and Building Inspectors	24.99
#47-4021	Elevator Installers and Repairers	33.07
#47-4031	Fence Erectors	19.72
#47-4041	Hazardous Materials Removal Workers	17.14
#47-4071	Septic Tank Servicers and Sewer Pipe Cleaners	16.99
#47-5021	Earth Drillers, Except Oil and Gas	16.47

Note: Journeyman wages are stipulated above. All apprentices and helpers will be paid a minimum of 50% of journeyman wages or minimum wage whichever is greater.

12. SUBMITTALS

Prior to the award of the Contract, the Engineer will notify the Proposer in writing if either the Owner or Engineer, after due investigation, has reasonable objection to a person or entity proposed by the Proposer. If the Owner or Engineer has reasonable objection to a proposed person or entity, the Proposer may, at the Proposer's option, (i) withdraw the proposal, or (ii) submit an acceptable substitute person or entity with an adjustment in the base proposal or alternate proposal to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted price of the proposal or disqualify the Proposer. In the event of either withdrawal or disqualification, bid security will not be forfeited.

The Proposer will be required to establish to the satisfaction of the Engineer and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the work described in the bidding documents.

The Proposer shall, as soon as practicable after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

A. A designation of the work to be performed with the Proposer's own forces;

B. Names of the manufacturers, products and the suppliers of principal items or systems of materials and equipment proposed for the work; and

C. Names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the work.

Persons and entities proposed by the Proposer and to whom the Owner and Engineer have made
no reasonable objection must be used on the work for which they were proposed and shall not be
changed except with the written consent of the Owner and Engineer.

13. INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

The Proposer shall carefully study and compare the bidding documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the work for which the proposal is submitted, shall examine the site and local conditions, and shall at once report to the Engineer errors,

inconsistencies or ambiguities discovered.

Proposer's and sub-Proposers requiring clarification or interpretation of the bidding documents shall make a written request which shall reach the Engineer at least seven days prior to the date for receipt of proposals.

Interpretations, corrections and changes of the bidding documents will be made by addendum. Interpretations, corrections and changes of the bidding documents made in any other manner will not be binding, and Proposers shall not rely upon them.

14. SUBMISSION OF PROPOSALS

All copies of the proposal, the bid security, if any, and other documents required to be submitted with the proposal shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to EISD and shall be identified with the project name, the Proposer's name and address and, if applicable, the designated portion of the work for which the proposal is submitted. If the proposal is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notations "SEALED PROPOSAL ENCLOSED" on the face thereof.

Proposals shall be deposited at the designated locations prior to the time and date of receipt for proposals. Proposals received after the time and date for receipt for proposals will be returned unopened.

The Proposer shall assume full responsibility for timely delivery at the location designated for receipt of proposals.

Oral, telephonic or telegraphic proposals are invalid and will not receive consideration.

No binding contract will be created between Eanes Independent School District and a prospective Proposer simply by virtue of the prospective Proposer's submission of the lowest responsible proposal. Eanes Independent School District expressly retains its authority to reject any and all proposals.

15. PROPOSAL PRICING

Proposal prices may not be altered or amended after opening of proposals has occurred except to correct self-evident errors.

No increase in price will be considered after opening of proposals has occurred, except a price decrease is permitted if the successful Proposer is the lowest and best Proposer according to all evaluative standards.

Proposal prices that include escalation clauses shall not be considered.

Proposal prices are firm for acceptance by Eanes Independent School District for 30 days from the date opening of proposals has occurred.

All prices for supplies and materials shall be quoted F.O.B. Destination.

16. CONTRACT AWARDS

Pursuant to Tex. Ed. Code, as amended, Eanes Independent School District may consider the following in determining to whom to award a contract, with the associated weighting:

A. Price; 25%
B. Proposer's experience and reputation; 20%
C. Proposer's past performance and quality of work; 25%
D. Proposer's personnel to be assigned to the project; 15%
E. Proposer's prior experience with Eanes ISD; 10%
F. Attendance at the pre-proposal conference. 5%

17. ADDITIONAL CONSIDERATIONS: NONRESIDENT PROPOSERS

Non resident Proposers' proposals shall be evaluated in compliance with Tex. Gov. Code 2252.002.

18. REJECTION OF PROPOSALS

Eanes Independent School District may, at it option, reject any proposal which;

Materially fails to conform to the specification requirements of the invitation, including but not limited to:

A. Failure to state the price;
B. Augmentation of the language to include impermissible conditions; and
C. Attempts to limit the rights of Eanes Independent School District under the contract.
D. Failure to submit a completed Contractor Qualification Statement.
E. Failure to notify Eanes Independent School District of, or misrepresentation of the conduct leading to, any felony conviction for any owner or operator of Proposer's organization. This requirement shall be waived as to publicly held corporations. (Tex. Ed. Code 44.034)

Fails to arrive at Eanes Independent School District within the time specified.

Is not in the best interest of Eanes Independent School District.

Has not been presented in a sealed envelope or has been presented with

incorrect information on the face of the envelope such as:

1. Incorrect project name
2. Incorrect proposal opening date
3. Incorrect name and address of Proposer

19. WITHDRAWAL AND AMENDMENT

Any Proposer may withdraw or amend his proposal at any time before the time for closing receipt of proposals. Any such amendment must be in writing and signed by the Proposer.

A contract awarded in violation of Sections 1 through 19 above is void. *Tex. Local Gvmt. Code, 271.028.*

20. PRE BID CONFERENCE

A bidders conference has been scheduled for 2:00 P.M., Thursday, February 7, 2017, at the Bridge Point Elementary School, 6401 Cedar Street, Austin Texas, 78746.

21. CONTRACTOR PROFILE AND METHODOLOGY

Company Name: _____

Company Address: _____

_____

Contact Numbers:

Voice: _____

E-mail: _____

Fax: _____

If there is no toll free number shall the company accept collect calls?
___ Yes ___ No

A person to contact when calling the company _____

References:

Please list three (3) Texas school districts of comparable size to EISD which you have served in the past three years, with contacts and telephone numbers:

1. _____

_____

2. _____

_____

3. _____

_____

Qualifications of Proposer's Personnel: Name, Years of Service, Experience, Resume (attach additional sheets if necessary).

Project Manager:_____

_____

_____

Superintendent:_____

_____

_____

Lead Trades Personnel: _____

_____

_____

Corporate contact for this proposal:

Name: _____ Address: _____

Phone: _____Fax: _____

E-Mail: _____

Local contact for this proposal:

Name: _____ Address: _____

Phone: _____Fax: _____

E-Mail: _____

Number of years company has been in business, doing the type of work required for this proposal: _____

Proposer's Methodology:

Construction sequence by area (listing major activities by trade and associated schedule), method of installation and location of barriers, coordination between trades, access routes, location of temporary facilities (field office, trash receptacle, personnel parking, construction vehicle parking, storage sheds, etc.), vehicle routing, construction fencing (if necessary), ductwork protection, final cleaning protection of roof, methods and schedule, demobilization method and schedule, and any other applicable information.

_____

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END OF INSTRUCTIONS TO PROPOSERS

Mrs. Sylvie Pouget
Eanes Independent School District
601 Camp Craft Rd
Austin, Texas 78746

Dear Ms. Pouget:

The undersigned, having examined the site of the proposed Work for the Bridge Point Elementary School HVAC Renovation hereby proposes as General Contractor to furnish all materials, labor, equipment and services necessary to complete the work in strict conformity with all of the Contract Documents, including the drawings, specifications and Addenda No. _____, Addenda No. _____, Addenda No. _____, prepared by MEP Engineering and any laws, statutes, ordinances, rules or regulations of any governmental agencies or public authorities relating thereto for the sum of:

Owner's Contingency Allowance (Betterment) of $100,000 to be included in Base Bid

Base Bid

_____Dollars

($_____).

Unit Price 1A: _____ Dollars ($_____).

Unit Price 1B: _____ Dollars ($_____).

Unit Price 2A: _____ Dollars ($_____).

Unit Price 2B: _____ Dollars ($_____).

If awarded the Contract, the undersigned agrees to execute the Contract for Construction as included in the Bid Package and Substantially Complete the work, including Final Clean within _____ calendar days from issuance of Notice to Proceed for the Bridge Point Elementary School as specified after Substantial Completion, or be subject to Liquidated Damages as explained in the Owner - Contractor Agreement (enclosed) at the rate schedule listed in the General Conditions of the Contract.

Contractor acknowledges that the Substantial Completion Date and Final Completion Date is essential to the Owner's operational and educational activities, and therefore time is of the essence in meeting said date. All bonds and proof of insurance (in a form satisfactory to the Owner) shall be provided to the Owner within ten (10) days of award of the Contract for Construction. Work to commence within ten (10) days of contract execution.

Bidder agrees that this Bid shall be good and may not be withdrawn for a period of Thirty (30) calendar days, after the scheduled closing time for receiving Bids.

The Owner does not obligate itself to accept the lowest or any bid. EISD reserves the rights to award the Contract to any bidder at any time within thirty days after the opening of the proposals, to reject any or all proposals, and to waive objection to any informality in the submission of proposals.

Capitalized terms not otherwise defined in this letter shall have the meanings assigned them in the Contract for Construction.

The undersigned affirms that they are duly authorized to execute this contract, that this company, corporation, firm, partnership or individual has not prepared this bid in collusion with any other Bidder, and that the contents of this bid as to prices, terms or conditions of said bid have not been communicated by the undersigned nor by any employee or agent to any other person engaged in this type of business prior to the official opening of this bid.

Respectfully Submitted,

Signed _____

Title _____

For (Firm)_____

Address _____

Telephone _____

(Sealed if Corporation)
State whether Corporation,
Partnership, or Individual

The "Standard Form of Agreement Between Owner and Contractor", On the Basis of A Stipulated Price, Form EJCDC No. 1910-8-A-1., (1996 Edition)., will be the form used as a contract for this work.

Copies of this Document may be examined in the Engineer's office.

END OF SECTION

SECTION 00 60 00 - PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that the undersigned Principal and Surety are firmly bound to Eanes Independent School District ("EISD") in the principal sum of

_____Dollars ($_____).

Now the condition of this bond is this: that, whereas the undersigned Principal has entered into a certain Contract with EISD, which Contract is dated for reference _____, whereunder Principal undertakes to perform the following-described Work of construction, alteration or repair:

Bridge Point Elementary School - HVAC Renovation
Eanes Independent School District

NOW, THEREFORE, if the Principal shall faithfully perform the Contract in accordance with the Contract Documents and shall fully indemnify and save harmless EISD from all costs and damage which EISD may suffer by reason of Principal's default or failure to do so, and shall fully reimburse and repay EISD all outlay and expense which EISD may incur in making good any such default, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

Surety waives notice of any change, extension of time, alteration or addition to the terms of the Contract or to the Work to be performed thereunder, and of any termination for the Principal's default of the Principal's right to proceed, and agrees and stipulates that no such change, extension of time, alteration, addition or termination shall, in anywise, affect its obligation on this bond.

Principal:_____

By :_____

Title:_____ Date:_____

Surety:_____

By:_____

Title:_____ Date:_____

SECTION 00 62 00 - PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that the undersigned Principal and Surety are firmly bound to Eanes Independent School District ("EISD") in the principal sum of

_____dollars ($_____).

Now the condition of this bond is this: that, whereas the undersigned Principal has entered into a certain Contract with EISD, which Contract is dated for reference _____, whereunder Principal undertakes to perform the following described Work of construction:

Bridge Point Elementary School - HVAC Renovation
Eanes Independent School District

NOW, THEREFORE, if the Principal shall well and faithfully make payment to each and every claimant (as defined in Article 5160, Revised Civil Statutes of Texas, as amended) supplying labor and material in the prosecution of the Work provided for in said Contract, then this obligation shall be null and void; otherwise, it shall remain in full force and effect. Each such claimant shall have a direct right of action on this bond.

Surety waives notice of any change, extension of time, alteration or addition to the terms of the Contract or to the Work to be performed thereunder, and of any termination for the Principal's default of the Principal's right to proceed, and agrees and stipulates that no such change, extension of time, alteration, addition or termination shall, in anywise affect its obligation on this bond.

Principal:_____

By:_____

Title: _____ Date:_____

Surety:_____

By:_____

Title: _____ Date:_____

SECTION 00 70 00 - INSURANCE REQUIREMENTS

1. INDEMNITY AND INSURANCE

A. Indemnification for personal injury, death, and property damage or loss. Contractor agrees to fully indemnify, and hold harmless Owner (including their officers, directors, agents, and Architect/Engineer) from and against any claims, demands, liability, causes of action, suits, judgments, or defense expenses (including attorney's fees) for the death or personal injury of any person (s) (including, but not limited to Contractor, Contractor's agents, employees, or invitees and the agents, employees, or invitees of such contractors) or for damage to property of any person, (including the loss or loss of use thereof), directly or indirectly connected with, attributable to, or arising from:

1. The work to be performed under this Contract, or any activities of Contractor (or of its agents, employees, subcontractors, invitees, or the agents, employees, or invitees of such contractors): or

2. The providing of Owner of any tools, machinery, equipment, equipment operators, or other personnel to Contractor or to its subcontractors or their use thereof.

This indemnity applies in either of the following instances: where injury, death, damage, or loss is caused by the negligence or fault of Contractor (or of its agents employees, subcontractors, invitees, or the agents, employees, or invitees of such subcontractors), even though also caused by the joint or concurrent negligence or fault of Owner; or where injury, death, damage, or loss is caused by the negligence or fault of Owner in failing to provide a safe place to work or in failing to warn or to supervise Contractor (or its agents, employees, subcontractors, invitees, or the agents, employees, or invitees of such Contractors), even though caused without the negligence or fault of Contractor.

B. Contractor shall indemnify and save harmless Owner from any and all laborers', materialmen's, and mechanics' liens upon the property and premises upon which the Work is being performed that arise out of the Work, and shall keep such property free and clear of all liens, claims and encumbrances arising out of the performance of this contract.

Contractor shall carry throughout the life of this Contract, at his expense, with insurers licensed in Texas having a rating by A.M. Best and Company of at least A-VIII.

Contractor shall promptly obtain insurance for the Work as specified in this Contract Agreement. Contractor shall provide the required accord form insurance certificate (s) to Owner prior to commencing the Work and shall be liable to Owner for the consequences of Contractor's delay in obtaining the required insurance policies and coverages. Contractor acknowledges that it may not enter the jobsite until owner receives and approves the specified insurance certificate (s).

Each insurance certificate must state that the insurance carrier is required to give Owner thirty (30) days prior written notice of cancellation or material change which reduces or restricts the coverages or liability limits of any insurance policy. Contractor's insurance certificate (s) shall include the Owner and it's agents as Additional Insured and also include the Project name in a conspicuous location. The insurance requirements described in this Agreement are not intended to and shall not in any way limit or qualify the liabilities and obligations Contractor assumes pursuant to this Agreement.

During the full term of the Work and of this Agreement, Contractor shall at all times maintain the following insurance coverage in primary and/or excess form with limits not less than those described below, with insurers licensed to do business and admitted in the State of Texas and in forms or policies acceptable to Owner.

The Worker's Compensation Insurance policy will be endorsed to include a waiver of subrogation in favor of the Owner and its agents.

Worker's Compensation Insurance:
Worker's Compensation: Statutory Limits
Employer's Liability: $500,000/500,000/500,000

Commercial General Liability Insurance:
Bodily Injury and Property Damage: $1,000,000/Occurrence
General Aggregate: $2,000,000

Products & Completed Operations Aggregate:
$1,000,000/Occurrence
General Aggregate: $2,000,000

The Commercial General Liability Policy shall include the following minimum coverages: Premises/Operations, Independent Contractors, Products and Completed Operations for a period of two (2) years after Substantial Completion of the Project, Broad Form Contractual Liability to cover the Indemnity and other applicable sections of this Agreement, Broad Form Property Damage, Personal Injury Liability.

Owners Protective Liability issued in the name of Leander Independent School District.

Bodily Injury and Property Damage: $1,000,000/Occurrence
General Aggregate: $2,000,000
Products and Completed Operations: $1,000,000/Occurrence

The Owners Protective Liability Policy shall include the following minimum coverages: Premises/Operations, Independent Contractors, Products and Completed Operations for a period of two (2) years after Substantial Completion of the Project, Broad Form Contractual Liability to cover the Indemnity and other applicable sections of this Agreement, Broad Form Property Damage, Personal Injury Liability.

Comprehensive Automobile Liability Insurance:

Bodily Injury and Property Damage: $1,000,000 Combined Single Limit The Comprehensive Automobile Liability Policy shall be written on a standard form and cover all owned, non-owned and hired automobiles.

Umbrella Insurance:

Bodily Injury and Property Damage: $5,000,000 per occurrence and in aggregate

The Umbrella Policy shall provide coverage that is as broad as the primary policy and the limits shall be in addition to those provided by the coverages required in the Employer's Liability (Worker's Compensation) Section, the Commercial General Liability Insurance Section, and the Comprehensive Automobile Liability Insurance Section.

Builder's Risk Insurance:

a. The Contractor shall obtain at their expense, on an All Risk of physical loss basis, Builder's Risk Insurance coverage including workmanship acceptable to the Owner, in the amount of insurance equal at all time to 100% of the insurable value of materials delivered and labor performed. The policy so issued in the name of the contractor shall also name his Subcontractors and the Owner as additional insureds, as their respective interests may appear. The policy shall have endorsements as follow:

> "This insurance shall be specific as to coverage and not considered as contributing insurance with any permanent insurance maintained on the present premises."

b. Loss, if any, shall be adjustable with and payable to the Owner and Contractor. The Builder's Risk insurance shall be issued to insure replacement cost and cover all property in transit, stored or installed at job site.

SECTION 01 00 00 – GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 CONTRACT TIME

A. In accordance with the proposal and agreement, all work under the contract is to begin June 3, 2017 and be substantially completed by the contractor including the Owner's acceptance and be ready for the Owner to operate on or before August 4, 2017. The contractor shall be complete (Final Completion) on or before August 18, 2017.

B. It is recommended that the contractor order items that require long delivery time as early as possible to insure that they can be obtained in adequate time to prevent any delays in the work. The engineer will endeavor to return submittals on long lead items in 2 calendar days or less.

1.2 INSPECTION OF SITE

A. The contractor and his subcontractors will be held to have examined the premises before submitting proposals for this work and to have satisfied himself as to the conditions under which he will be obligated to perform his work or that will in any manner affect that work under this contract. No extra payments will be allowed for claims for additional work that could have been determined or anticipated by such inspection.

1.3 FIELD MEASUREMENTS

A. Before ordering any materials or doing any work, each contractor shall verify all measurements at the area of construction and shall be responsible for their correctness. No extra charge or compensation will be allowed on account of differences between actual dimension of work and the measurements indicated on the drawings.

B. Any difference which may be found shall be submitted to EISD and the Engineer for consideration before proceeding with the work.

1.4 INTERPRETATION OF CONTRACT DOCUMENTS

A. Figures shall prevail over scaled measurements and detailed drawings over general drawings. Conflicts in drawings or specifications shall be brought to EISD’s attention at once before proceeding with work. EISD’s and the Engineer's interpretation shall be binding.

1.5 TEMPORARY CONSTRUCTION AND SERVICES

A. The contractor shall provide the following specific items of temporary construction and services:

1.6 STORAGE OF MATERIALS

A. The contractor shall utilize space for the storage of equipment and material as designated by the Owner.

B. The contractor shall take all reasonable precautions to protect his materials and equipment from damage due to weather, theft, vandalism, etc. He shall continue such protection until final completion of the work and its acceptance by the

Owner. All materials affected by the weather shall be covered and protected to keep them free from damage while being transported to the site; when stored at the site, they shall be placed on raised platforms and protected by waterproof covers. Any material damaged by water or other causes shall be removed from the site.

C. Losses of material or equipment from theft, fire, vandalism, etc., prior to final acceptance shall be borne by the contractor.

1.7 SECURITY/PROTECTION PROVISIONS

A. The types of temporary security and protection provisions required include but are not limited to fire protection, barricades, warning signs/lights, site enclosure fence, building enclosure/lock-up, watchman service, personnel security program (theft prevention), environmental protection and similar provisions intended to minimize property losses, personal injuries and claims for damages at project site. Provide security/protection services and systems in coordination with activities and in a manner to achieve effectiveness.

B. The contractor shall protect and be responsible for damage to his work from date of agreement until final payment is made and shall make good without cost to the Owner any damage or loss that may occur during this period. He shall cover building openings to protect and secure buildings from unauthorized intrusion and weather damage. He shall at no time leave unsecured tools or materials unattended to create an "attractive nuisance". The contractor shall protect the exterior of buildings and premises from damage resulting from construction operations and shall be held liable for repair and/or replacement made necessary by such operations.

C. Barriers: The contractor shall furnish, install and maintain suitable barriers to prevent injury to the public or Owner's personnel where construction operations pose a hazard. The contractor and Owner shall coordinate the specific type and location of barriers which may be required. Such barriers shall not hinder the Owner's use of the facilities from time to time as may be necessary.

1.8 OWNER'S OPERATIONS

A. All contractors are hereby notified that the Owner's operations in the existing buildings are to continue from time to time during construction of this project. It shall be the General Contractor's responsibility to take such steps as may be necessary to prevent the following or similar circumstances from happening due to his operations:

1. Injury to Owner's personnel.
2. Damage to Owner's property.
3. Damage to Owner's stored equipment.
4. Interference with Owner's operations.
5. Creation of fire, safety or health hazard.
6. Loss of security on existing buildings.
7. Leaks in existing buildings.

B. Subcontractors and suppliers are also expected to cooperate fully in preventing circumstances such as those noted above in facilitating the Owner's operation in the existing buildings.

1.9 CONTRACTOR'S USE OF PREMISES

A. The contractor shall limit his use of the premises to access to and egress from the work and storage area for materials, equipment and job office.

B. The contractor shall provide his own job office. Job office shall have facilities for storage of submittals and review of plans and specifications.

C. The contractor shall assume full responsibility for the protection and safe-keeping of products and equipment under this contract stored on the site.

D. The contractor shall assume full responsibility for repairs to existing building and premises caused by damage due to negligence or improper use of the Owner's facilities.

E. The contractor shall coordinate with school personnel any utility outages, work involving access to the existing facility or any other activity that would interfere with or interrupt school operations.

F. The contractor shall be prepared to adjust the work schedule to after school hours, construct temporary barricades, dust proof enclosures and take appropriate action for noise attenuation if required.

G. Exit doors from the existing buildings within the general construction area will remain open during school hours for emergency purposes. The contractor shall maintain safe egress from these points at all times.

1.10 UTILITY OUTAGES

A. Before starting any work relating to existing utilities (electrical, sewer, water, heat, gas, fire lines, etc.) that will temporarily discontinue or disrupt service to the existing building, notify the Engineer and the Owner 72 hours in advance and obtain the Owner's approval before proceeding with this phase of the work. When possible schedule utility outages when the building is closed.

1.11 CLEAN UP

A. Each contractor shall provide daily clean-up and removal of debris resulting from his construction operations. Exterior grounds shall be left clean at end of each construction day. Interiors shall be left broom clean at end of each construction day.

B. The contractor may with the Owner's permission place approved commercial-type trash receptacles with closeable top for deposit of trash and debris and provide for disposal of contents at no expense to Owner.

C. The Contractor will not be permitted to use any EISD trash or garbage receptacles. Clean-up of all construction related materials, waste or litter must be completed before the work will be considered complete.

END OF SECTION 01 00 00

EISD Campus Cleaning Guidelines

ALL AREAS
(includes offices, conference rooms, classrooms, restrooms, lobbies, corridors, stairwells, entry ways, breezeways, elevators.)

Empty trash receptacles, replace liner (if soiled), wash receptacles (as needed) and dispose of trash
Sweep floors, removing debris from behind doors, in corners and around furniture.
Vacuum carpets/floors, removing debris from behind doors, in corners and around furniture.
Spot mop floors/spot clean carpet, removing spills/stains.
Do not water natural plants.
Damp mop all hard surface floors including hallways, interior stairs, landings, breezeways
Spot wash walls and doors, clean around light switches as needed.
Clean wash basins and utility sinks.
Dust all interior surfaces below and above 6 ft. and ceiling areas for cobwebs, etc.
Wash interior window as time permits.
Clean air grills and vents and dust venetian blinds and window sills.
Flush eye washers, flush safety showers.

RESTROOMS

Complete a full-scale cleaning of restrooms. Disinfect wash basins, urinals, commodes, trash receptacles and dispensers. Sweep & mop floors.
Damp wipe doors, walls & partitions. Clean mirrors and bright metal surfaces.
Service all dispensers, including sanitary napkins dispensers.
Spray clean walls, stalls, fixtures and scrub restroom floors.

LOBBIES, CORRIDORS & STAIRWELLS

Clean drinking fountains.
Sweep and spot mop interior stairs and landings.
Dust & clean handrails, metal railings, fire extinguishers.
Apply a coat of floor finish and buff hard surfaces (lobbies & corridors).
Bonnet-shampoo carpeted areas.

ENTRYWAYS & BREEZEWAYS

Sweep building entrances, remove dust tags, spider webs from walls, ceiling, & corners.
Vacuum entry mats and exchange as required.
Clean entry glass doors and walls.
Wash down floors, exterior signs and landings.

ELEVATORS

Vacuum all elevator tracks.

Specific Requirements

Stripping & waxing of all VCT or terrazzo floors
Shampoo all carpet
Deep clean all restrooms

Special Cleaning

Cleaning processes

Cleaning chemicals, wax, floor stripper
Betco Quat-Stat Disinfectant
Betco Fast Draw PH7 ULTRA Daily Floor Cleaner
Betco #11 Oxy Cleaner
Betco glass cleaner

Floor stripping process / Ax-it plus strip
Equipment needed: dust mops, broom, dust pan, protective gear, measuring cup, wet floor signs, tape, double bugs, mop, mop bucket, buffer, black pads, scrappers, wet vac, floor stripper
Dust Mop floor
Tape off doorways and edges
Put wet floor signs
Wear protective equipment
Mix floor stripper properly to specs using cool water
Scrape finish from edges if needed
Floor mop stripper, let dwell to specs
Use a clean black stripping pad
Walk where you scrub, flip or change pad when clogged or needed
Wet vac pickup
Damp mop rinse with clean water 2x
Change out mop water when dirty
Properly clean and store all equipment
Apply finish when floor is completely dry

Waxing Process / Betco Hard As Nails 20% Solid
Equipment needed:, waxing rayon mop, mop bucket, trash liner, wet floor signs, wax
Use a clean rayon flush mop
Put floor signs out.
Line the bucket, pour finish in bucket.
Wax areas in sections
Flip mop to prevent dragging of wax.
Recoat floor when touch to the floor is completely dry.
Put 5 complete coats to floor.

Prespraying Extraction of carpet / ES-Steam extraction cleaner
Equipment needed: protective gear, wet floor signs, vacuum, spray bottle, prespray pressure sprayer
Vacuum area completely and spray spots with prespray remover see specs on spotter
Place wet floor signs on carpet or entrance
Allow dwelling time for cleaner on carpet
Use cleaning solution in extractor.
Use the double pass method and overlap your passes.
Use carpet floor dryer to allow appropriate drying time (24 Hrs. Maximum)

Restroom Cleaning

Equipment needed: mop bucket, wet mop, dust pan, broom, paper towels, swab bowl mop, duster, Betco Quat-Stat Disinfectant, Betco glass cleaner.
Remove all trash or debris from floor
Remove trash from trash can
High dust all areas
Sweep floor
Using Betco Quat-Stat Disinfectant spray inside and outside of toilet and all urinals, scrub inside of toilet and urinals and flush, dry with dry towels and wipe chrome handle with a damp wet towel.
Spray and wipe sinks and counter tops with Betco Quat-Stat Disinfectant
Spray and wipe mirrors with Betco glass cleaner.
All restroom partitions will be wiped down with Betco Quat-Stat Disinfectant and wipe down toilet dispenser with damp towel
All chrome to be wiped down with damp towel, no chemical needed
Wet mop floor with Betco Fast Draw PH7 ULTRA Daily Floor Cleaner.

Classroom cleaning process

Equipment needed: vacuum , duster, Betco glass cleaner , Betco Quat-Stat Disinfectant
Throw all trash from classroom
High dust all areas
Clean and dust window seals
Wipe all walls down to remove dust
UseBetco Quat-Stat Disinfectant clean all sinks
Vacuum carpet
If VCT floor,. Strip and wax.

SECTION 01 11 00 – SUMMARY OF WORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROJECT DESCRIPTION

A. The project consists of:

1. Replacing heating ventilating and air conditioning (HVAC) split heat recovery unit (HRU) equipment as shown on plans.
2. Replacing heating ventilating and air conditioning (HVAC) split heat pump console equipment with fan coil units (FCUs) as shown on plans.
3. Replacing heating ventilating and air conditioning (HVAC) split heat pump fan coil indoor and outdoor units (FCUs) with like units as shown on plans
4. Replacing heating ventilating and air conditioning (HVAC) console heat pump equipment with RTUs as shown on plans.
5. Adding new DDC Controls to the new HVAC systems in the building.

All of the above work is as shown on Contract Documents prepared by MEP Engineering, Inc.

1.3 CONTRACTOR USE OF PREMISES

A. General: Limit use of the premises to construction activities in areas indicated.

B. Confine materials and equipment storage, temporary facilities, and parking to areas as required by Owner to minimize conflicts and facilitate Owner's usage. The site may not be used for living quarters. Existing employees and visitors parking areas may be used.

1.4 OWNER OCCUPANCY

A. Owner occupancy: The Owner may occupy limited portions of the site and existing building during the construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the work so as not to interfere with the Owner's operations including vehicular circulation on the site.

B. Provide minimum of 72-hour notice to owner and receive written notice to proceed before interrupting any utility.

C. Partial Owner occupancy: The Owner reserves the right to occupy and to place and install equipment in areas of the building prior to substantial completion. Such placing of equipment and partial occupancy shall not constitute acceptance of the total work.

D. Contractor to phase work as much as possible to assist AISD housekeeping prepare for the following school year.

1.5 COORDINATION

A. General: The work of the Contract includes coordination of the entire work of the project including diagrams and schedules and control of site utilization from beginning of construction activity through project close-out and warranty periods.

1.6 MISCELLANEOUS PROVISIONS

A. Copies of Contract Documents: The Owner will supply to the contractor not less than five sets of contract documents and any additional surplus sets from bidding, free of charge, for construction purposes; additional copies will be available to the contractor at the cost of reproduction.

B. Asbestos: In accordance with federal legislation (Asbestos Hazard Emergency Response Act, 1986, PL99-519), each project must be certified to be constructed with no materials containing asbestos. Contractor, subcontractors and suppliers will be required to sign a statement to this effect. Any asbestos discovered in the existing facility will be removed by Owner.

C. Construction Operations: The Engineer assumes no responsibility for physical construction operations. The contractor shall be solely responsible for construction methods, means, procedures and supervision of the work.

D. Safety: Comply with all laws governing safety, specifically the "Occupational Safety and Health Standards" (OSHA).

E. Permits and fees: Contractor shall procure and pay for building permit and other permits, licenses, deposits, meters, connecting of temporary and permanent utilities and all fees required. Contractor shall verify and coordinate all work with utility company requirements and shall verify inverts.

F. Cooperation with building officials: Cooperate with utility and governmental authorities and inspectors to facilitate required inspections and approvals.

G. Notification: The contractor shall notify the Engineer at least 48 hour in advance of start of each classification of work and concealment of work. Notify Engineer and Testing and Inspection Service 24 hours in advance of operations requiring testing services.

H. Cutting and patching: Cut existing construction as required to provide for installation of other components or performance of other construction activities and patch and restore construction using methods least likely to damage elements to be retained or adjoining construction.

I. Work in existing building: Provide barricades, warning signs and other forms of protection as required to protect Owner's personnel and general public. Protect existing finish work indicated to remain from damage. Repair or replace damaged work indicated to remain as required to restore to condition equal to or better than condition at start of work. Provide temporary weather protection where interior of existing building is exposed due to alterations to exterior of building to insure no water leakage or damage occurs to interior of building or contents. Owner will remove contents in areas of construction as required for performance of work in advance of construction operations. Coordinate scheduling with Owner. The Owner will add all moveable furniture from the building before construction begins.

J. Final cleaning: Final cleaning shall be performed by the Contractor and includes normal construction clean up as well as cleaning as defined by the attached EISD Cleaning Guidelines, as well as stripping and waxing floors and shampooing and drying carpets. The Contractor shall only use the cleaning and waxing products listed in the EISD Cleaning Guidelines unless specific permission is given in writing by the Owner. The school shall be Final Cleaned thoroughly inside and outside. The ***entire*** Bridge Point Elementary School shall be Final Cleaned after substantial completion on August 4, 2017. Remove all debris, waste materials, the contractor's tools, construction equipment and surplus materials from the site. Remove all temporary facilities. All cleaning shall be complete by August 18, 2017. All carpets shall be dry and ready for use by 5:00PM August 18, 2017. The contractor shall obtain any temporary devices such as dehumidifiers, fans etc, as necessary, to ensure that all carpets are dry within 24 hours of being shampooed. Carpets that are not dry and ready for use at 5:00 PM on August 18, 2017 will begin assessment of liquidated damages. Remove all debris, waste materials, the contractor's tools, construction equipment and surplus materials from the site. Remove all temporary facilities.

K. Warranties: All warranties will start after the date of Substantial Completion. All materials, equipment, work etc. performed will have a Warranty date that begins based on the Substantial Completion of that work.

END OF SECTION 01 11 00

SECTION 01 22 00 – UNIT PRICES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

B. Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.

C. Defect assessment and non-payment for rejected work

1.2 AUTHORITY

A. Measurement methods delineated in the individual specification sections complement the criteria of this Section. In the event of conflict, the requirements of the individual specification section govern.

B. Take all measurements and compute quantities. The Architect will verify measurements and quantities.

1.3 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Contract Documents are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Engineer determine payment.

B. If the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit sum/prices contracted.

1.4 MEASUREMENT OF QUANTITIES

A. Measurement Devices:

1. Weigh Scales: Inspected, tested and certified by the applicable State Weights and Measures Department within the past year.
2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
3. Metering Devices: Inspected, tested and certified by the applicable State department within the past year.

B. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.

C. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

D. Measurement by Area: Measured by square dimension using mean length and width or radius.

E. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.

F. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

1.5 PAYMENT

A. Payment Includes: Full compensation for all required labor, Products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit..

B. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the Architect multiplied by the unit/sum price for Work which is incorporated in or made necessary by the Work.

1.6 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Architect, it is not practical to remove and replace the Work, the Engineer will direct one (1) of the following remedies::
   1. The defective Work may remain, but the unit sum/price will be adjusted to a new sum/price or reduced 50 percent at the discretion of the Engineer.
   2. The defective Work will be partially repaired to the instructions of the Architect, and
   3. the unit sum/price will be adjusted to a new sum/price or reduced 50 percent at the discretion of the Engineer.

C. The individual specification sections may modify these options or may identify a specific formula or percentage sum/price reduction.

D. The authority of the Engineer to assess the defect and identify payment adjustment is final.

1.7 NON-PAYMENT FOR REJECTED PRODUCTS

A. Payment will not be made for any of::
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from the transporting vehicle.
   4. Products placed beyond the lines and levels of the required Work.
   5. Products remaining on hand after completion of the Work.
   6. Loading, hauling and disposing of rejected Products.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1 – Unit Prices for Refrigeration Lines
   A. Base Proposal Price: Shall be based on new refrigeration lines for each split DX unit from the indoor unit located in the building to the new outdoor unit. Lengths of refrigeration lines as shown on Drawings. In addition, proposers shall quote unit prices for the following:
   1A Unit price per 50 feet of length to reuse the existing fan coil unit located in the new closet to the new heat pump located outside. This unit price shall include cleaning and pressure testing of existing refrigeration lines.
   1B Unit price per 50’ of length to reuse the existing heat recovery unit located on the mezzanine to the condensing unit(s) located outside. This unit price shall include cleaning and pressure testing of existing refrigeration lines.

B. Unit Price No. 2 – Unit Prices for Electrical
   B Base Proposal Price: Shall be based on new branch circuits and conduit to the new fan coil unit locations in the new classroom mechanical closet.
   2A Unit price per 10 feet of length to reuse the existing conductor and raceway from the panel to the existing fan coil unit location.
   2B Unit price per 10 feet of length to extend the new conductor and raceway from the existing fan coil unit location to the new classroom mechanical closet.

END OF SECTION 01 22 00

SECTION 01 25 13 – PRODUCTS AND SUBSTITUTIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to the work of this section.

1.2 DESCRIPTION OF REQUIREMENTS

A. Definitions: Definitions used in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including such terms as, "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction" and similar terms. Such terms are self explanatory and have recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation int he Work, regardless of whether they were specifically purchased for the project or taken from the Contractor's previously purchased stock. The term "product" as used herein included the terms "material", "equipment", "system" and other terms of similar intent.
2. "Named Products" are products identified by use of the manufacturer's name for a product, including such items as a make or model designation, as recorded in published product literature, of the latest issue as of the date of the Contract Documents.
3. "Materials" are products that must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form units of work.
4. "Equipment" is defined as a product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

B. Substitutions: Requests for change in the products, materials, equipment and methods of construction required by the Contract Documents are considered requests for "substitutions" and are subject to the requirements specified herein. The following are not considered substitutions:

1. Revisions to the Contract Documents, where requested by the Owner or Engineer, are considered as "changes" not substitutions.
2. Substitutions requested during the bidding period, which have been accepted prior to the Contract Date, are included in the Contract Documents by Addendum.
3. Specified Contractor options on products and construction methods included in the Contract Documents are choices available to the Contractor and are not subject to the requirements for substitutions as herein specified.
4. Except as otherwise provided in the Contract Documents, the Contractor's determination of and compliance with governing regulations and orders as issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders.

1.3 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work. When it is discovered that specified products are available only from sources that do not or cannot produce an adequate quantity to complete project requirements in a timely manner, consult with the Engineer for a determination of what product qualities are most important before proceeding. The Engineer will designate those qualities, such as visual, structural, durability, or compatibility, that are most important. When the Engineer's determination has been made, select products from those sources that produce products that possess the moses important qualities, to the fullest extent possible.

B. Compatibility of Options: Compatibility of products is a basic requirement of product selections. When the Contractor is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

1.4 SUBSTITUTION REQUEST

A. During Bidding, only written Request for Substitutions will be considered. Written requests must include all pertinent information noted in the following paragraphs 1.4.C and 1.4.D. Written requests must be received no later than 7 days prior to the bid date.

B. After date of Contract, the Owner may consider formal requests from Contractor for substitution of products in place of those specified when submitted in accordance with the requirements of this Section. One or more of the following conditions must also be documented.

C. The substitution must be required for compliance with interpretation of code requirements or insurance regulations.

D. The substitution must be due to the unavailability of the specified products, through no fault of the Contractor.

E. The substitution may be requested when subsequent information discloses the inability of the specified products to perform properly or to fit in the designated space.

F. The substitution may be due to the manufacturer's or fabricator's refusal to certify or guarantee performance of the specified product as required.

G. The substitution may be requested when it is clearly seen, in the judgment of the Engineer that a substitution would be substantially to the Owner's best interest in terms of cost, time or other consideration.

H. Submit one copy of Request for Substitution. Include in Request:

I. Complete data substantiating compliance of proposed substitution with Contract Documents.

J. Product identifications, including manufacturer's name and address.

K. Manufacturer's literature including product description, performance and test data, and reference standards.

L. Name and address of similar projects on which product was used and date of installation.

M. Itemized comparison proposed substitution with product or method specified.

N. For request submitted after bids are received, accurate cost data on proposed

substitution in comparison with products or method specified, and date relating to changes in construction schedule.

O. In submitting Request for Substitution, Manufacturer, Subcontractor or Contractor where Contractor is initiating request makes the following representations.

P. They have personally investigated proposed product and insure that it acceptable or superior in all respects to that specified.

Q. They will provide the same guarantee for substitution as for product specified, and that substitution will not adversely effect any related specified products guarantee.

R. They will coordinate installation of accepted substitution into Work, making changes as may be required for Work to be completed in all respects as originally specified.

S. They waive all claims for additional costs related to substitution which consequently becomes apparent.

T. Cost data is complete and included all related costs under the Contract, but excludes:
   1. Cost under separate Contracts.
   2. Design consultant's redesign.
   3. Substitutions will not be considered if:
      i. They are indicated or implied on Shop Drawings or Product Data submittals without request.
      ii. Acceptance will require substantial revision of Contract Documents.

PART 2 – PRODUCTS

2.1 GENERAL PRODUCT COMPLIANCE

A. General: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a contract requirement. These requirements may be specified in any one of several different specifying methods, or in any combination of these methods. These methods include the following:
   1. Proprietary
   2. Descriptive
   3. Compliance with Reference Standards

B. Compliance with codes, compliance with graphic details, allowances, and similar provisions of the Contract Documents also having a bearing in the selection process.

C. Procedures for Selecting Products: The Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects. Required procedures include but are not limited to the following for the various indicated methods of specifying:

D. Proprietary and Semiproprietary Specification Requirements:
   1. Proprietary Specification: Where only a single product or manufacturer is named, provide the product indicated, unless the specification indicates possible consideration of other products. Advise the Engineer before proceeding, when it is discovered that the named product is not a reasonable or a feasible solution.
   2. Semiproprietary Specification: Where two or more products or

manufacturers are named, provide one of the products named, at the Contractor's option. Exclude products that do not comply with specification requirements. Do not provide or offer to provide an unnamed product, unless the specification indicates possible consideration of other products. Advise the Engineer before proceeding where none of the named products comply with specification requirements, or are feasible for use.

3. Descriptive Specification Requirements: Where the specifications describe a product or assembly generically, in detail, listing the exact characteristics required, but without use of a band or trade name, provide products or assemblies that provide the characteristics indicated and otherwise comply with Contract requirements.
4. Compliance with Standards, Codes and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirement, including the standards, codes and regulations.
5. Allowances: Refer to individual sections of the specifications and "Allowance" provisions in Division 1 sections for an indication of product selections that are controlled by established allowances, and for the procedures required for processing such selections.

2.2 GENERAL PRODUCT REQUIREMENTS

A. General: Provide products that comply with the requirements of the Contract Documents and that are undamaged and, unless otherwise indicated, unused at the time of installation. Provide products that are complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

PART 3 – EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. General: Except as otherwise indicated in individual sections of these specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.

END OF SECTION 01 25 13

SECTION 01 30 00 – ADMINISTRATIVE PROVISIONS

PART 1 – GENERAL

1.1 SECTION INCLUDES
- A. Title of Work, and type of Contract
- B. Preconstruction Conference
- C. Work Sequence
- D. Contractor Use of Premises
- E. Owner-furnished Products
- F. Allowances
- G. Coordination
- H. Reference Standards
- I. Project Meetings

1.2 RELATED REQUIREMENTS

1.3 WORK COVERED BY CONTRACT DOCUMENTS
- A. Work of this contract comprises general construction including site work, plumbing, mechanical and electrical for the Summitt Elementary School HVAC Renovation for the Austin Independent School District, Austin, Texas.

1.4 CONTRACT METHOD
- A. Construct the work under a single lump sum contract. (See enclosed Agreement)

1.5 PRECONSTRUCTION CONFERENCE
- A. A preconstruction meeting will be held at a time and place designated by the Engineer, for the purpose of identifying responsibilities of the Owner's and the Engineer's personnel and explanation of administrative procedures.

1.6 WORK SEQUENCE
- A. Construct work during the construction period, coordinate construction schedule and operations with owner. Renovation and other disruptive activities shall not commence prior to June 3, 2107 unless approved by Eanes ISD. Substantial completion shall be on or before August 4, 2017.

1.7 CONTRACTOR USE OF PREMISES
- A. Limit use of premises for Work and for construction operations, to allow for limited Owner occupancy. Owner will not move out of areas of construction and contractor shall minimize access to these areas during summer.
- B. Coordinate use of premises under direction of Engineer with Owner.

1.8 OWNER-FURNISHED PRODUCTS
- A. None
- B. Owner's Responsibilities
  - 1. Coordinate with Contractor
  - 2. Warranty on owner furnished products.
- C. Contractor's Responsibilities
  - 1. Receive and unload new products at site; inspect new products for

completeness, for damage, jointly with Owner.
2. Handle, store, install and finish products.
3. Repair or replace items damaged by Work of this contract.

1.9 COORDINATION
A. Coordinate work of the various sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.
B. Verify characteristics of elements of interrelated operating equipment are compatible; 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 mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practical; make runs parallel with lines of building. Coordinate locations of fixtures and outlets with finish elements. Utilize spaces for other installations, for maintenance and for repairs.
D. In finished areas except as otherwise shown, conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

1.10 REFERENCE STANDARDS
A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
B. The date of the standard is that in effect as of the date of OWNER-CONTRACTOR Agreement, except when a specified date is specified.
C. Obtain copies of standards when required by Contract Documents. Maintain copy at job site during progress of the specific work.

1.11 PROJECT MEETINGS
A. Project meetings will be held bi-weekly or as often as Owner requests with the Contractor, major Subcontractors, Owner and Engineer.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 30 00

SECTION 01 32 00 – RECORD DRAWINGS

PART 1 – GENERAL

1.1 DESCRIPTION AND RESPONSIBILITIES

A. Record drawings are drawings that reflect changes in the work from that shown on the original drawings. Record drawings are the responsibility of the contractor and are part of the Contract between the Owner and contractor. At the end of the Project, the contractor is to submit the record drawings to the Engineer.

B. As-built conditions are important to the Owner for future maintenance, repairs, renovations and auditions to the work; therefore, the contractor is required to furnish Record Drawings that are complete and accurate and that are clear and legibly drawn.

1.2 AS BUILTS

A. The following general requirements apply to all record drawings:

1. They shall be produced and maintained at the contractor's expense.
2. They shall be complete, indicating all elevations and changes from the original drawings.
3. They shall be done clearly, carefully and legibly and additional drawings shall be provided as necessary for clarification.
4. They shall be kept up to date during the entire course of the work and shall be available for examination when requested or when needed to establish clearance for other parts of the work.

1.3 DRAWING REQUIREMENTS

A. The contractor shall maintain Record Drawings on one set of drawings reserved exclusively for that purpose. Changes shall be drawn and indicated on these copies in red pencil or ink.

B. The quality of the drawings is required to be clear and legible. Should the person maintaining the Record Drawings be unable to print, write or draw legibly, then the contractor shall employ a draftsperson who can produce proper drawings of good quality. The Engineer reserves the right of approval as to the quality of the Record Drawings.

C. The drawings shall indicate all changes in sizes, dimensions, change orders, locations of piping and other changes authorized by the Engineer including but not limited to the following:

1. Engineer reviewed changes that the contractor elects to make in construction or location of work..
2. All changes in location of electrical equipment and conduit runs, all changes in location of plumbing equipment and piping, and all changes in the location of HVAC ductwork and equipment.
3. In addition, it shall be possible using these documents to correctly and easily locate, identify and establish sizes of all piping, directions and the like as well as all other features of work which will be concealed in the finished building.

D. Owner's as-built drawings

1. The contractor will submit the completed set of as-built blueline prints within five (5) days after the date of Substantial Completion for the project. The Engineer will not authorize final payment to the contractor until as-built drawings have been approved..

END OF SECTION 01 32 00

SECTION 01 33 00 - SUBMITTALS

PART 1 – GENERAL

1.1 SCOPE

A. Submittals and their submissions shall be in complete conformance with the contract Documents including General, Supplemental and Special Conditions.

B. The number of copies to be submitted with each Submittal will be determined at the Pre-Construction Conference; however, in no case shall the number be less than that required to be returned to the contractor plus three (3) copies retained by the Engineer, Project Manager and Owner.

1.2 SUBMITTAL LIST

A. Within ten (10) days after date of Start Work Order or Notice to Proceed with the work, the contractor shall submit to the Engineer a "Submittal List" indicating the specified submittal requirements of each section.

B. The Engineer may approve or reject the list. If rejected, revise and resubmit the list in accordance with the Engineer's comments. The Engineer may delete or add to the list of Submittals at his discretion.

1.3 LOGGING AND NUMBERING

A. The contractor shall keep a "submittal log" detailed enough for tracking and identifying each submittal and indicating the dates of submission and return.

B. Consecutively number all submittals. Accompany each with a letter of transmittal containing all pertinent information required for identification.

1.4 SHOP DRAWINGS AND SAMPLES

A. Make all shop drawings accurate, to scale and sufficient in size to show all pertinent aspects of the item, its construction jointage and its method of connection to the work. Shop drawings must be sufficient in detail to show compliance with the Contract Documents and to indicate fabrication.

1.5 MANUFACTURER'S SPECIFICATIONS AND INSTRUCTIONS

A. Submit all required manufacturers' information and specifications of a product together with all other required data in one submittal. Do not break up a single product into several submittals.

B. When specified, include the following manufacturers' data with the submittal:

1. Certification.
2. Guarantee/warranty.
3. Installation instructions.
4. Color or product samples.
5. Specifications.
6. Code compliance (Fire, UL, etc.)
7. Maintenance requirements and instructions.

1.6 CONTRACTOR'S REVIEW

A. The contractor shall review submittals for conformance to the Contract Documents in quality, quantity, design and dimension before they are sent to the Engineer for review.

B. To certify that the submittal has been reviewed and approved by the contractor, he shall stamp the submittal with an "Approved" ink stamp and sign and date the submittal.

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY CONTROL

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Quality assurance and control of installation.
B. References.
C. Inspection and testing laboratory services.
D. Manufacturers' field services and reports.
E. Permits and inspections.

1.2 RELATED SECTIONS

A. Section 01 30 00 - Submittals: Submission of Manufacturers' Instructions and Certificates.
B. Section 01 60 00 - Material and Equipment: Requirements for material and product quality.

1.3 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
B. General Contractor to be responsible for payment all of testing and inspection.
C. Comply fully with manufacturers' instructions, including each step in sequence.
D. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
E. 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.
F. Perform work by persons qualified to produce workmanship of specified quality.
G. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 REFERENCES

A. Conform to reference standard by date of issue current on date specified in product Sections.
B. Obtain copies of standards when required by Contract Documents.
C. Should specified reference standards conflict with Contract Documents, request clarification for Architect/Engineer 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.

1.5 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, test, adjust, and balance of equipment as applicable, and to initiate instructions when necessary.
B. Individuals to report observations and site decisions or instructions given to

applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within 30 days of observation to Architect/Engineer for review.

1.6 PERMITS AND INSPECTIONS

A. The Contractor is required to pay for all required Building Permits, etc.

B. All Inspections by the City or other Governing Offices shall be coordinated by the Contractor.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 40 00

SECTION 01 60 00 - MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Products.
- B. Transportation and handling.
- C. Storage and protection.
- D. Product options.
- E. Substitutions.

1.2 RELATED SECTIONS
- A. Section 01 30 00 - Administrative Provisions.
- B. Section 01 40 00 - Quality Control: Product quality monitoring.

1.3 PRODUCTS
- A. Products: Means new material, machinery, components, equipment, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- C. Provide interchangeable components of the same manufacturer, for similar components.

1.4 TRANSPORTATION AND HANDLING
- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION
- A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.
- B. For exterior storage of fabricated products, place on sloped supports, above ground.
- C. Provide off-site storage and protection when site does not permit on-site storage or protection. Materials and equipment stored offsite must be in a licensed, bonded and insured warehouse (within 50 miles of Jobsite) in order to be included on a pay application. The Owner reserves the right to verify materials and equipment stored in warehouses.
- D. No materials or equipment may be stored at jobsite prior to June 14, 2013. Any materials and equipment that is to be stored from shall be stored indoors, except for the Heat Recovery Unit equipment.
- E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- F. Store loose granular materials on solid flat surfaces in a well-drained area. Provide mixing with foreign matter.
- G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.6 ASBESTOS PRODUCTS

A. Contractor and Subcontractors shall certify that no asbestos products have been incorporated within the construction of this project. Certificates to accompany warranties.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not used

END OF SECTION 01 60 00

SECTION 01 77 00 - CONTRACT CLOSEOUT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.
B. Final cleaning.
C. Adjusting.
D. Project record documents.
E. Operation and maintenance data.
F. Warranties.
G. Spare parts and maintenance materials.

1.2 RELATED SECTIONS

A. Section 01 30 00 - Administrative Provisions
B. Conditions of the Contract: Fiscal provisions, legal, submittals, and other administrative requirements.

1.3 CLOSEOUT PROCEDURES

A. Inspection
   1. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection. Engineer will make final inspection and prepare a list of deficiencies remaining to final completion.
   2. Contractor will correct deficiencies and notify Engineer who make a re-inspection. If project is completed and ready for Owner move-in, Engineer will and declare project substantially complete and notify owner the project is ready for final inspection and acceptance.
   3. The Owner, Engineer and contractor will inspect the facility and note remaining deficiencies, if any, and the owner will begin to move into the facility.
   4. Contractor will correct all deficiencies and notify Engineer. Engineer and owner will make final inspection and determine if all deficiencies are completed. Failure to pass this inspection, i.e., correct all deficiencies, could result in back charge of costs to Contractor of additional inspections by Engineer and Owner.
B. Provide submittals to Engineer that are required by governing or other authorities, including one set of final as-built submittals for Owner.
C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
D. Owner will occupy Project for the purpose of conducting business, under provision stated in Certificate of Substantial Completion.

1.4 FINAL CLEANING

A. Execute final cleaning as described in Section 01 11 00.
B. Clean surfaces exposed to view; remove temporary labels, stains and foreign

substances.

C. Clean equipment and fixtures to a sanitary condition.
D. Clean debris from roofs, gutters, downspouts, and drainage systems.
E. Clean site; sweep paved areas, rake clean landscaped surfaces.
F. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.5 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
   1. Contract Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other Modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
B. Store Record Documents separate from documents used for construction.
C. Record information concurrent with construction progress.
D. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and Modifications.
E. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish main floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances 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.
F. At Contract Closeout, submit documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.
G. Provide electronic copy of project record documents.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit three (3) sets prior to final inspection, bound in 8-1/2 x 11 inch text pages, three D side ring high capacity binders with durable plastic covers.
B. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
C. Internally subdivide the binder contents with permanent page dividers, logically

organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, type on 24 pound white paper.

E. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.

F. Part 2: Operation and maintenance instructions, arranged by and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
   1. Significant design criteria.
   2. List of equipment.
   3. Parts list for each component.
   4. Operating instructions.
   5. Maintenance instructions for equipment and systems.
   6. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

G. Part 3: Project documents and certificates, including the following:
   1. Shop drawings and product data.
   2. Certificates.
   3. Photocopies of warranties.

H. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned with Engineer comments. Revise content of documents as required prior to final submittal.

I. Submit final volumes revised, within ten days after final inspection.

1.8 WARRANTIES

A. Provide duplicate notarized copies.

B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover.

D. Submit prior to final Application for Payment.

E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

F. All materials, equipment, and work completed will have warranties that begin at the Substantial Completion of that work.

1.9 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 2 – PRODUCTS

Not used

PART 3 – EXECUTION

Not used

END OF SECTION 01 77 00

SECTION 02 07 20 - MINOR DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES
A. Removal of designated building components, equipment and fixtures.
B. Removal of designated construction.
C. Identification of utilities

1.2 RELATED SECTIONS
A. Section 01 77 00 - Contract Closeout: Project record documents.

1.3 PROJECT RECORD DOCUMENTS
A. Submit under provisions of Section 01 77 00 Contract Closeout.
B. Accurately record actual locations of capped utilities, and subsurface obstructions.

1.4 REGULATORY REQUIREMENTS
A. Conform to applicable codes for demolition work and safety of structure.
B. Notify affected utility companies before starting work and comply with their requirements.
C. Re-direct egress to exits.
D. Do not disable or disrupt building fire or life safety systems without one [1] day prior written notice to the Owner.
E. Conform to procedures applicable when discovering hazardous or contaminated materials.

PART 2 PRODUCTS
Not Used

PART 3 EXECUTION

3.1 PREPARATION
A. Provide and maintain temporary barriers at locations to isolate construction areas.
B. Protect existing materials, equipment and fixtures which are not to be demolished.
C. Prevent movement of structure; provide required bracing and shoring.
D. Mark location of utilities.

3.2 DEMOLITION REQUIREMENTS
A. Conduct demolition to minimize interference with adjacent building areas.
B. Cease operations immediately if structure appears to be in danger. Notify Architect/Engineer. Do not resume operations until directed.
C. Maintain protected egress and access to the Work.

3.3 DEMOLITION

A. Identify, disconnect, remove and/or cap designated utilities within demolition areas.
B. Demolish in an orderly and careful manner. Protect existing supporting structural members and adjacent finishes.
C. Except where noted otherwise, remove demolished materials from site. Do not burn or bury materials on site.
D. Remove demolished materials from site as work progresses. Upon completion of work, leave areas in clean condition.
E. Remove temporary Work.
F. Obtain Owner's prior approval of **ALL** demolished items. Owner may elect to retain items and will promptly remove them from the project site.

END OF SECTION 02 07 20

SECTION 06 10 00 - CARPENTRY WORK

PART 1 GENERAL

1.1 WORK INCLUDED

A. Rough carpentry for:
   1. Miscellaneous lumber for attachment and support of other work.
   2. Construction panels for miscellaneous uses.

B. Preservative treatment.

C. Fire retardant treatment.

D. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material.
   1. Fire-retardant treatment: Include certification by treating plant that treatment material complies with specified standard and other requirements.

PART 2 PRODUCTS

2.1 DIMENSION LUMBER

A. Nominal sizes are indicated, except as shown be detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

   Miscellaneous Lumber: Provide wood for support or attachment of other work. Provide lumber of sizes indicated, worked into shapes shown.
   1. Moisture content: 19 percent maximum (S-dry).
   2. Lumber: S4S, No.2 or standard grade.
   3. Boards: Construction, 2 common, or No.2 grade.

2.2 CONSTRUCTION PANELS

A. Construction Panels/Plywood: Miscellaneous uses.
   1. Concealed plywood: C-C Plugged exterior.
   2. Electrical/telephone panel backer: APA rated sheathing, Exposure I, Treating Grade fire-retardant treated.
   3. Roof decking for framing over metal roof deck.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide size, type, materials and finish as indicated and as recommended by applicable standards.
   1. Provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153) for treated lumber and where rough carpentry work is either ground contact, in an area of high relative humidity, or exposed to weather.

2.4 WOOD TREATMENT BY PRESSURE PROCESS

A. Pressure-treat aboveground items with waterborne preservatives to comply with AWPB LP-2.
   1. After treatment, kiln-dry lumber to a minimum moisture content of 19 percent.
   2. Treat indicated items and the following:
      a) Wood members in contact with roofing, flashing, or waterproofing.

b) Wood members in contact with masonry or concrete.
c) Wood framing members less than 18 inches above grade.

B. Pressure-treat the following with waterborne preservatives for ground contact use complying with AWPB LP-22.
1. Wood members in contact with ground.

C. Fire-Retardant Treatment:
1. Treat backing panels for electrical and mechanical equipment and wood framing over metal roof deck. Provide treatment classified for use as Interior Type A.

D. Inspect each piece of treated wood before use and discard damaged or defective pieces.

PART 3 EXECUTION

3.1 INSTALLATION – GENERAL

A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabrication work with minimum joints or optimum joint arrangement.

B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as shown, and as required by recognized standards.

D. Countersink nail heads on exposed carpentry work and fill holes.

3.2 MISCELLANEOUS CARPENTRY

A. Provide miscellaneous blocking, nailers, grounds, and framing as shown and as required for support of facing materials, fixtures, specialty items, and trim. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate locations with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.
1. Miscellaneous plywood panels: Nail or screw to supports.

END OF SECTION 06 10 00

SECTION 07 21 00 - BATT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES
A. Interior batts.

1.2 RELATED SECTIONS
A. Section 09 20 00 – Gypsum Wallboard Systems

1.3 REFERENCES
A. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
B. FS HH-I-521 - Insulation Blankets, Thermal, (Mineral Fiber for Ambient Temperatures).
C. FS HH-I-558 - Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type).
D. ASTM C423 Test Method for Sound Absorption Coefficient by the Reverberation Room Method
E. NFPA 101 Life Safety Code.
F. ASTM C1104 - Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
G. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

1.4 PERFORMANCE REQUIREMENTS
A. Materials of this Section shall provide continuity of thermal barrier at building enclosure elements.

1.5 SUBMITTALS
A. Submit under provisions of Section 01 30 00.
B. Product Data: Provide data on product characteristics, performance criteria, limitations.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
D. Submit two 12" x 12" samples of insulation specified.

1.6 COORDINATION
A. Coordinate Work with other Sections.

PART 2 PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS
Thermal Batt Insulation

1) CertainTeed
2) Owens Corning
3) Manville

4) U.S. Gypsum
5) Mizell Bros. Co.
6) Or Equal

2.2 MATERIALS

A. Batt Insulation: Faced and unfaced preformed inorganic glass fibers of spun material batt; suspended and friction fit, conforming to the following:

WALLS	
Flame Spread	25
Thermal Resistance	R-23 total.
Type	One layer of R-10, 3”, VR-R facing, draped over girts (sag and bag) to support a second layer of R-13, 4”, in between the girts.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

A. Install insulation in accordance with insulation manufacturer's instructions.
B. Install in exterior walls where demolition has created gaps and voids.
C. Trim insulation neatly to fit spaces.
D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.
E. Friction fit between framing members.
F. Install insulation in all spaces as indicated on the drawings and as required to form a continuous insulated building envelope.

END OF SECTION 07 21 00

SECTION 07 60 00 - FLASHING AND SHEET METAL

PART I - GENERAL

1.1 WORK INCLUDED

A. Install flashing and sheet metal as indicated on Drawings and in these specifications as required for a complete and proper installation. The following items are included:
   1. Perimeter edge flashing, counter-flashing
   2. Gutters and Downspouts.
   3. Sheet metal counterflashing.
   4. Termination bars.

1.2 RELATED WORK

A. Section 06 00 00 – Rough Carpentry

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 00.
B. Describe material profile, jointing pattern, jointing details, fastening methods, and installation details.
C. Submit samples under provisions of Section 01 33 00.
D. Provide full sized sample of metal flashing and post supports illustrating typical seam, external corner, internal corner, material, and finish.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA and NRCA standard details and requirement.

1.5 QUALIFICATIONS

A. Company specializing in sheet metal flashing work with a minimum of 10-years documented experience.

1.6 STORAGE AND HANDLING

A. Stack pre-formed materials to prevent twisting, bending, or abrasion, and to provide ventilation.
B. Prevent contact with materials during storage that may cause discoloration, staining, or damage.
C. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

1.7 WARRANTY

A. Sheet Metal work and accessories to be included in Contractor's Warranty.
B. Provide pre-finished metal manufacturer's twenty-year coating guarantee.
C. Provide pre-finished metal manufacturer's twenty-year galvanized steel guarantee.

PART 2 - PRODUCTS

2.1 SHEET METALS
- A. Sheet metal flashing not exposed to public view: 24 gauge galvanized steel.
- B. Sheet metal flashing exposed to public view: Pre-finished 24 gauge galvanized steel, Kynar 500.

2.2 SHEET METAL COMPONENTS
- A. Counterflashing: 24 gauge galvanized steel.
- B. Perimeter edge flashing, gutters, and downspouts: pre-finished 24 gauge galvanized steel.
- C. Two-piece fascia extension is required whenever fascia vertical height exceeds 8 inches.
- D. Downspout Hangers: Minimum 1/8-inch by 1-inch galvanized steel.
- E. Cover plates, end caps and miscellaneous sheet metal: same materials, gauge and profile as edge metal or expansion joint material.
- F. Cleats: 22 gauge galvanized steel.
- G. Termination Bar: 1/8-inch by 1-inch galvanized bar with pre-drilled holes minimum 12-inches on center.

2.3 ACCESSORIES
- A. Solder: ANSI/ASTM B 32 50/50 type.
- B. Blind Pop-Rivets: Stainless steel.
- C. Clamping Collar: Stainless steel of size necessary to fit over vent or pipe circumference, as applicable.
- D. Metal closures for louvered vents at penthouses: 24 gauge galvanized steel.
- E. New door thresholds and weather-stripping for penthouse door modifications.
- F. Self-adhering underlayment: self-adhering, high temperature, modified bitumen metal and tile underlayment, minimum 40 mils.
- G. Self-adhering underlayment primer: primer for self-adhering underlayment.
- H. Hat channels: 20 gauge galvanized steel, 1-1/2” hat-shaped corrosion-resistant framing for metal panel brick masonry cladding.

2.4 SEALANT
- A. Type I: Application exposures to sunlight, ASTM C-920-87, Federal Specification TT-S-00230-C one component gun-grade polyurethane sealant suitable for continuous immersion and resistant to asphalt products.
- B. Type II: Applications not exposed to sunlight, butyl rubber based.
- C. Hot vent sealant: One-component neutral moisture curing silicone sealant.

2.5 SCHEDULE OF FASTENERS
- A. Exposed fasteners: Shall be stainless steel with stainless steel bonded neoprene or EPDM washers.
- B. Fasteners shall be compatible to all materials to which they come in contact.
- C. Cleat, Counter-flashing, and Surface Fastened Components.
  - 1. Wood Substrate: No. 10 stainless steel wood screws with stainless steel bonded neoprene washers of length necessary to penetrate wood substrate one inch.

2. Metal Substrate: Minimum No. 10 stainless steel sheet metal screws or as necessary to suit application with stainless steel bonded neoprene washers.

2.6 FABRICATION

A. Form sections to match existing profiles, true to shape, accurate in size, square, and free from distortion or defects.
B. Fabricate continuous cleats and starter strips of same material as sheet, inter-lockable with sheet.
C. Form pieces in longest practical lengths.
D. Hem exposed edges of metal 1/2-inch; miter and seam corners.
E. Form materials with cover plate seam.
F. Fasten and seal metal joints.
G. Fabricate corners from one piece with minimum 18-inch and maximum 36-inch long legs; fasten for rigidity, seal with sealant.
H. Fabricate vertical faces with bottom edge formed outward 1/4-inch and hemmed to form drip.
I. Form edge metal/fascia as existing profiles as specified herein and as shown on Drawings.
J. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
K. Enlarge holes for fastening counter flashing, coping, and pressure bars as necessary to allow for thermal expansion and contraction. Cover exposed holes with appropriate washers.
L. All fabrication and installation of sheet metal shall be in accordance with the latest published SMACNA and NRCA guidelines and recognized roofing and sheet metal industry standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and cant strips in place, and nailing strips located.
B. Verify membrane termination and base flashings are in place, sealed, and secure.
C. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Field measure site conditions prior to fabricating work.
B. Tie-ins or contact with dissimilar metals: Install separation layer of elastomeric membrane between metal surfaces.

3.3 INSTALLATION - GENERAL

A. Provide flashings of materials indicated on Drawings at all junctures of the roof with perimeters, curbs, mechanical, electrical equipment, etc., that a completely watertight installation is achieved.
B. Fabricate and install sheet metal work with lines, arises and angles sharp and true, and plane surfaces free from warps and buckles. Bead or return all exposed edges. Tin metal for full area of contact on soldered seams and joints. Do

soldering slowly with well heated coppers, thoroughly heating seams and completely filling them with solder.

C. Apply bed of roof membrane manufacturer's water block mastic directly below sheet metal that is set over roofing membrane or in other areas as required by the Drawings, and the manufacturer's specifications.
D. Submit details not covered in Drawings for approval by Owner or Roof Consultant.
E. Install starter and edge strips, and cleats before starting installation.
F. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by Roof Consultant.
G. Lock and seal all joints.
H. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
I. Fasten sheet metal with approved fasteners at a minimum of 12 inches on centers unless otherwise specified in these Specifications or the Drawings.

3.4 TWO-PIECE COUNTERFLASHING INSTALLATION
A. Secure counterflashing receiver over base flashing to substrate with appropriate fasteners. Secure counterflashing to receiver with stainless steel screws with bonded neoprene washers spaced 12-inches on centers.
B. Pop-rivet and solder all seams.

3.5 CLEAT INSTALLATION
A. Install cleats for edge/coping flashing with appropriate fasteners on eight-inch centers.

3.6 METAL EDGE FLASHING INSTALLATION
A. Install edge flashing in a uniform application of water block mastic over roof membrane.
B. Apply sealant, Type I, under cover plates at all joints prior to installation.
C. Fasten horizontal flange in a staggered pattern on three-inch centers.
D. Strip-in edge flashing as specified in membrane roofing sections.

3.7 PIPE PENETRATION FLASHING
A. Pipe penetrations shall be through raised wood curbs with a minimum height of 12" above the plane of the finished roof, in accordance with Drawings.

3.8 PLUMBING VENT SLEEVE
A. Install manufacturer provided plumbing vent sleeves in accordance with manufacturer's installation instructions. Field fabricated plumbing vent sleeves are prohibited.
B. Install top of sleeve in bed of water block mastic and wrap top of sleeve with stainless steel clamping ring. Seal the top of the clamping ring with manufacturer's sealant.

END OF SECTION 07 60 00

SECTION 07 84 00 - FIRESTOPPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. This Section includes firestopping for the following:
   1. Firestopping materials shall be furnished and installed at all penetrations in fire rated assemblies to maintain an effective barrier against spread of flame, smoke and gases. Fire rated assemblies shall be as indicated on the drawings, which shall include all roof construction, walls, and partitions that are part of an enclosure having a fire rating. Firestopping shall be used but shall not be limited to the following locations:
      a) At tops of fire rated partitions and walls.
      b) Penetrations of vertical shafts.
      c) Ductwork, conduit, tubing and piping penetrations through fire rated walls, and partitions.
      d) Penetrations of any other material through any fire-rated construction.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 07900 - "Joint Sealants" for non-fire-resistive-rated joint sealants.
   2. Division 15 Sections specifying ducts and piping penetrations.
   3. Division 16 Sections specifying cable and conduit penetrations.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings indicated, as determined per ASTM E 814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:
   1. Where firestop systems protect penetrations located outside of wall cavities.
   2. Where firestop systems protect penetrations located outside fire-resistive shaft enclosures.
   3. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
   4. Where firestop systems protect penetrating items larger than a 4-inch-diameter nominal pipe or 16 sq. inches in overall cross-sectional area.

D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or

exceeding the fire-resistance rating of the construction in which the joint occurs.

E. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
   1. For piping penetrations for plumbing systems, provide moisture-resistant through-penetration firestop systems.
   2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.4 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.
   1. Certification by firestopping manufacturers that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

C. Shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.

D. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

E. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:
   1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
   2. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.

B. Installer Qualifications: Engage an experienced Installer who has completed firestopping that is similar in material, design, and extent to that indicated for Project and that has performed successfully.

C. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction conditions from a single manufacturer.

D. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

E. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.
B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time.
C. Storage of products shall comply with manufacturer's requirements.
D. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

PART 2 PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
   1. Permanent forming/damming/backing materials including the following:
      a) Semirefractory fiber (mineral wool) insulation.
      b) Ceramic fiber.
      c) Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
      d) Fire-rated formboard.
      e) Joint fillers for joint sealants.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Collars.
   5. Steel sleeves.
C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.2 MANUFACTURERS

A. Approved Manufacturers: Subject to compliance with requirements of this section, provide products from one of the following manufacturers:
   1. USG Interiors, Inc.
   2. Fibrex.
   3. Termco.
   4. Thermal Ceramics.

5. GE Silicones.
6. Flammadur Corp. of America
7. Hilti.
8. Bio Fireshield, Inc.
9. Standard Oil.
10. 3M Brand.
11. Dow Corning.
12. Nelson.
13. Flame Stop, Inc.

B. Substitutions will be reviewed if they are equal to, or greater than, specified products.

2.3 FIRESTOPPING MATERIALS

A. Ratings: The fire resistance ratings shall be a minimum of one hour but not less than the fire resistance rating of the assembly being penetrated.

B. Large Space Fiber Insulation:
1. USG Interiors, Inc. "Thermafiber" safing insulation; 4 lb. density.
2. Fibrex "FBX" safing insulation.

C. Ceramic Fiber Insulation:
1. Tremco "Cerablanket - FS."
2. Thermal Ceramics "Kaowool Fire Master Blanket."
3. Standard Oil "Fiberfrax."

D. Foamed Insulation:
1. Dow Corning Foam: Catalog #2001.
2. GE Silicones "Pensil 200 Firestop Foam."

E. High Temperature Caulking Compounds:
1. 3M Brand "Interam Fire Dam 150 Caulk."
2. Dow Corning Sealant #2000.
3. Nelson "FSP Firestop Putty."
4. Flame Stop, Inc. "Flame Stop V Caulk."
5. Bio Fireshield, Inc. "Biotherm Firestop Sealant."
6. GE Silicones "Pensil 100 Firestop Sealant."
7. Flammadur Corp. of America A107/E473.
8. Hilti CS240 Firestop - Sealant.

2.4 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
   1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
   2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install material and systems in accordance with the manufacturer's printed instructions.

C. Observations: Work by steps that permit observation of each step before it is covered up. When the work requires immediate cover, give notice early enough to arrange for observation in progress.

D. Installation of Large Space Fiber Insulation:
   1. Thickness, as required, minimum of 4 inches.
   2. Compress material before placing so a tight friction fit is formed.
   3. Where material spans a horizontal gap in excess of material thickness or any danger exists of sagging or displacement, support or galvanized iron or on spikes.

3.4 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.5 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 07 87 00

SECTION 07 90 00 - SEALANTS

PART 1 GENERAL

1.1 WORK INCLUDED
A. Clean and prepare joint surfaces.
B. Sealant and backing materials.

1.2 RELATED WORK
A. Section 07 21 00 – Batt Insulation: Sealants used over mineral wool insulation at partition/structural deck intersections.
B. Section 09 20 00 – Gypsum Wallboard Systems: Acoustical sealant and Fire Rated sealants.

1.3 REFERENCES
ASTM C920 Elastomeric Joint Sealants.
ASTM C1193 Guide for Use of Joint Sealants
ASTM C1330 Cylindrical Sealant Backing for Use With Cold, Liquid-Applied Sealants
ASTM C1382 Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish System (EIFS) Joints

1.4 SUBMITTALS
A. Submit product data in accordance with Section 01 30 00.
B. Submit manufacturer's surface preparation and installation instructions.
C. Submit samples of sealant colors.

1.5 WARRANTY
A. Provide two (2) year warranty in accordance with Section 01 70 00.
B. Warranty: Replace sealants which fail because of loss of cohesion or adhesion, or do not cure.

PART 2 PRODUCTS

2.1 SEALANT MATERIALS
A. General Sealant: Silicone base, single component, conforming to ASTM C920, Type S, Grade NS, Class 25 non-staining; non-bleeding; color as selected by Architect. Equal to Dow Corning 791 Weatherproofing Sealant.
B. Exterior Pre-Cast and Tilt-Up Concrete Sealant: Silicone base, single component, ASTM C920, Type S, Grade NS, Class 25, equal to Dow Corning 790 Building Sealant. Color selected by architect.
C. Interior Pre-Cast and Tilt-Up Concrete Sealant: Sonolastic Ultra, One –component, polyurethane security sealant. Color selected by Architect.
D. Painted Surfaces: Polyurethane base, single component, ASTM C920, Type S, Grade NS, Class 25, equal to Sonneborn Sonolastic NP-1. Color selected by architect.
E. Glazing Sealant: Silicone base, single component, ASTM C920, Type S, Grade NS, Class 25, equal to Dow Corning 795 Building Sealant. Color selected by

architect.

F. Seal joints in gypsum sheathing and around all penetrations to provide a barrier to the passage of air and moisture with long term joint protection methods recommended by the manufacturer.
G. Acoustical Sealant – Equal to USG Sheetrock Acoustical Sealant.
H. At sidewalks and other concrete flatwork, provide ASTM C920, Type S, Class 25, self-leveling urethane sealant equal to BASF/Sonneborn Sonolastic SL 2.
I. Substitutions: Refer to Section 01 60 00 for substitution procedures.

2.2 ACCESSORIES
A. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
B. Joint Primer: As recommended by sealant manufacturer for specific substrate and sealant application.
C. Joint Filler: ASTM C1330; round, closed cell, non-gassing, polyethylene foam rod; oversized as recommended by manufacturer for secure friction fit.
D. Expansion Joint Filler: At building expansion joints provide elastic fillers of closed cell neoprene with minimum 50% compressibility.
E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 INSPECTION
A. Verify that joint dimensions, physical, and environmental conditions are acceptable to receive work of this Section.
B. Beginning of installation means acceptance of conditions and surfaces.

3.2 PREPARATION
A. Clean, prepare, and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant or spray foam insulation.
B. Examine joint dimensions and size backer rod materials to achieve required width/depth ratios of 2W:1D.
C. Use joint filler to achieve required joint depths, to allow sealants to perform properly.
D. Use bond breaker where required as sealant backing to prevent three-sided adhesion.

3.3 INSTALLATION
A. Install sealant in accordance with Manufacturer's instructions, including substrate priming where recommended.
B. Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature ranges.
C. Tool joints concave or to match adjacent joints.
D. Joints: Free of air pockets, foreign embedded matter, ridges, and sags.
E. Install sealant and/or spray foam insulation at all EXTERIOR building voids, gaps or penetrations to form a continuously sealed and insulated building envelope.

3.4 TYPICAL LOCATIONS

A. Thresholds
B. Door Frames
C. Acoustical partition/structural deck intersections
D. As noted on drawings
E. As required to seal and weatherproof the building.

END OF SECTION 07 90 00

SECTION 08 12 00 - STANDARD STEEL FRAMES

PART 1 GENERAL

1.1 WORK INCLUDED
A. Standard and fire rated pressed steel hollow metal door frames and sidelight frames.

1.2 RELATED WORK
A. Section 08 12 00: Standard Steel Frames.
B. Section 08 14 00: Plastic Faced Wood Doors.
C. Section 08 70 00: Finish Hardware for Doors.

1.3 REFERENCE STANDARDS
A. SDI-100- Recommended Specifications-Standard Steel Doors and Frames of Steel Door Institute.
B. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

1.4 SHOP DRAWINGS AND PRODUCT DATA
A. Submit shop drawings and product data in accordance with Section 01 30 00.
B. Indicate general construction, configurations, jointing methods, reinforcements, anchorage methods, hardware locations and installation details.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Manufacturer and Type: Equal to shop welded type manufactured by Steelcraft.
B. Acceptable Manufacturers:
1. Amweld
2. Ceco
3. Kewanee
4. Pearland Industries
5. Republic
6. Steelcraft
7. Tex-Steel
C. Substitutions: Items of same function and performance are acceptable in conformance with Section 01600.

2.2 HOLLOW METAL FRAMES
A. Materials and Fabrication: SDI-100 except as amended in this Section.
B. Types: Interior welded frames - 16 gauge minimum.
C. All exterior welded frames - 14 gauge minimum.
D. Mortar Guard Boxes: Minimum 22 gauge welded in place.
E. Door Bumpers: Manufacturer's standard resilient type; removable for replacement.

2.3 FABRICATION

A. Accurately form and cut mitered corners of welded type frames. Weld on inside surfaces. Grind welded joints to smooth uniform finish.
B. Accurately cope and securely weld butt joints of mullions. Grind welded joints to smooth uniform finish.
C. Reinforce frames wider than 4 feet with 12 gage formed steel channels weld in place, flush with top of frames.
D. Reinforce and prepare frames to receive hardware. All frames with continuous hinges to receive continuous reinforcement. Refer to Section 08700 for hardware requirements.
E. Place minimum of 3 single bumpers on single door frames.
F. Place minimum of 2 single bumpers on double door frames.
G. Provide jamb anchors: SDI-100. Weld floor jamb anchors in place.
H. Fill surface depressions of hollow metal frames with metallic paste filler and grind to smooth finish.
I. Chemically treat surfaces and apply one coat of primer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install door frames in accordance with SDI-100 except as amended in this Section.
B. Install hollow metal frames plumb and square, in correct locations indicated on drawings and with a maximum diagonal distortion of 1/16 inch. Ensure frames are securely and rigidly anchored to adjacent construction.
C. Install continuous sealant between frames and adjacent surfaces. Refer to Section 07 90 00 for sealant requirements.

3.2 DOOR FRAME SCHEDULE - See Drawings

A. After installation, touch-up scratched or damages surfaces. Use type of primer identical to that used for shop coat.

END OF SECTION 08 12 00

SECTION 08 14 00 - PLASTIC FACED WOOD DOORS

PART 1 GENERAL

1.1 WORK INCLUDED
A. Standard type doors, with flush faces.
B. Install hardware.

1.2 RELATED WORK
A. Section 08 12 00 - Standard Steel Frames
B. Section 08 71 00 - Hardware: Supply of door hardware.

1.3 REFERENCES
A. AWI Quality Standards.

1.4 SHOP DRAWINGS AND PRODUCT DATA
A. Submit shop drawings and product data in accordance with Section 01 30 00.
B. Indicate general construction.

1.5 SAMPLES
A. Submit samples for color and finish selection in accordance with Section 01 30 00.

1.6 WARRANTY
A. Provide 5 year manufacturer's warranty for correcting doors exhibiting warp or delamination including rehanging and refinishing, in accordance with Section 01 70 00.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Ragland Manufacturing Co., Inc.
B. Buell Door Co.
C. Or equal.
D. Substitutions: Items of same function and performance are acceptable in accordance with Section 01 60 00.

2.2 MATERIALS
A. Interior Doors: 1-3/4 inch thick, standard and fire rated type, plastic laminate facing, AWI premium grade, particle board core.
B. Plastic Laminate: General purpose type, minimum 1/16 inch 1. Selection by Architect and Owner.
C. Vertical Edges: Close grained hardwood. (option) Laminate same as door face.

2.3 FABRICATION

A. Fabricate doors in accordance with requirements of AWI Quality Standards.
B. Fabricate fire rated doors to UL labeling requirements.
C. Provide astragals for double doors where center frame mullions are not provided.
D. Bevel strike edge of single acting doors 1/8 inch in 2 inches.
E. Prepare doors to receive hardware.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install wood doors plumb and square, and with maximum diagonal distortion of 1/16 inch.
B. Install hardware in accordance with requirements of Section 08 70 00.

END OF SECTION 08 14 00

SECTION 08 71 00 - FINISH HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work under this section comprises of furnishing and installing hardware specified herein and noted on drawings for a complete and operational system, including any electrified hardware components, systems, controls and hardware for aluminum entrance doors. Any door shown on the drawing and not specifically referenced in the hardware sets shall be provided with identical hardware as specified on other similar openings and shall be included in the General Contractor's base bid. All fire rated door shall be provided with fire rated hardware as required by local code Authority as part of the General Contractor's base bid. The hardware supplier shall verify all cylinder types specified for locking devices supplied as part of the door system with the door manufacturer and/or door supplies.

B. The General Contractor shall notify the Architect in writing of any discrepancies (five (5) days prior to bid date) that could and/or would result in hardware being supplied that is none functional, hardware specified and/or hardware that has not been specified that will result in any code violations and any door that is not covered in this specification. Failure of the General Contractor to address any such issue shall be considered acceptance of the hardware specified and all discrepancies shall be corrected at the General Contractor's expense and considered a part of their base bid. Change orders shall not be issued if deemed by the Architect and/or Eanes ISD to fall under and/or be covered as a part of the General Contractor base bid, due to failure to comply with this instruction notification.

C. Items include but are not limited to the following:

1. Hinges - Pivots
2. Flush Bolts
3. Exit Devices
4. Locksets and Cylinders
5. Push Plates - Pulls
6. Coordinators
7. Closers
8. Kick, Mop and Protection Plates
9. Stops, Wall Bumpers, Overhead Controls
10. Electrified Hold Open Devices
11. Thresholds, Seals and Door Bottoms
12. Silencers
13. Miscellaneous Trim and Accessories
14. Electrified Hardware Items, Controls and Power Supplies
15. Wiring diagrams

1.2 RELATED DOCUMENTS, drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.3 RELATED WORK specified elsewhere that should be examined for its effect upon this section:
- A. Section 06 10 00 – Carpentry Work
- B. Section 08 12 00 – Standard Steel Frames
- C. Section 08 14 00 – Plastic Faced Wood Doors
- D. Sections within 09 90 00 - Painting
- E. Division 16 - Electrical

1.4 REFERENCES SPECIFIED in this section subject to compliance as directed:
- A. NFPA-80-1995 - Standard for Fire Doors and Windows
- B. NFPA-101-1994 - Life Safety Code
- C. ADA - The Americans with Disabilities Act - Title III - Public Accommodations
- D. ANSI-A 117.1 - American National Standards Institute - Accessible and Usable Buildings and Facilities
- E. ANSI-A 156.5 - American National Standards institute -Auxiliary Locks and Associated Products
- F. UFAS - Uniform Federal Accessibility Standards
- G. UL - Underwriter's Laboratories
- H. WHI - Warnock Hersey International, Testing Services
- I. State and Local Codes including Authority Having Jurisdiction
- J. U.B.C.7-2-97 and UL10C
- K. IBC-2003/IBC-2006 – International Building Code
- L. NFPA-70-2005 – National Electrical Code

1.5 SUBMITTALS
- A. HARDWARE SCHEDULES: Submit copies of schedule in accordance with Division 1, General Requirements. Schedule to be in vertical format, listing each door opening, including: handing of opening, all hardware scheduled for opening or otherwise required to allow for proper function of door opening as intended, and finish of hardware. At doors with door closers or door controls include degree of door opening. Supply the schedules all Finish Hardware within two (2) weeks from date purchase order is received by the hardware supplier.
- B. Submit manufacturer's cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.
- C. Certification of Compliance:
  1. Submit any information necessary to indicate compliance to all of these specifications as required.
  2. Submit a statement from the manufacturer that electronic hardware and systems being supplied comply with the operational descriptions exactly as specified.
- D. Submit any samples necessary as required by the Architect.
- E. Templates for finish hardware items to be sent to related door and frame suppliers within three (3) working days of receipt of approved hardware schedule.
- F. Doors and Frames used in positive pressure opening assemblies shall meet U.B.C. 7-2-97 and UL10C in areas where this specification includes Seals for smoke door.

1.6 QUALITY ASSURANCE

A. Hardware supplier to be a qualified, Factory Authorized, direct distributor of the products to be furnished. In addition, the supplier to have in their regular employment an A.H.C. or person of equivalent experience who will be made available at reasonable times to consult with the Architect/Contractor and/or Eanes ISD regarding any matters affecting the finish hardware on this project.

B. All hardware used in labeled fire or smoke rated openings to be listed for those types of openings and bear the identifying label or mark indicating UL. (Underwriter's Laboratories) approved for fire. Exit devices in non-labeled openings to be listed for panic.

C. The hardware supplier, general contractor, hardware installer, Eanes ISD representative and manufactures representatives of the Locksets, Closers and Exit Devices after six (6) months of Eanes I. S. D. acceptance of the facility shall do an on site survey of hardware installation. Any item of hardware that is found to be defective shall be replaced at the manufacture expense. Any item of hardware found to be installed incorrectly shall, be repaired at the general contractors expense. All hardware found to be loose or out of proper adjustment shall be adjusted for proper function and operation by the hardware installer. After this survey is complete the hardware supplier shall submit a written report of all findings to Eanes ISD and the Architect.

1.7 DELIVERY, HANDLING AND PACKAGING

A. Furnish all hardware with each unit clearly marked and numbered in accordance with the hardware schedule. Include door and item number for each.

B. Pack each item of hardware completes with all necessary parts and fasteners.

C. Properly wrap and cushion each item to prevent scratches and dents during delivery and storage.

1.8 SEQUENCING AND SCHEDULING

Any part of the finish hardware required by the frame or door manufacturers or other suppliers that is needed in order to produce doors or frames is to be sent to those suppliers in a timely manner, so as not to interrupt job progress.

1.9 WARRANTY

All finish hardware shall be supplied with a two- (2) year warranty against defects in materials and workmanship, commencing with substantial completion of the project except as follows:

1. All Closers to have a ten- (10) year warranty.
2. All Exit Devices to have a three- (3) year warranty.
3. All Grade 1 Locksets to have a seven- (7) year warranty.
4. All Continuous Hinges to have a ten- (10) year warranty.

PART 2 – PRODUCTS

2.1 FASTENERS

A. Furnish with finish hardware all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position for a long life under hard use.

B. Furnish fastenings where necessary with expansion shields, toggle bolts and other anchors designated by the Architect according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer. All closers and exit devices on labeled wood doors shall be through-bolted. All thresholds shall be fastened with machine screws and anchors. Where specified in the hardware sets, security type fasteners of the type called for are to be supplied. No plastic anchors shall be used for hardware.

C. Design of all fastenings shall harmonize with the hardware as to material and finish.

2.2 ENVIRONMENTAL CONCERN FOR PACKAGING

The hardware shipped to the job site is to be packaged in biodegradable packs such as paper and/or cardboard boxes and wrapping. If non-biodegradable packing such as plastic, plastic bags or large amounts of Styrofoam is utilized, then the Contractor will be responsible for the disposal of the non-biodegradable packing to a licensed or authorized collector for recycling of the non-biodegradable packing.

2.3 HINGES

A. All hinges to be of one manufacturer as hereafter listed for continuity and consideration of warranty. Provide one of the following manufacturers Select Products, Ives or Hager.

B. Unless otherwise specified provide five-knuckle, heavy-duty, button tip, full mortise template type hinges with non-rising loose pins. Provide non-removable pins for out swinging doors at secured areas or as called for in this specification.

C. Provide out-swinging door hinges with non-removable pins or security studs as called for in this specification (Reference 3.02 hardware sets).

D. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof unless otherwise specified in 3.02 Hardware Sets.

E. Provide size 4½” x 4½” for all 1¾” thick doors up to and including 36 inches wide. Exterior doors over 1¾” through 2¼” thick, use geared continuous hinges.

F. Where required to clear the trim and/or to permit the doors to swing 180 degrees furnish hinges of sufficient throw.

G. At labeled door’s steel or stainless steel, bearing-type hinges shall be provided. For all doors equipped with closers provide bearing-type hinges.

H. Finishes

1. At wood doors, hinges are to be plated to match adjacent hardware or as called for in 3.02 Hardware Sets.
2. At hollow metal exterior out-swinging doors, hinges shall be aluminum or stainless steel unless otherwise specified in 3.02 Hardware Sets.

I. Continuous hinges shall be Ives “112HD” as specified or equal products manufactured by Select Products and Hager. Hinges shall be fire rated up to 90 minute and shall have been tested to carry a maximum door weight of 450 plus pounds.

2.4 LOCK AND LOCK TRIM

A. All of the locksets, latch sets, and trim to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty. Locks, passage sets and privacy sets are to be Falcon “MA” & “B” series levers (No Substitutions Allowed). All locks, passage and privacy sets are to be provided in a dull chrome (626) finish.

B. Falcon “MA” & “B” series locks as specified – no substitutions allowed.

C. Provide metal wrought box strike boxes and curved lip strikes with proper lip length to protect trim of the frame, but not to project more than 1/8 inch beyond frame trim or the inactive leaf of a pair of doors. All pairs of doors shall have a ¾” latch projection.

D. Mechanical Locks shall meet ANSI Operational Grade 1, Series 1000 as specified in 3.02 Hardware Sets.

1. Hand of lock is to be easily reversible in the field or non-handed.
2. All lever trim is to be through-bolted through the door.
3. All pairs of doors shall be provided with a ¾” latch throw or projection.
4. All doors specified with Sound and/or Light Seals shall be provided with a 3-3/4” back-set.

2.5 PERMANENT CYLINDERS, KEYING AND ACCEPTABLE SUPPLIERS

A. The hardware supplier shall provide locks and Exit devices requiring cylinders prepared for Falcon small format interchangeable core 7 pin key System and comply with performance requirements of ANSI A156.5. All keys shall be manufactured of nickel silver material only. All exterior and interior locks shall be supplied with keyed construction cores for the duration of the construction period by the hardware supplier. Construction cores are to be returned to the hardware supplier no later than thirty (30) days after the installation of permanent cores. The hardware supplier shall provide ten- (10) construction keys and two- (2) construction control keys total (No Substitutions Allowed).

B The hardware supplier and the general contractor shall Initiate and conduct a meeting with the Eanes I. S. D. Representative at the project site to determine exactly how all the permanent cores are to be keyed.

C. All permanent cores shall be installed by the Owner upon substantial completion. The Owner shall remove the keyed construction cores and install the permanently keyed core and/or cores for the locking device. The Owner shall then verify permanent keys are functional in the locking device. Upon completion of the installation of all permanent cores the Owner shall return all construction cores and keys to the General Contractor for credit.

2.6 EXIT DEVICES

A. All exit devices and trim, including electrified items, to be of one manufacturer as hereafter listed and in the hardware sets for continuity of design and consideration of warranty.

B. Exit Devices to be “UL” listed for life safety. All exit devices for labeled doors shall have “UL” label for “Fire Exit Hardware”. All devices mounted on labeled wood doors are to be through-bolted or per the manufacturer’s listing requirements. All devices shall conform to NFPA 80 and NFPA 101 requirements.

C. All exit devices to be of a heavy duty, chassis mounted design, with one-piece removable covers, eliminating necessity of removing the device from the door for standard maintenance and keying requirements.
D. All trims to be through-bolted to the lock stile case. Lever design to be the same as specified with the lock sets. Install all Exit Device with the Manufacturers standard sex-nut-bolts (SNB).
E. Exit Devices to be the modern push rail design. Finish shall be satin aluminum (628).
F. All devices shall carry a three- (3) year warranty against manufacturing defects and workmanship.
G. All Exterior doors, high traffic doors, and high abuse area doors to be provided with 99 style Von Duprin devices.
H. Exit Devices shall be convertible in the field to accept electrified operations without purchasing completely new exit devices.
I. Exit Devices shall be Von Duprin 99 series as specified (No Substitution).

2.7 SURFACE MOUNTED DOOR CLOSERS
A. All closers for this project shall be the products of a single manufacturer for continuity of design and consideration of warranty. All door closers shall be mounted as to achieve the maxium degree of opening (trim permitting).
B. All closers to be heavy duty, surface-mounted, fully hydraulic, rack and pinion action with high strength cast iron cylinder to provide control throughout the entire door opening cycle. All closers shall have been tested and passed a ten million-cycle test.
C. Size all closers in accordance with the manufacturer’s recommendations at the factory.
D. All closers to have adjustable spring power sizes 1 through 4 or 6 as specified and separate tamper resistant, brass, non-critical regulating screw valves for closing speed, latching speed and back-check control as a standard feature unless specified other wise.
E. All closer covers to be rectangular, full cover type of non-ferrous, non-corrosive material painted to match closer.
F. Closer to have heavy-duty arms. All closer arms shall be of sufficient length to accommodate the reveal depth and to insure proper installation. Install all Door Closers with the Manufacturers standard sex-nut-bolts (SNB).
G. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.
   1. All parallel arm mounted closers to be factory indexed to insure proper installation.
   2. Furnish heavy-duty cold forged parallel arms for all parallel arm mounted closers.
H. Provide closers with special application and heavy-duty arms as specified in the hardware sets or as otherwise called for to insure a proper operating, long lasting opening.
I. Finish: Sprayed enamel finish shall match other hardware.
J. Closers shall be LCN 1461 interior and 4041XP Exterior as specified (No Substitutions Allowed).

2.8 DOOR STOPS AND HOLDERS

A. Door stops are to be furnished for every door leaf. Every door is to have a floor, wall, or an overhead stop.

B. Place doorstops in such a position that they permit maximum door swing, but do not present a hazard of obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors. The contractor shall place wood blocking in all stud walls specified and scheduled to receive wall stops.

C. Where overhead stops and holders are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass, bronze or stainless steel with no plastic parts as specified.

D. Finish: Same as other hardware where available.

E. Acceptable Products

1. Floor and wall stops as listed in hardware sets. Equivalent products as manufactured by Ives, Rockwood and Trimco are acceptable.

2.9 PUSH PLATES, DOOR PULLS, AND KICKPLATES

A. All push plates, door pulls, kick plates and other miscellaneous hardware as listed in hardware sets. Equivalent products as manufactured by Ives, Rockwood and Trimco are acceptable.

B. Kick plates to be 10 inches high and Mop plates to be 6 inches high, both by 2 inches or 1 inch less than door width (LDW) as specified. They are to be of 16 gauge (.050 inches) thick stainless steel. For door with louvers or narrow bottom rails, kick plate height to be 1 inch less dimension shown from the bottom of the door to the bottom of the louver or glass.

C. Where required armor plates, edge guards and other protective hardware shall be supplied in sizes as scheduled in the hardware sets.

D. Finish: Same as other hardware where available.

2.10 FLUSH BOLTS AND COORDINATORS

Provide Flush bolts with Dust Proof Strikes as indicated in the individual hardware sets by Ives, Rockwood and Trimco are acceptable. Finish shall match the adjacent hardware.

2.11 THRESHOLDS AND SEALS

A. Provide materials and finishes as listed in hardware sets. Equivalent product by National Guard Products, Reese and Zero are acceptable. All thresholds must be in accordance with the requirements of the ADA and ANSI A117.1.

B. Provide thresholds with wood screws and plastic anchors. Supply all necessary anchoring devices for weather strip and sound seal. The hardware supplier shall assist in the coordination of door under-cuts at all openings specified and/or scheduled to receive Threshold.

C. Seals shall comply with requirements of U.B.C. 7-2-97 and UL10C. All thresholds, door bottoms and weather stripping shall be provided with silicone inserts as specified in 3.02 Hardware Sets.

D. Seals shall comply with the requirements of the Wood Door Manufacturer’s certification requirements.

2.12 FINISHES

A. Finishes for all hardware are as required in this specification and the hardware sets to be dull chrome (626).

B. Special care is to be taken to make uniform the finish of all various manufactured items.

2.13 DOOR SILENCERS AND KEY CABINET

A. Provide door silencers at all openings without gasket. Provide two- (2) each at each pair of doors and three (3) or four- (4) each for each single door (coordinate with the frame manufacturer).

B. Provide a key cabinet Lund 1200 series for installation by the contractor as instructed by the Architect and Eanes I. S. D. The key cabinet shall have the capacity to hold the total number of key changes plus 100% expansion.

2.14 PROPRIETARY PRODUCTS

A. References to specific products are used to establish quality standards of utility and performance. Unless otherwise approved provide only the specified product.

B. All other materials, not specifically described, but required for a complete and proper finish hardware installation, are to be selected by the Contractor, subject to the approval of the Architect and Eanes ISD.

C. Architect and Eanes ISD reserve the right to approve all the substitutions proposed for this specification. All requests for substitution to be made prior to bid in accordance with Division 1, General Requirements, and are to be in writing, hand delivered to the Architect. Two (2) copies of the manufacturer's brochures and a physical sample of each item in the appropriate design and finish shall accompany requests for substitution.

PART 3 - EXECUTION

3.1 INSTALLATION OF FINISH HARDWARE

A. Hardware is to be installed by experienced finish hardware installers with a minimum of ten (10) years experience in the installation of finish hardware. A pre-installation meeting shall occur between EISD, the Architect, the General Contractor, the hardware supplier, hardware Manufacturers representative, electrical contractor, security contractor, hollow metal supplier, wood door supplier and the hardware installer to coordinate all aspects of the installation. Factory certification of qualified installers shall be required for the installation of all card access products (No Exception). Final selection of the hardware installer(s) shall be determined by Eanes ISD.

B. Check hardware against the reviewed hardware schedule upon delivery. Store the hardware in a dry and secure location to protect against loss and damage.

C. Install finish hardware in accordance with approved hardware schedule and manufacturers' printed instructions. Pre-fit hardware before finish is applied to door; remove and reinstall after finish is complete and dry. Install and adjust hardware so that parts operate smoothly, close tightly, and do not rattle.

D. Mortise and cutting to be done neatly, and evidence of cutting to be concealed in the finished work. Protect all Finish hardware from scratching or other damage.

3.02 HARDWARE SCHEDULE:

HW1 ALL DOORS

1-1/2 PR HINGES	1279 - 4-1/2 X 4-1/2
1 LOCKSET	B561BD-Q - ICC/7
1 STOP	1270WV / 1211ES
3 SILENCER	GJ64

END OF SECTION 08 71 00

SECTION 09 11 00 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed metal stud framing for interior stud partition walls, interior drywall ceilings and soffit framing.
B. Framing accessories.

1.2 RELATED SECTIONS

A. Section 07 21 00 - Batt Insulation
B. Section 09 11 00 - Gypsum Wallboard Systems: Metal studs for partitioning.

1.3 REFERENCES

A. ASTM C645 – Standard specification for non-structural steel framing members.
B. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum panel products.
C. FS TT-P-645 - Primer, Paint, Zinc-Chromate, Alkyd Type.
D. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.
E. Specification of the Design of Cold-Formed Steel Structural Members of the American Iron and Steel Institute.
F. Specifications for Metal Lathing and Furring of the Metal Lath/Steel Framing Association.
G. ASTM A-653/A-653M – Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
H. ASTM A-570 – Specification of Hot-Rolled Carbon Steel Sheets and Strip, Structural Quality.
I. ASTM A-611 – Specification for Steel, Cold Rolled Sheet, Carbon, Structural.

1.4 SYSTEM DESCRIPTION

A. Metal stud framing system for interior walls, with batt type insulation specified in Section 07 21 00, gypsum board specified in Section 09 20 00.

1.5 DESIGN REQUIREMENTS

A. Maximum Allowable Deflection: 1/360 of unbraced height or span.
B. Design systems to meet the requirements of the International Building Code, accommodate construction tolerances, deflection of building structural members and clearances of intended openings. Design lateral load for interior partitions shall be 5 psf. Design live loads for accessible ceilings is 10 psf. For unaccessible ceilings, design shall be sufficient to support the dead load of the ceiling and any suspended items only.

1.6 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Submit product data describing standard framing member materials and finish, product criteria, load charts and deflection tables, bridging requirements and limitations. Provide shop drawings showing bracing heights, bracing member sizes and properties and bracing connections. Drawings shall bear the seal of professional engineer currently licensed in Texas.

C. Submit product data for framing connections, including method of anchorage to the structure, type and location of fasteners, method for securing studs to tracks and accessories. Provide manufacturer's data and detail drawings on partition head to structure connections showing compliance with the requirements of these specifications. Connection details shall bear the seal of a professional engineer currently licensed in Texas.

D. Manufacturer's installation instructions, indicating special procedures and conditions requiring special consideration.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with GA 203 and ASTM C754.

1.8 SEQUENCING AND SCHEDULING

A. Sequence work with other work directly affected by this Section.

B. Coordinate the work of related Sections.

C. Coordinate the placement of components to be installed within stud wall or ceiling framing systems.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The Steel Network.

B. Dietrich Industries.

C. Clark Steel Framing Systems.

D. Dale/Incor Steel Framing.

E. Inryco/Miller Steel Framing.

F. Marino-Ware.

G. Or approved alternate.

2.2 STUD FRAMING MATERIALS

A. Design, analysis and computation of section properties shall be in conformance with the Specification for the Design of Cold-Formed Steel Structural Members of the American Iron and Steel Institute.

B. Technical tabulations of section properties, load capacities and deflections shall indicated dimensions, steel characteristics and allowable stresses upon which computations are based.

C. All steel members shall be galvanized.

D. All 16 gage and heavier galvanized structural members shall be formed from steel that corresponds to the requirements of ASTM A653/A653M with a minimum yield strength of 50 ksi.

E. All 18 gage and lighter galvanized structural members shall be formed from steel that corresponds to the requirements of ASTM A653/A653M with a minimum yield strength of 33 ksi.

F. Studs/Joists: ASTM A525, galvanized to G90 coating class, ANSI/ASTM A591, non-load bearing rolled steel, channel shaped, punched for utility access.

G. Stud and Joist Schedules: Unless otherwise specified in the architectural drawings, the following schedules shall be applicable for non-load bearing partition wall studs and ceilings. Schedules assume gypboard finishes are applied to both sides of studs for full height of partitions, and that bridging has been installed at 6'-0" maximum on centers for joists to provide adequate lateral bracing. Member sizes that are specified on the architectural drawings that are deeper and/or heavier gage than those scheduled herein shall govern over those scheduled herein. Conditions encountered that do not fall within the criteria shown for the schedules shall be referred to the Architect.

LIGHT GAGE STEEL STUD SCHEDULE – INTERIOR GYPBOARD WALL PARTITIONS

INTERIOR STUDS: SPACING AT 16” ON CENTERS

(5 PSF LATERAL LOAD, MAXIMUM ALLOWABLE DEFLECTION = UNBRACED HEIGHT/360)

MAXIMUM UNBRACED HEIGHT (FEET)	STUD DESIGNATION	STUD DEPTH (INCHES)	FLANGE WIDTH (INCHES)	STUD GAGE	MINIMUM EFFECTIVE I (INCHES 4)	MINIMUM EFFECTIVE S (INCHES 3)
11	362S125-18	3 5/8	1¼	25	0.227	0.125
13	362S125-27	3 5/8	1¼	22	0.336	0.185
14	362S137-33	3 5/8	1 3/8	20	0.479	0.254
16	362S200-33	3 5/8	2	20	0.643	0.318
	400S162-33	4	1 5/8	20	0.692	0.332
18	400S137-54	4	1 3/8	16	0.953	0.477
	400S162-43	4	1 5/8	18	0.892	0.443
	600S137-33	6	1 3/8	20	1.582	0.510
20	400S200-54	4	2	16	1.292	0.646
	600S162-33	6	1 3/8	20	1.582	0.510
28	600S250-54	6	2 1/2	16	3.819	1.159
	800S162-33	8	1 5/8	20	3.582	0.757
32	800S200-43	8	2	18	5.302	1.293

LIGHT GAGE STEEL STUD SCHEDULE – INTERIOR GYPBOARD WALL PARTITIONS

INTERIOR STUDS: SPACING AT 24” ON CENTERS

(5 PSF LATERAL LOAD, MAXIMUM ALLOWABLE DEFLECTION = UNBRACED HEIGHT/360)

MAXIMUM UNBRACED HEIGHT (FEET)	STUD DESIGNATION	STUD DEPTH (INCHES)	FLANGE WIDTH (INCHES)	STUD GAGE	MINIMUM EFFECTIVE I (INCHES 4)	MINIMUM EFFECTIVE S (INCHES 3)
10	362S125-18	3 5/8	1¼	25	0.227	0.125
11	362S125-27	3 5/8	1¼	22	0.336	0.185
12	362S125-33	3 5/8	1¼	20	0.407	0.224
14	362S200-33	3 5/8	2	20	0.643	0.318
	400S162-33	4	1 5/8	20	0.692	0.332
16	400S137-54	4	1 3/8	16	0.953	0.477
	600S137-33	6	1 3/8	20	1.582	0.510
18	400S200-68	4	2	14	1.589	0.795
	600S137-33	6	1 3/8	20	1.582	0.510
20	600S200-33	6	2	20	2.059	0.617
28	800S200-43	8	2	18	5.302	1.293
32	800S200-68	8	2	14	8.140	2.035

LIGHT GAGE STEEL JOIST SCHEDULE – INACCESSIBILE INTERIOR GYPBOARD CEILINGS

SPACING AT 16” ON CENTERS

(5 PSF DEAD LOAD, MAXIMUM ALLOWABLE DEFLECTION = SPAN/360)

MAXIMUM SPAN (FEET)	JOIST DESIGNATION	JOIST DEPTH (INCHES)	FLANGE WIDTH (INCHES)	STUD GAGE	MINIMUM EFFECTIVE I (INCHES 4)	MINIMUM EFFECTIVE S (INCHES 3)
8	250S125-18	2½	1¼	25	0.089	0.060
10	362S125-18	3 5/8	1¼	25	0.221	0.075
12	362S125-27	3 5/8	1¼	22	0.376	0.156
14	362S125-33	3 5/8	1¼	20	0.415	0.182
16	400S132-33	4	1 3/8	20	0.603	0.259
	600S132-33	6	1 3/8	20	1.548	0.455
18	400S162-43	4	1 5/8	18	0.776	0.359
	600S137-33	6	1 3/8	20	1.548	0.455
20	600S137-33	6	1 3/8	20	1.548	0.455

LIGHT GAGE STEEL JOIST SCHEDULE – INACCESSIBLE INTERIOR GYPBOARD CEILINGS

INTERIOR STUDS: SPACING AT 24” ON CENTERS

(5 PSF DEAD LOAD, MAXIMUM ALLOWABLE DEFLECTION = SPAN/360)

MAXIMUM UNBRACED HEIGHT (FEET)	JOIST DESIGNATION	JOIST DEPTH (INCHES)	FLANGE WIDTH (INCHES)	STUD GAGE	MINIMUM EFFECTIVE I (INCHES 4)	MINIMUM EFFECTIVE S (INCHES 3)
8	250S125-30	2½	1¼	22	0.145	0.098
10	362S125-30	3 5/8	1¼	22	0.376	0.156
12	362S162-33	3 5/8	1 5/8	20	0.479	0.232
14	400S137-33	4	1 5/8	20	0.603	0.259
16	400S137-43	4	1 5/8	18	0.776	0.359
	600S137-33	6	1 3/8	20	1.548	0.455
18	600S137-33	6	1 3/8	20	1.548	0.455
20	600S137-43	6	1 3/8	18	2.041	0.643

LIGHT GAGE STEEL JOIST SCHEDULE – ACCESSIBLE INTERIOR GYPBOARD CEILINGS

SPACING AT 16” ON CENTERS

(5 PSF DEAD LOAD, 10 PSF LIVE LOAD, MAXIMUM ALLOWABLE DEFLECTION = SPAN/360)

MAXIMUM UNBRACED HEIGHT (FEET)	JOIST DESIGNATION	JOIST DEPTH (INCHES)	FLANGE WIDTH (INCHES)	STUD GAGE	MINIMUM EFFECTIVE I (INCHES 4)	MINIMUM EFFECTIVE S (INCHES 3)
8	362S125-30	3 5/8	1¼	22	0.342	0.135
10	362S137-33	3 5/8	1 3/8	20	0.479	0.232
12	400S137-33	4	1 3/8	20	0.603	0.259
14	600S137-33	6	1 3/8	20	1.548	0.455
16	600S137-43	6	1 3/8	18	2.041	0.645
18	600S137-33	6	1 3/8	18	2.041	0.645
20	600S162-54	6	1 5/8	16	2.860	0.954
	800S137-43	8	1 3/8	18	4.001	0.896

LIGHT GAGE STEEL JOIST SCHEDULE – ACCESSIBLE INTERIOR GYPBOARD CEILINGS

INTERIOR STUDS: SPACING AT 24" ON CENTERS

(5 PSF DEAD LOAD, 10 PSF LIVE LOAD, MAXIMUM ALLOWABLE DEFLECTION = SPAN/360)

MAXIMUM UNBRACED HEIGHT (FEET)	JOIST DESIGNATION	JOIST DEPTH (INCHES)	FLANGE WIDTH (INCHES)	STUD GAGE	MINIMUM EFFECTIVE I (INCHES 4)	MINIMUM EFFECTIVE S (INCHES 3)
8	362S125-33	2½	1¼	20	0.415	0.182
10	362S137-33	3 5/8	1 3/8	20	0.479	0.232
	400S137-33	4	1 3/8	20	0.603	0.259
12	600S137-43	6	1 3/8	18	2.041	0.643
14	600S137-43	6	1 3/8	18	2.041	0.643
16	600S162-43	6	1 5/8	18	2.316	0.767
18	600S162-54	6	1 5/8	16	2.860	0.954
	800S137-54	8	1 3/8	16	5.077	1.179
20	800S162-54	8	1 5/8	16	5.702	1.334

G. Tracks and Runners: Of same material and finish as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud. Thickness of tracks or runners shall be at least equal to the stud thickness.
H. Furring and Bracing Members: Of same material and finish as studs. Size and thickness of bracing members shall be as required for the conditions for which braces are installed.
I. Fasteners: Self-drilling, self-tapping screws.
J. Metal Backing: 20 gage galvanized steel for reinforcement of hinges.
K. Anchorage Devices: Power driven and/or powder actuated.
L. Primer: FSTT-P-645, for touch-up of galvanized surfaces.
M. Framing Connectors:
1. Framing connectors shall be factory-made and formed from steel sheet conforming to the requirements of ASTM A653/A653M, SS Grade 50, with a G60/Z180 hot dipped galvanized coating and factory punched holes. Connectors shall have a minimum thickness of 16 gage.
2. Movement connections: At partition head to structure connections, to the prevent the unintended transfer of vertical structure loads to the studs, make provisions to permit movement of the structure above. Provide track fastened to structure with legs of sufficient length to accommodate the specified deflections for friction fit of studs cut short and screwed to a

secondary deflection channel set inside, but unattached to, the top track, or provide slips with slotted holes, shoulder screws or anti-friction bushings, or other appropriate connection devices. Such devices shall be capable of transferring lateral loads. Connections shall accommodate a vertical deflection of the structure of 1 inch at floor framing, and 1.5 inch at roof framing. Heads of partitions at structural framing shall not be installed tightly against or to the structure.

N. Acoustic sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

O. Touch-up primer for Galvanized Surfaces: SSPC-Paint 20, Type I – Inorganic.

2.3 FABRICATION

A. Fabricate assemblies of studs, tracks, etc. to sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditions are ready to receive work.

B. Verify field measurements are as shown on Drawings.

C. Verify that rough-in utilities are in proper location.

D. Beginning of installation means installer accepts existing conditions.

3.2 ERECTION

A. Align and secure top and bottom tracks to floor and overhead structure at 24 inches on centers. Studs shall be seated squarely in the bottom tracks with the stud webs and flanges abutting the track webs. All studs shall be plumbed and aligned with the top and bottom tracks. Studs shall be securely fastened to both flanges of the bottom track.

B. Where the studs extend to the structure above, attach to track to structure, maintain clearance between the top of studs and bottom of track/structure and connect the studs to the track using the approved movement devices in accordance with the manufacturer's instructions to avoid deflection transfer to the studs. Provide extended leg tracks to top of wall and bottom of structure. Verify free vertical movement of top of stud connections. Place two beads of acoustic sealant between tracks and substrate.

C. Partitions with acoustic rating:

1. Provide components and install as required to produce STC rating of 45, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E 413.
2. Place two beads of acoustic sealant between tracks and substrate.
3. Place two beads of acoustic sealant between studs and adjacent vertical surfaces.

D. Fit tracks under and above openings and secure intermediate studs to tracks at the same spacing specified for the wall studs.

E. Install studs at 16 inches on centers unless specifically noted otherwise.

F. Connect studs to tracks using fastener method.

G. Provide lateral bracing and bridging in stud systems in accordance with the manufacturer's recommendations. Bridging at ceiling joists shall be provided in accordance with the manufacturer's recommendations, but shall not exceed 8 feet on centers under any circumstances.
H. Splicing of studs will not be permitted.
I. Construct corners using a minimum of three studs.
J. Unless otherwise noted, double studs at wall openings and door and window jambs.
K. Coordinate erection of studs with the requirements of door and window frame dimensions, supports, details and attachments.
L. Align stud web openings.
M. Coordinate installation of bucks, anchors, bridging and braking with electrical and mechanical work to be place inside or behind the stud framing.
N. Blocking: Install and secure wood or light gage blocking to studs. Install blocking as required for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories hardware, opening frames, handrails, TV brackets and any other wall mounted and supported items, devices or equipment.
O. Refer to drawings for indication of partitions extending to ceiling only and for partitions extending through ceiling to structure above.
P. Bracing: Install bracing above ceilings where required by the submittal drawings to limit vertical spans. Bracing shall be installed using approved connection details. Where bracing is to be attached to and perpendicular to structural framing, bracing shall be attached to the top chords of trusses or top flanges of beams. Attachment of bracing members to the bottom chords of joists or bottom flanges of beams at structural framing will not be permitted. Bracing may be attached to the bottom chords of joists or bottom flanges of steel beams only where such bracing is parallel to the structural framing members.

3.3 TOLERANCES
A. Maximum Variation From True Position: 1/8 inch in 10 feet.
B. Maximum Variation of any Member from Plane: 1/8 inch in 10 feet.

END OF SECTION 09 20 00

SECTION 09 20 00 - GYPSUM WALLBOARD SYSTEMS

PART 1 GENERAL

1.1 WORK INCLUDED
A. Gypsum board.
B. Taped and sanded joint treatment.

1.2 RELATED WORK
A. Section 06 10 00 - Carpentry Work
B. Section 07 21 00 - Batt Insulation
C. Section 09 11 00 – Non Structural Metal Framing
D. Section 09 90 00 - Painting: Textured finish

1.3 QUALITY ASSURANCE
A. Perform gypsum wallboard systems work in accordance with recommendations of ASTM C754 and GA 216 unless otherwise specified in this section.
B. Keep copy of GA 216 in field office for duration of project.
C. See Section 09 11 00 – Non Structural Metal Framing for additional information and requirements.

1.4 SUBMITTALS
A. Submit manufacturer's literature for materials and installation of all materials required.

1.5 REFERENCES
A. GA 216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
B. ASTM C754 - Installation of Steel Framing Members to Receive Screw-attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.
C. Acceptable manufacturers: USG, American Gypsum, Georgia Pacific, National Gypsum, Temple-Inland or equal.

PART 2 PRODUCTS

2.1 GYPSUM WALLBOARD
A. Provide gypsum wallboard materials in accordance with recommendations of GA 216.
B. Moisture Resistant Gypsum Board (install at ALL ceramic tile and epoxy wall coated wall finishes): GP Tile Backer Board, 5/8 inch thick; maximum permissible lengths; ends square cut; tapered edges at finished surfaces; water repellent paper faces.
C. Interior Gypsum Wallboard: Equal to GP Paperless DensArmor® Plus Interior Wallboard, 5/8 inch thick; maximum permissible lengths; ends square cut; tapered edges at finished surfaces; water repellent paperless faces.

2.2 GYPSUM WALLBOARD ACCESSORIES

A. Provide gypsum wallboard accessories in accordance with GA 216.
B. Corner Beads: Metal, Galvanized, Dura-AA-Bead by U.S.G., 1 1/4" flanges.
C. Edge Trim: At all edges abutting another material.
D. Reinforcing tape, Joint compound, Adhesive, Water, Fasteners: GA 216.
E. Provide USG P-1 vinyl trim at the perimeter of all suspended gypsum wallboard ceilings.

PART 3 EXECUTION

3.1 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with recommendations of GA 216.
B. Erect single layer standard gypsum board in direction most practical and economical, with ends and edges occurring over firm bearing.
C. Erect moisture resistant gypsum board on walls behind all plumbing fixtures, wet areas, ceramic tile and epoxy wall coating.
D. Use screws when fastening gypsum board to metal furring or framing. Use nails or screws when fastening gypsum board to wood furring or framing.
E. Treat cut edges, damaged paper and holes in moisture resistant gypsum board and exterior gypsum sheathing board with sealant.
F. Place corner beads at external corners. Use longest practical lengths. Place edge trim where gypsum ceiling board abuts dissimilar materials.
G. Tape, fill, and sand exposed joints, edges, corners, openings and fixings, to produce surface ready to receive surface finishes. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch. Finishing of taping is not required at walls above ceilings, behind tack and chalk boards, and behind hardboard paneling.
H. Painted walls - Mix joint cement according to Manufacturer's directions, embed joint cement over joints and edges, embed tape in joint cement, Perf-a tape System by U.S.G., Apply coat joint cement over tape and feather edges minimum 18" as necessary to insure a smooth surface, sand lightly with 00 sandpaper. Apply rolled or sprayed orange peel texture.

END OF SECTION 09 20 00

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 WORK INCLUDED
- A. Non-fire rated suspended metal grid systems complete with wall trim.
- B. Lay-in ceiling boards.

1.2 RELATED WORK
- A. Division 16: Lighting fixtures within ceiling system.
- B. Division 15: Air Diffusers within ceiling system.

1.3 REFERENCE STANDARDS

1.4 SUBMITTAL
- A. Submit shop drawings of acoustical ceiling system in accordance with Section 01 30 00.
- B. Clearly indicate grid layout and all related dimensioning, junctions with other work or ceiling finishes, inter-relation of mechanical and electrical items related to system and walls.

1.5 ENVIRONMENTAL CONDITIONS
- A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead mechanical work is completed, tested and approved.
- B. Permit work to dry prior to commencement of installation.
- C. Maintain uniform temperatures of minimum (61 degrees F.) and humidity of 20% to 40% prior to, during and after installation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
- A. Substitutions: Items of same function and performance are acceptable in conformance with Section 01631.

2.2 SUSPENSION SYSTEM
- A. Type and Manufacture: 15/16" Intermediate duty, Class "A".
  - 1. Acceptable Manufacturers:
    - a) Armstrong - Prelude XL
    - b) Chicago Metalic Corp. 200 Series
    - c) USG Interiors – DX/DXL-24
    - d) CertainTeed - Classic
- B. Grid: Non-fire rated exposed tee components die cut and interlocking.
- C. Accessories: stabilizer bars, furring clips, splices, edge moldings hold down clips and as required to complete and complement suspended ceiling grid system.
- D. Materials/Finish: Commercial quality cold rolled steel with galvanized coating; white finish on exposed surfaces.

E. Carrying Channels and Hangers: Galvanized steel; size and type to suit application and to rigidly secure the complete acoustic unit ceiling system, with maximum deflection of 1/360.

2.3 LAY-IN PANELS

A. Type 1 – 2'x2'x3/4" Acoustical Ceiling Tile. NRC = 0.55. Square edge. Mineral fiber. High Humidity, Sag Resistant. Color: White.
   1. Acceptable products:
      a) Armstrong Ultima #1900.
      b) USG Radar ClimaPlus #2210.
      c) CertainTeed Performa Fine Fissured.
      d) Or Architect-approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install acoustical system(s) in accordance with manufacturer's recommendations to produce finished ceiling true to lines and levels and free from warped, soiled or damaged grid or lay-in panels.

B. Install ceiling system(s) in a manner capable of supporting all superimposed loads, with maximum permissible deflection of 1/360 of span and maximum surface deviation of 1/8 inch in 10 ft.

C. Install after major above-ceiling work is complete. Co-ordinate the location of hangers with other work. Ensure the layout of hangers and carrying channels are located to accommodate fittings and units of equipment which are to be placed after installation of ceiling grid system(s).

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest adjacent hangers and related carrying channels as required to span the required distance.

E. Supply hangers or inserts for installation to the respective section in ample time and with clear instructions for their correct placement. If steel deck is not supplied with hanger tabs, co-ordinate the installation of hanger clips during steel deck erection. Provide additional hangers and inserts as required.

F. Hang independently of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of the longitudinal axis of face plane of adjacent members.

G. Center ceiling system(s) on room axis leaving equal border pieces (or as shown on reflected ceiling plan).

H. Do not support fixtures from or on main runners or cross runners if weight of the fixture causes the total dead load to exceed the deflection capability. In such cases, support fixture loads by supplementary hangers located within 6 inches of each corner, or support the fixtures independently.

I. Do not install fixtures so that main runners and cross runners will be eccentrically loaded. Where fixture installation would produce rotation of runners, provide stabilizer bars.

J. Install edge moldings at intersection of ceiling and vertical surfaces, using maximum lengths, straight, true to line and level. Miter corners. Provide edge moldings at junctions with other ceiling finishes.

K. Fit acoustic lay-in panels in place, free from damaged edges or other defects detrimental to appearance and function. Lay directionally patterned tile one way

with pattern parallel to shortest room axis. Fit border units neatly against abutting surfaces.

L. Install lay-in panels level, in uniform plane and free from twist, warp and dents.

M. Install hold-down clips on all lay-in panels to hold such panels tight to grid system where within 20 ft. of exterior door(s).

3.2 ADJUSTMENTS

A. Adjust any sags or twists which develop in the ceiling system(s) and replace any part which is damaged or faulty.

END OF SECTION 09 51 00

SECTION 09 90 00 - PAINTING

PART 1 GENERAL

1.1 WORK INCLUDED

A. Prepare surfaces which are to receive finish.
B. Finish all exposed surfaces, included factory primed material, throughout the project, both interior and exterior with the exception of the following:
   1. Surfaces which are delivered to the job site with a factory final finish, unless indicated to be painted.

1.2 RELATED WORK

A. Section 08 12 00 - Standard Steel Frames: Shop primed products.
B. Section 09 20 00 - Gypsum Board Systems

1.3 MOCKUP

A. Before proceeding with paint application, finish one complete surface of each color scheme required, under provisions of Section 01400, clearly indicating selected colors, finish texture, materials and workmanship.
B. If approved, sample area will serve as a minimum standard for work throughout Work.

1.4 SUBMITTALS

A. Furnish a "Detailed Painting Schedule" for approval by the Architect. Indicate type of surface, type of paint material, and number of coats required, as set forth in the "Painting Requirements" hereinafter specified. Approval of this schedule by the Architect must be received by the Contractor before delivering material to the site.
B. Submit brand designation and grade of the indicated type produced by the approved manufacturer for each application listed or required.
C. Submit product analysis and performance characteristics for all paint material as requested by the Architect.
D. No claim by the painting contractor as to the unsuitability or unavailability of any material specified or his unwillingness to use same or his inability to produce first-class work with same will be entertained, unless such claims are made in writing and submitted with his bid.
E. The Architect will review the "Detailed Painting Schedule" and if any painting material listed therein does not represent, in the opinion of the Architect, such highest quality of the manufacturer, the Architect may direct its replacement with an acceptable painting material at no additional cost to the Owner.
F. Contractor shall prepare 8 inch (200 mm) x 10 (250 mm) samples of each color and finish. When possible, apply finishes on identical type materials to which they will be applied on job.
G. Identify each sample as to finish, formula, color name and number, and sheen name.
H. Colors to be selected by Architect/Engineer prior to commencement of work. No claim by or additional compensation to the painting contractor will be entertained

for additional work required (additional coats of paint) to provide proper finish due to colors selected.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver paint materials under provisions of Section 01600 in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, color designation and instructions for mixing and/or reducing.
B. Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 45 degrees F in well ventilated area.
C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture contents of surfaces are below manufacturer's published maximums.
B. Ensure surface temperatures are above 40 degrees F (5 degrees C) before applying finishes. Minimum application temperatures for latex paints for interior work is 45 degrees F (7 degrees C) and 50 degrees F (10 degrees C) for exterior work. Do not apply paint when temperature is greater than 90 degrees F, or when excessive humidity is present.
C. Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 45 degrees (7 degrees C) for 24 hours before, during and 45 hours after application of finishes.

1.7 PROTECTION

A. Protect or remove hardware, escutcheons, plates, covers and other items subject to damage or discoloration from painting.
B. Carefully and adequately protect all surfaces not requiring painting in areas where painting is being carried on. Use tarpaulins or other suitable covers, with supports, if needed, to protect adjacent or underlying surfaces.
C. Maintain all wrappings or other factory-applied protection furnished with finishing hardware or other items provided by other trades and installed in areas where painting is requires. If wrappings are displaced or removed, protect surfaces for the duration of painting work.

1.8 EXTRA STOCK

A. Leave on premises, where directed by Architect/Engineer, not less than one gallon of each color used.
B. Containers to be tightly sealed and clearly labeled for identification.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Sherwin Williams (Listed unless noted otherwise)
B. PPG
C. Devoe
D. Glidden Company

E. Benjamin Moore
F. Pratt and Lambert, Inc.
G. Tnemec
H. Jones-Blair
I. Dantex
J. Euclid Chemical Co.
K. Substitutions: Under provisions of Section 01600

2.2 MATERIALS

A. Prepared Paints and Coatings: All by the same manufacturer, unless otherwise specified.
B. Tinting Colors: By manufacturer of prepared paint.
C. Spackling Compound: Finely ground, grit-free when dry, non-shrink. Shall set with smooth, hard, white surface and will sand properly and receive any finish.
D. Paint Accessory Materials: (Linseed oil, shellac, turpentine and other materials not specifically indicated herein but required to achieve the finishes specified) of high quality and approved manufacturer.
E. Paints: Ready-mixed except field catalyzed coatings. Pigments fully ground maintaining a soft paste consistency, capable of readily and uniformly dispersed to a complete homogeneous mixture.
F. Paints to have good flowing and brushing properties and be capable of dry or curing free of streaks or sags.
G. Texture/Coatings: Drywall surfaces shall receive rolled-on light orange peel texture.
H. PRIMERS
    1. Alkyd Metal Primer: Tnemec Series 10 Primer.
    2. Alkyd Wood Primer (Interior): Sherwin Williams Preprite Wall & Wood Primer B49WZ2
    3. Alkyd Wood Primer (Exterior): Sherwin Williams A-100 Alkyd Wood Primer Y24.
    4. Latex Wall Primer: Sherwin Williams Preprite Classic Latex Primer B28W101 or PPG Speedhide 6-2 Sheetrock Sealer.
    5. Galvanized Primer: Sherwin Williams Galvite HS B53.
I. FILLERS/SEALERS
    1. Block Filler: Sherwin Williams Loxon Block Surfacer A24W200 or PPG 16-90 Series – Pitt Glaze Interior/Exterior Block Filler Latex.
    2. Wood Filler: Sherwin Williams Paste Wood Filler.
    3. Knot Sealer: Formula WP0578 of the Western Pine Association.
    4. (Moisture prone areas): UGL “Drylock” Sealer.
J. ALKYD/OIL BASED PAINTS
    1. Alkyd Gloss Enamel: Sherwin Williams Industrial Enamel HS B54.
    2. Alkyd Semi-Gloss Enamel: Sherwin Williams Pro Mar 200 Alkyd Semi-Gloss B34.
    3. Alkyd Spray Enamel (Flat): Sherwin Williams Super Save-Lite Dryfall Flat B48.
    4. Alkyd Spray Enamel (Semi-Gloss): Sherwin Williams Super Save-Lite Dryfall Semi-Gloss B47.

5. Alkyd Spray Enamel (Gloss): Sherwin Williams Super Save-Lite Dryfall Gloss B47WZ65.
6. Epoxy Ester (one step prime and finish): Sherwin Williams Galvite Epoxy Ester Dryfall B48W602.

K. LATEX PAINTS
1. Latex Wall and Trim Paint: Sherwin Williams ProMar 200 Latex Eg-Shell B20W200 or PPG 89-6 Series – Manor Hall Interior Premium Eggshell Acrylic Latex .
2. Latex Trim Paint: Sherwin Williams Pro Classic Waterborne Latex Semi-Gloss B31 or PPG 6-8510 Series – Speedhide Interior High-Lustre Semi-Gloss Latex.
3. Latex Masonry Paint, Acrylic: Sherwin Williams Loxon Masonry Primer or PPG 16-90 Series – Pitt Glaze Interior/Exterior Block Filler Latex and Topcoat A24 Series.
4. Masonry Patch: Conseal Patch
5. Acrylic House Paint: Sherwin Williams A-100 Satin House Paint A82.

L. TRAFFIC MARKING PAINT; Sherwin Williams “ProMar” Alkyd Traffic Paint, white TM5494.

M. LACQUER SANDING SEALER; Sherwin Williams Lacquer Sanding Sealer T60F20.

N. LACQUER; Sherwin Williams Clear Satin Lacquer.

O. CONCRETE FLOOR SEALER; Equal to H&C, Clear 23, Concrete Sealer, High Gloss.

P. CONCRETE STAIN; Equal to Scofield Systems, Lithochrome Tintura Stain. Apply to concrete benches below stairs. See Drawings for locations, quantity and additional information.

2.3 MIXING

A. Paint colors shall be selected by the Architect. Before any work is begun, the Architect will furnish the Contractor with a color schedule and/or chips showing where the various colors shall be used.

B. Apply paint of consistency recommended by manufacturer. Additional thinning is not approved unless specifically permitted by the Architect.

PART 3 EXECUTION

3.1 INSPECTION

A. Thoroughly examine surfaces to be painted prior to commencement of work. Report in writing to Architect/Engineer, any condition that may potentially affect proper application. Do not commence until such defects have been corrected.

B. Correct defects and deficiencies in surfaces which may adversely affect work of this Section.

3.2 PROTECTION

A. Adequately protect other surfaces from paint and damage. Repair damage as s result of inadequate or unsuitable protection.

B. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces

within storage and preparation areas.

C. Place cotton waste, cloths, and material which may constitute a fire hazard.

D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be carefully stored, cleaned, and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

3.3 PREPARATION

A. Remove surface contamination and repair defects.

3.4 APPLICATIONS

A. Apply each coat at proper consistency in accordance with manufacturer's recommendations.

B. Prime top and bottom edges of doors with enamel undercoat when they are to be painted.

3.5 MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to mechanical and electrical Sections with respect to painting and finishing requirements, color coding, identification banding of equipment, ducting, piping and conduit.

B. Remove grilles, covers, and access panels for mechanical and electrical systems from location and paint separately.

C. Finish paint primed equipment to color selected.

D. Prime and paint insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars and supports, except where items are plated or covered with a pre-finish coating.

E. Replace identification markings on mechanical or electrical equipment when painted over or spattered.

F. Paint exposed conduit and electrical equipment occurring in finished areas. Color and texture to match adjacent surfaces.

G. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.

H. Color code equipment, piping, conduit and exposed ductwork in accordance with requirements indicated. Color banding and identification (flow arrows, naming, numbering, etc.).

3.6 CLEANING

A. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered.

B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Upon completion of work leave premises neat and clean, to the satisfaction of Architect/Engineer.

3.7 PAINTING AND FINISHING SCHEDULE

A. INTERIOR WORK

1. Miscellaneous Iron, Steel & Bonderized Steel
   - 1st coat Tnemec Series 10 Primer.
   - 2nd coat Sherwin Williams Pro Mar 200 Alkyd Semi-Gloss
   - 3rd coat Sherwin Williams Pro Mar 200 Alkyd Semi-Gloss
2. Primed Miscellaneous Iron & Steel
   - Spot prime Tnemec Series 10 Primer.
   - 2nd coat Sherwin Williams Pro Mar 200 Alkyd Semi-Gloss
   - 3rd coat Sherwin Williams Pro Mar 200 Alkyd Semi-Gloss
3. Galvanized Iron & Steel
   - 1st coat Sherwin Williams Galvite HS Primer
   - 2nd coat Sherwin Williams Pro Mar 200 Alkyd Semi-Gloss
   - 3rd coat Sherwin Williams Pro Mar 200 Alkyd Semi-Gloss
4. Galvanized Touch-Up
   - 1st coat ZRC Cold Galvanizing Compound, for flat, light gray finishes or ZRC Galvalite, for silvery-shiny finishes, as manufactured by Z. R. C. Products Company, 21 Newport Avenue, Quincy, Massachusetts 02171, Telephone 617-328-6700. Alternates or substitutions will not be accepted.

   Refer to Section 09800 for additional information and requirements.
5. Gypsum Board
   - 1st coat Sherwin Williams Prep Rite High Build Latex Primer or PPG Speedhide 6-2 Sheetrock Sealer
   - 2nd coat Sherwin Williams ProMar 200 Latex Eg-Shell B20W200 or PPG 89-6 Series Manor Hall Interior Premium Eggshell Acrylic Latex
   - 3rd coat Sherwin Williams ProMar 200 Latex Eg-Shell B20W200 or PPG 89-6 Series Manor Hall Interior Premium Eggshell Acrylic Latex
   - 4th coat If required for proper coverage
6. Surfaces to receive Epoxy Finish
   - 1st coat Sherwin Williams Loxon Block Surfacer or PPG 16-90 Series – Pitt Glaze Interior/Exterior Block Filler Latex
   - 2nd coat Sherwin Williams Water Based Catalyzed Epoxy B70 Series
   - 3rd coat Sherwin Williams Water Based Catalyzed Epoxy B70 Series
7. Wood Surfaces (Painted)
   - 1st coat Sherwin Williams Wall & Wood Primer B49WZ2
   - 2nd coat Sherwin Williams Pro Mar 200 Alkyd Semi-Gloss
   - 3rd coat Sherwin Williams Pro Mar 200 Alkyd Semi-Gloss

C. PAINT COLORS

1. Interior: Standard color to be furnished by Owner.

END OF SECTION 09 90 00

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work covered by Division 22 includes all materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for, and the complete installation of, all plumbing work required by the Contract Documents (the Work).

B. The intent of the Contract Documents is to provide an installation that is functionally complete in every respect. If additional details or special construction are required for the work indicated or specified in Division 22, or work indicated or specified in other portions of the Contract Documents, include all such additional Work as is usually furnished with or reasonably inferable as being required for such systems, to make the installation complete and operational.

C. Coordinate and properly relate the work of Division 22 to the building structure and to the work of other trades. Verify all dimensions and visit the site to become thoroughly familiar with the existing conditions that affect the Work.

D. Advise the Architect/Engineer in writing of any discrepancy prior to bidding. The submission of a bid is deemed evidence of the Contractor's site visit, the coordination of all existing conditions, and the inclusion of all consideration for existing conditions.

1.2 CODES AND STANDARDS

A. Comply with the latest edition in effect of the applicable standards, rules, and regulations of the ASTM, ASME, UL, ANSI, AWWA, IBC, UPC, IFC, NEC, IECC, and Americans with Disabilities Act (ADA) and Texas Accessibility Standards (TAS), and any other authorities that may have lawful jurisdiction concerning the work specified. None of the terms or provisions of this specification waive any of the rules, regulations, or requirements of these codes or authorities.

B. Comply with the Federal law, "Reduction of Lead in Drinking Water Act" – 2011.

C. Perform work in accordance with applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.

D. Materials that are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplement in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where capacities, size or other features of equipment, devices or materials exceed these minimums, meet listed or shown capacities.

E. Material and equipment for electrical work must bear an approval label or be listed by Underwriter's Laboratories.

F. Resolve any code violation discovered in the Contract Documents with the Architect/Engineer prior to award of the Contract. After award of the Contract, make any correction or additions necessary for compliance with applicable codes as part of the Work.

G. In any instance where the Drawings or Specifications call for materials of a better quality or larger size than required by the codes, those provisions of the Drawings or Specifications shall take precedence. The codes shall govern in case of direct conflict between the codes and the Drawings or Specifications.

1.3 RELATED DOCUMENTS

A. The Drawings and Specifications, the General Conditions, Supplementary General Conditions and other requirements of Division 1 apply to the work specified in Division 22. Comply with these Documents in every respect. Examine all of the documents that make up the Contract Documents and coordinate them with the plumbing work on the Drawings and in Division 22 of these Specifications.

1.4 DRAWINGS AND SPECIFICATIONS

A. Drawings for the project and details of the installations accompany these Specifications, to indicate the locations of equipment, piping, fixtures, controls, etc. Schedules incorporated into the Drawings and/or Specifications tabulate performance characteristics of equipment and other devices. The Drawings, Schedules, and Specifications are complementary to each other, and what is required by one is as binding as if required by all.

B. If the Contractor deems any departures from the Contract Documents necessary, submit details of such departures and the reasons therefore in writing to the Architect/Engineer for review. Make no departures from the Contract Documents without prior written approval of the Architect/Engineer.

C. The interrelation of the Specifications, Drawings, and Schedules is as follows: The Specifications determine the nature and quality of the materials, the Drawings establish the quantities, dimensions and details, and the Schedules give the performance characteristics. Should the Drawings disagree in themselves, or with the Specifications, include the better quality or greater quantity of work or materials unless otherwise directed by the Architect/Engineer in writing. Figures shown on Drawings govern scale measurements and large scale Details govern small scale Drawings. In case of disagreement between Specifications and Drawings, see Division 1 of these specifications for clarification.

D. Furnish and install all items specifically mentioned in the Specifications but not indicated on the Drawings and/or items shown on the Drawings but not specifically mentioned in the Specifications under the appropriate section of work as if they were both specified and indicated.

E. In the event of a discrepancy between a manufacturer's product number and the description of that product, either on the Drawings or in the Specifications, the description shall take precedence over the product number.

1.5 PERMITS

A. Obtain and pay for all permits and inspections.

1.6 BUILDING CONSTRUCTION

A. Review all the Contract Drawings and Specifications so as to thoroughly become familiar with the type and quality of construction to be provided on this project.

B. The Drawings are diagrammatic in character and cannot show every connection in detail or every pipe in its exact location. Carefully investigate structural and finish conditions and coordinate with all other trades to avoid interference between the various phases of Work.

C. The approximate location of plumbing items is indicated on the Mechanical Drawings. These Drawings are not intended to give complete and exact details regarding location of outlets, apparatus, etc. Determine exact locations by taking actual measurements at the job site; locations are subject to the review of the Architect/Engineer. The Architect/Engineer reserves the right to make any reasonable changes in the locations indicated as part of the Work.

1.7 BUILDING DEMOLITION

A. Unless indicated otherwise, remove all Plumbing materials and equipment from areas designated for demolition.

B. Remove all equipment, piping, fixtures, valves, trim, hangers, supports, and other items of Plumbing material not required to remain as part of the remodeled Work. Remove any abandoned Plumbing materials, equipment, etc. encountered during the demolition phase. Ensure that systems serving adjacent areas of the building, not part of the demolition and renovation, are kept in service.

C. Patch all wall, floor, or other openings created as a result of the demolition.

D. Remove any materials or equipment to be relocated and/or reinstalled as part of the renovation. Protect all such items from damage during the removal, storage, and reinstallation process. Clean all such items before reinstallation.

E. Wherever new connections are made to existing Plumbing systems, include all materials (e.g.,

piping, fittings, wiring, etc.) and labor required to make the connections.

F. Keep all existing Plumbing systems in full operation during construction, as required to maintain in a fully functional condition all areas of the existing facility that are still in use. Include any and all temporary piping, power, etc. required to comply with this provision, as part of the Work.

1.8 CONTRACTOR QUALIFICATIONS

A. An acceptable contractor for the work under this Division must be a specialist in this field and have the personal experience, training, skill and the organization to furnish a practical working system. If required, furnish acceptable evidence of having contracted for and installed not less than three systems of comparable size and type to this one, that have served their owners satisfactorily for not less than three years.

B. Provide a foreman for this Work who has experience in installing not less than three such systems. Provide adequate and competent supervision to ensure first class construction and installation.

C. Execute the work and install all materials in accordance with the best practice of the trades in a thorough, substantial, workmanlike manner using competent workmen, so that the Work presents a neat appearance when completed. Perform all work using mechanics skilled in the trade.

D. Accept responsibility for all construction techniques required for all Plumbing systems specified and indicated on the Drawings.

1.9 OBSERVATION OF THE WORK

A. Architect/Engineer's and/or Owner's authorized representatives have the right to observe the work at any time. Provide a representative to be present when the Work is being observed, and give assistance, as may be required, to the Architect/Engineer's representative. Promptly correct all deficiencies noted by Architect/Engineer. Replace, rework, and/or repair all unsatisfactory material and/or workmanship to the satisfaction of the Architect/Engineer.

B. Periodic observation of the work by Architect/Engineer is only for the express purpose of verifying compliance with the Contract Documents. Observation by the Architect/Engineer does not relieve Contractor, any Subcontractor, and/or Material Supplier of responsibility for deviation from requirements of Contract Documents nor for errors or omissions in the performance of work.

1.10 SUBMITTALS

A. Comply with the requirements of Section 01 33 00
   1. Submit information in a 3-ring binder
      a. With project information clearly displayed on front cover and spine
      b. With Sections indexed by specification Section number
   2. Submit information in .pdf format
      a. With a cover sheet for each Section of the specifications having the following information
         i. Project name
         ii. Architect's name
         iii. Consultant's name
         iv. Contractor's name
         v. Sub-contractor or supplier's name
         vi. Index of materials included in submittal
      b. With a separate file name for each Section of the specifications followed by a number identifying submission number; example: 22 05 00-01.pdf for original submittal and 22 05 00-02.pdf for first resubmittal

B. Product data
      a. Clearly indicate proposed products where more than one product is shown on data sheet
      b. Clearly indicate where products of different manufacturers are proposed for the same purpose

C. Shop drawings
  1. Prepare shop drawings
    a. On sheets no larger than the project drawings
    b. Of Mechanical rooms and portions of rooms where plumbing equipment is installed
      i. In AutoCAD .dwg format
      ii. At a minimum scale of 1/2" = 1'-0"
      iii. Showing location of proposed plumbing equipment to scale
      iv. Showing the location of other equipment in proximity to plumbing equipment, when space is shared with non-plumbing equipment
D. Test Reports
  1. Submit within two weeks of successful completion of testing
  2. Include copies with Closeout Submittals
E. Contract Closeout Submittals
  1. Operation and Maintenance Data
  2. Warranties
  3. Project Record Documents
  4. Test Reports
F. Resubmittals
  1. Submissions that require corrections and/or additional information shall be resubmitted in their entirety
  2. Data that has been revised and or added to the original submission shall be clearly marked on the Index of Materials
G. Scope of review
  1. Review is only for
    a. General conformance with the design concept of the Project
    b. General compliance with the Contract Documents
  2. The Contractor is responsible for
    a. Confirming and correlating equipment dimensions at the Site
    b. Information that pertains to fabrication processes or construction techniques
    c. Coordination of the Work of all Trades
  3. Review and acceptance of submittals does not relieve the Contractor, any Subcontractor and/or Material Supplier of responsibility for
    a. deviation from the requirements of the Contract Documents
    b. Errors or omissions in submittals
    c. Failure to coordinate with Work required by other trades

1.11 SUBSTITUTIONS AND PRODUCT OPTIONS
A. Comply with the requirements of Section 01 25 13.

1.12 DELIVERY, STORAGE, AND HANDLING
A. Order all materials and equipment adequately in advance of the scheduled installation date to avoid construction delays.
B. Do not deliver any equipment to the job site until the equipment is ready to be installed or until there is suitable space provided to properly protect equipment from weather, humidity, dust, and physical damage.
C. Protect all equipment in accordance with the manufacturer's recommendations.
D. Keep all materials and equipment a minimum of 4 in. off the ground.
E. If insulation materials become damp or wet and are not completely dry within 48 hours of getting damp or wet, whether raw materials or part of equipment, replace the insulation; do not just dry out the insulation.
F. Keep openings to the interior of equipment capped to protect the equipment from weather, humidity, dust, and debris until such time as the equipment is installed and the openings are covered by the connecting work.

G. For equipment not specifically designed for outdoor installation, either store equipment inside, protected from the weather, or completely cover the equipment with tarps, plastic sheeting, etc. until such time as the equipment is moved indoors. Maintain the covering for as long as the equipment is kept outdoors.
H. Keep ends of all piping capped to protect the interior of such work from weather, humidity, dust, dirt, debris, etc. until such time as the piping is joined together or connected to equipment.
I. Replace all equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being erected and installed, and while being tested, until time of final acceptance.

1.13 PROJECT RECORD DOCUMENTS
A. Comply with the requirements of Section 01 77 00, Contract Closeout.

1.14 OPERATION AND MAINTENANCE DATA
A. Comply with the requirements of Section 01 77 00, Contract Closeout.
B. Submit a separate Operation & Maintenance (O&M) Manual for the work of each Subcontractor for Division 22 work.
C. Include the following in each O&M Manual as a minimum.
1. Summary of the scope of work included in the Manual.
2. Name of Subcontractor who performed the work.
3. Warranty information as defined in this Section.
4. Table of Contents, organized by Specification Section.
5. Listing of each major item of equipment furnished as part of the work, including equipment mark as identified on the Drawings, manufacturer, model number, serial number, capacity in gpm, cfm, Btuh, hp, etc. as appropriate, and where the O&M information for that item is contained in the O&M Manual.
6. A copy of the final submittal information including all revisions and submittal reply comments from the Engineer.
7. Manufacturer's brochures for installation, operation, and maintenance wherever available.
8. Manufacturer's list of recommended spare parts.
9. For each item of equipment as appropriate, a listing of replaceable parts by part number, size, quantity, etc. as appropriate, e.g., belts, filters, sheaves, fuses, motors.
10. For each item of equipment as appropriate, a listing of the control setpoints as established during startup, testing, and balancing.
11. Valve charts indicating location of valves. Refer to section 22 05 53.

1.15 GUARANTEE
A. Guarantee Work for one year from the date of final acceptance of the project; during that period make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship.
B. Provide written warranties to the Owner, as part of the O&M Manual, that identify, for each Subcontractor performing Division 22 work, the portion of the Work performed by that Subcontractor, the effective date of the warranty, names of at least two contact persons for obtaining warranty service, and a number by which the Owner can obtain 24 hours, seven days per week emergency service.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT
A. Furnish new and unused materials and equipment of locally represented manufacturers, meeting the requirements of the paragraph in each equipment Specification section regarding Acceptable Manufacturers.
B. Where the specifications list "Acceptable Manufacturers" for a particular product, the listed

manufacturers are believed to be capable of building a product which meets the quality standards specified for the applicable product.

C. Where families of products or model numbers are listed for one or more acceptable manufacturer, equivalent products from the remaining acceptable manufacturers are acceptable.

D. Notwithstanding the listing of any manufacturer as an "Acceptable Manufacturer", each product submitted for use in the Work of this Project must meet the performance, technical, and service requirements of these specifications.

E. Where two or more units are required of the same type or class of equipment, furnish units of a single manufacturer.

2.2 STANDARD PRODUCTS

A. All materials and equipment must be standard catalog products of domestic manufacturers regularly engaged in the manufacture of products conforming to these Specifications. Materials and equipment must have been in satisfactory use at least two years prior to bid date. Where custom or special items are required, fully describe these in drawings and/or material lists which detail the item proposed for use on this Project.

2.3 RUST PREVENTION

A. Protect all metallic materials from corrosion. Give all exposed metallic parts of outdoor apparatus a rust inhibiting treatment and standard finish by the manufacturer. Protect all parts such as boxes, bodies, fittings, guards, and miscellaneous parts by galvanizing, except where other equivalent protective treatment is specifically approved in writing.

2.4 CAPACITIES AND SPACE LIMITATIONS

A. Verify that the proposed equipment will physically fit within the space indicated on the Contract Documents, that there is adequate width and height along the path of installation / removal for setting / replacing the equipment, and that the required code clearances and maintenance access are maintained. Note any space conflicts in the submittals. Provide scale drawings to the Architect/Engineer indicating proposed solutions to any space conflict, for the Architect/Engineer's review.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect all materials and equipment to be installed under this Division from physical and weather damage.

B. Adequately protect work, equipment, fixtures, and materials. At work completion, make all work clean and in good, unblemished condition. Keep piping, equipment, etc. capped to prevent construction dust, paint spray, and any other contaminants from entering these items during construction.

C. Remove, round, or protect with ¾ inch Armaflex insulation all sharp corners of pipe, supports, equipment and appurtenances where such corners pose a hazard to occupants or maintenance personnel.

3.2 MANUFACTURER’S INSTRUCTIONS

A. Accept full responsibility for furnishing the proper plumbing equipment and/or material and for installing it as intended by the manufacturer's written instructions. Request advice and assistance from a representative of the specific manufacturer, if needed for proper installation, operation, or start up. Follow the manufacturers’ published instructions for preparing, assembling, installing, erecting, and cleaning all materials and equipment. If any conflict arises between the requirements of the Contract Documents and the manufacturer’s directions, promptly notify the Architect/Engineer in writing and request the Architect/Engineer’s instructions before proceeding with the work. Bear all costs arising in connection with correcting any deficiencies due to failure

to perform the Work in accordance with these manufacturer's directions and/or Architect/Engineer's instructions.

3.3 COORDINATION

A. Contract Documents are diagrammatic in showing certain physical relationships to other trades. Interfacing and coordinating with other Work including utilities and electrical Work is the exclusive responsibility of the Contractor.

B. Coordinate with Division 26 and other divisions as required. This includes but is not limited to verification of power, voltage, phase and other characteristics as being compatible with that called for on the Electrical Drawings and Division 26 Specifications, as well as that called for in Division 22 Drawings and Specifications or other Divisions requiring electrical connections or interface with this Division. Perform this coordination before placing orders for equipment.

C. Arrange plumbing work in a neat, well-organized manner, with services running parallel to the primary lines of the building construction, and with the maximum overhead clearance possible.

D. Locate operating and control equipment properly to allow easy access. Arrange entire plumbing work with adequate access for operation and maintenance of all components requiring access. If any equipment or components are shown in such a position that proper access cannot be provided, resolve the problem by coordinating with the General Contractor before installation. In the event access still cannot be provided, advise Architect/Engineer and request review of the situation.

E. Advise other trades in advance of the relevant construction of openings required in their work for the subsequent move-in of large units of plumbing work.

F. Verify exact locations of existing equipment and determine exact requirements for connections before routing services to equipment.

G. Contract Drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work or show all offsets or required fittings. Determine exact locations from field measurements. Making adjustments to field conditions is considered as part of the Work.

H. Before installing plumbing equipment, plumbing fixtures, water heaters, water coolers and other plumbing items, obtain Architect/Engineer review as to the exact method and exact placement and location of equipment in the various areas shown on the drawings. Do not determine location by scaling the Drawings. Mount plumbing fixtures at the heights as directed by the Architect and applicable authorities. Relocate equipment and devices and pay all costs of modifying work of all trades required by failure to comply with this requirement as part of the Work.

I. Determine whether or not there is an adequate path in the finished construction to remove and replace all such items without tearing out or removing permanent construction. In the event an adequate path is not available, notify the Architect/Engineer in writing **prior to ordering such equipment.**

J. The Drawings show diagrammatically the location of the various outlets and apparatus. Determine exact locations of these outlets and apparatus by reference to the Drawings and to all detail Drawings, equipment drawings, rough-in drawings, etc., by taking measurements at the building, and in cooperation with the other trades. The Owner reserves the right to make any reasonable change in location of any outlet or apparatus before installation, as part of the Work.

3.4 CONCEALED WORK

A. Where the word "concealed" is used in connection with insulating, painting, piping, and the like, the word is understood to mean hidden from sight as in crawl spaces, chases, furred spaces or suspended ceilings. "Exposed" is understood to mean open to view, including exposed in mechanical rooms.

3.5 OBSTRUCTIONS

A. The Drawings indicate certain information pertaining to surface and subsurface obstructions taken from available drawings. However, such information is not guaranteed as to accuracy of location or completeness.

B. Before any cutting or trenching operations are begun, verify with Owner's representative, utility company, municipalities, and other applicable parties that all available information has been provided. Verify locations given.
C. Should obstruction be encountered, whether indicated or not, alter routing of new Work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever Work is necessary to satisfy the purpose of the new Work and leave existing services and structures in a satisfactory and serviceable condition.
D. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are indicated.

3.6 OPENINGS
A. Framed, cast or masonry openings for piping or equipment are specified under other Divisions. Provide all drawings and layout work for exact size and location of all such openings as part of the Work.
B. Place all equipment, piping, sleeves, etc. to avoid cutting new construction.

3.7 PIPE STRAINERS
A. Immediately before substantial completion of the project, inspect, clean and service strainers.

3.8 OPERATING TESTS
A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual Specification sections.

3.9 LUBRICATION, REFRIGERANT AND OIL
A. Furnish a complete charge of correct lubricant for each item of equipment requiring lubrication.

3.10 HOISTING, SCAFFOLDING, AND TRANSPORTATION
A. Include all hoisting, scaffolding and ladders as required to set all materials and equipment in place.
B. Include all necessary transportation required for the delivery of all materials, equipment, tools, and labor to the job.

3.11 CLEANING AND TOUCH-UP PAINTING
A. At all times, keep the premises free from accumulations of waste material or rubbish resulting from Division 22 Work. Remove debris not only from the building, but also from the site and from any public areas adjacent to the site.
B. At the completion of the project, remove all tools, scaffolding, and surplus materials.
C. Touch-up or repaint to match original color, any finished surfaces scratched or discolored.

3.12 CUTTING, SEALING, AND PATCHING
A. Perform any required operations when it becomes necessary to cut through any wall, floor, or ceiling to install any Work under this Contract, or to repair any defects that may appear up to the expiration of the guarantee period. Do not cut or modify any structural members without the written permission of the Architect/Engineer.
B. Patch all openings cut by the Contractor, and repair any damage to the Work of other trades caused by cutting or by the failure of any part of the Work installed.
C. Furnish and install suitable covers over any openings cut through exterior walls or roofs, while they are left open, to protect the property or materials involved. Properly protect any openings cut through walls below grade to prevent entrance of water or other damaging elements. Waterproof all openings upon completion of the work.

D. Seal any openings through fire rated walls or floors to maintain the minimum fire rating of wall or floor penetrated, using fire barrier penetration sealing, "3M" Fire Barrier Caulk Type CP-25, type 303 Putty Fire-Stop Sealant, and "3M" Fire Barrier Penetration Sealing Systems, or approved equivalent.

3.13 EXISTING FACILITIES

A. Assume responsibility for loss or damage to the existing facilities used by workers, and for repairing or replacing such loss or damage. Send proper notices and receive written permission from the Owner to enter existing areas. Before beginning work in existing areas, make the necessary arrangements and perform other services required for the care, protection, and in-service maintenance of all electrical, communication, plumbing, heating, air conditioning, and ventilating services for existing facilities. Erect temporary barricades with necessary safety devices as required to protect personnel from injury, removing all such temporary protection upon completion of the Work.

B. Provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted because of the Work being accomplished under this project.

C. Where existing construction is removed to provide working and extension access to existing utilities, remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork, and equipment, etc., to provide this access; reinstall same upon completion of Work in the areas affected.

D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed and equipment in those areas is required to remain in operation, remove and reinstall all equipment required for the operation of the remaining plumbing systems.

3.14 OUTAGES

A. Outages of services as required by the project will be permitted only at times approved in writing by the Owner. Notify the Owner in writing two weeks before the requested outage to schedule required outages. The time allowed for outages may not be during normal working hours unless otherwise approved by the Owner. Include all costs of outages, including overtime charges, in the Work.

3.15 VIBRATION ISOLATION

A. Furnish and install vibration isolation means for all equipment and materials furnished as part of the Work to prevent the transmission of perceptible vibration, and structure-borne or airborne noise to occupied areas.

B. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping or other parts of work, rectify such conditions as part of the Work.

3.16 SUBSTITUTIONS REQUIRING CHANGES

A. Manufacturers and power requirements indicated on the Drawings are the basis of design. If changes are required for the equipment submitted, such as changes in connection sizes and/or locations, supports, housekeeping pads, orientation, routing of piping, conduit size, conductors, breakers, disconnects, etc., make such changes as part of this Work.

3.17 OPERATING INSTRUCTIONS TO OWNER

A. Prior to startup and substantial completion of work, and at a time designated by the Architect, arrange to provide services of a competent representative of the Contractor and/or Manufacturers as appropriate, to instruct Owner's representative in the operation and maintenance of each plumbing system.

B. Refer to the individual sections of this Division for requirements specific to each section.

END OF SECTION 22 05 00

SECTION 22 05 33 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. This section includes the furnishing and installation of hangers and supports for all plumbing piping systems.

1.2 APPLICABLE PROVISIONS

A. Refer to Section 22 05 00 Common Work Results for Plumbing

1.3 REFERENCE STANDARDS

A. ASTM B 633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
B. ASTM A 123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
C. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
D. ASTM A 1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability.
E. MSS SP-58 - Manufacturers Standardization Society: Pipe Hangers and Supports - Materials, Design, and Manufacture.
F. MSS SP-69 - Manufacturers Standardization Society: Pipe Hangers and Supports - Selection and Application.

1.4 SUBMITTALS

A. Submit manufacturer's technical product data for all hangers and supports, including shields and attachment methods. Product data to include, but not be limited to materials, finishes, approvals, load ratings, and dimensional information. Include sufficient data to substantiate that materials conform to the requirements of this section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver hangers and supports properly bundled and fittings properly packaged in factory-fabricated containers.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging hangers and supports.

1.6 QUALITY ASSURANCE

A. Steel pipe hangers and supports shall have the manufacturers name, part number, and applicable size stamped in the part itself for identification.
B. Hangers and supports shall be designed and manufactured in conformance with MSS SP-58.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Anvil International
B. Cooper B-Line, Inc.
C. ERICO / CADDY
D. Thomas & Betts

2.2 PIPE HANGERS AND SUPPORT

A. Hangers
1. Uninsulated pipes 2 inch and smaller:
a. Adjustable steel swivel ring (band type) hanger, B-Line B3170.

b. Adjustable steel swivel J-hanger, B-Line B3690.
c. Malleable iron ring hanger, B-Line B3198R or hinged ring hanger, B3198H.
d. Government type hanger, B-Line B3225 or B3226.
e. Adjustable steel clevis hanger, B-Line B3104 or B3100.

2. Uninsulated pipes 2-1/2 inch and larger:
   a. Adjustable steel clevis hanger, B-Line B3100.
   b. Pipe roll with sockets, B-Line B3114.
   c. Adjustable steel yoke pipe roll, B-Line B3110.
3. Insulated pipe - Hot water piping:
   a. 4 inch and smaller pipes: use adjustable steel clevis with galvanized sheet metal shield, B-Line B3100 with B3151 or B3153 series.
   b. 2-1/2 inch and larger pipes:
      i. Adjustable steel yoke pipe roll with pipe covering protection saddle, B-Line B3110 with B3160 - B3165 series.
      ii. Pipe roll with sockets with pipe covering protection saddle, B-Line B3114 with B3160 - B3165 series.
4. Insulated pipe - Cold water piping:
   a. 4 inch and smaller pipes: use adjustable steel clevis with galvanized sheet metal shield, B-Line B3100 with B3151 or B3153 series.
   b. 6 inch and larger pipes:
      i. Adjustable steel yoke pipe, B-Line B3110, with B3380CW - B3384CW calcium silicate shield.
      ii. Pipe roll with sockets, B-Line B3114, with B3380CW - B3384CW calcium silicate shield.
5. At Contractor's option, non-bolted clevis hangers conforming to MSS SP-58 and SP-69 Type 1, CADDY Slot Lock or equivalent.

B. Pipe Clamps
1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, B-Line B3140 or B3142 with B3200. For insulated lines use double bolted pipe clamps, B-Line B3144 or B3146 with B3200.

C. Multiple or Trapeze Hangers
1. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A 1011 SS Gr. 33 structural steel channel, 1⅝" x 1⅝" minimum, B-Line B22 strut or stronger as required.
2. Mount pipes to trapeze with two piece pipe straps sized for outside diameter of pipe, B-Line B2000 series.
3. For pipes subjected to axial movement:
   a. Strut mounted roller support, B-Line B3126. Use pipe protection shield or saddles on insulated lines.
   b. Strut mounted pipe guide, B-Line B2417.
4. At Contractor's option, use spin-in style strut clamps for piping 2" and under, suitable for use in air plenums, UL listed for fire and smoke, as well as having UV inhibitors for exterior application, CADDY Swift Clip or equivalent.

D. Wall Supports
1. Pipes 4 inch and smaller:
   a. Carbon steel hook, B-Line B3191.
   b. Carbon steel J-hanger, B-Line B3690.
2. Pipes larger than 4 inch:
   a. Welded strut bracket and pipe straps, B-Line B3064 and B2000 series.
   b. Welded steel brackets, B-Line B3066 or B3067, with roller chair or adjustable steel yoke pipe roll. B-Line B3120 or B3110. Use pipe protection shield or saddles on insulated lines.

E. Floor Supports
1. Hot piping under 6 inch and all cold piping:
   a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation, B-Line B3093 and B3088T or B3090 and B3088. Screw or weld

pipe saddle to appropriate base stand.

2. Hot piping 6 inch and larger:
   a. (Adjustable) Roller stand with base plate, B-Line B3117SL (or B3118SL).
   b. Adjustable roller support and steel support sized for elevation, B-Line B3124

F. Vertical Supports
1. Steel riser clamp sized to fit outside diameter of pipe, B-Line B3373 or B3374.
2. At Contractor's option, slotted designed riser clamps conforming to MSS SP-58 and SP-69 Type 1 or Type 8. CADDY EZ Riser or EZ Riser CQ, or equivalent.

G. Copper Tubing Supports
1. Use hangers sized to fit copper tubing outside diameters.
   a. Adjustable steel swivel ring (band type) hanger, B-Line B3170CT.
   b. Malleable iron ring hanger, B-Line B3198CT or hinged ring hanger B3198HCT.
   c. Government type hanger, B-Line B3225CT or B3226CT.
   d. Adjustable steel clevis hanger, B-Line B3104CT.

H. Plastic Pipe Supports
1. Use V-bottom clevis hanger with galvanized 18 gauge continuous support channel, B-Line B3106 and B3106V, to form a continuous support system for plastic pipe or flexible tubing.

I. Supplementary Structural Supports
1. Design and fabricate supports using structural quality steel bolted framing materials. Use channels that are roll formed, 12 gauge ASTM A 1011 SS Grade 33 steel, 1-5/8" x 1-5/8" or greater as required by loading conditions. Submit designs for pipe tunnels, pipe galleries, etc., to engineer for approval. Use clamps and fittings designed for use with the strut system.

2.3 UPPER ATTACHMENTS

A. Beam Clamps
1. Use Beam clamps where piping is to be suspended from building steel. Select clamp type on the basis of load to be supported, and load configuration.
2. Use C-Clamps which have locknuts and cup point set screws, B-Line B351L, or B3036L. Top flange C-clamps shall be used when attaching a hanger rod to the top flange of structural shapes, B-Line B3034 or B3033. Refer to manufacturers' recommendation for setscrew torque. Use retaining straps to maintain the clamp's position on the beam where required.
3. Use center loaded beam clamps where specified. Steel clamps, B-Line B3050 or B3055. Malleable iron or forged steel beam clamps with cross bolt, B-Line B3054 or B3291 - B3297 series as required to fit beams.
4. At Contractor's option, non-threading beam clamp, anchor screws and hardware with Push To Install Technology, CADDY Rod Lock System or equivalent.

B. Concrete Inserts
1. Use cast in place spot concrete inserts where applicable, either steel or malleable iron body, B-Line B2500 or B3014. Use spot inserts which allow for lateral adjustment and have means for attachment to forms. Select insert nuts to suit threaded hanger rod sizes, B-Line N2500 or B3014N series.
2. Use continuous concrete inserts where applicable. Use channels that are 12gauge, ASTM A 1011 SS Grade 33 structural quality carbon steel, complete with styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert must have a load rating of 2,000 lbs/ft. in concrete, B-Line B22I, B32I, or B52I (B52I is limited to 1,500 lbs/ft.). Select channel nuts suitable for strut and rod sizes.

2.4 VIBRATION ISOLATION AND SUPPORTS

A. For hydraulic, pneumatic, and other vibrating system applications, use a clamp that has a vibration dampening insert and a nylon inserted locknut. For copper and steel tubing use B-Line BVT series VibraClamps, for pipe sizes use BVP series.
B. For larger tubing or piping subjected to vibration, use neoprene or spring hangers as required.
C. For base mounted equipment use vibration pads, molded neoprene mounts, or spring mounts

as required.

D. Vibration isolation products as manufactured by B-Line, VibraTrol systems.

2.5 ACCESSORIES

A. Use hanger rods that are threaded both ends, B-Line B3205, or continuous threaded rods of circular cross section. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

B. Use shields that are 180˚ galvanized sheet metal, 12 inch minimum length, 18 gauge minimum thickness, designed to match outside diameter of the insulated pipe, B-Line B3151.

C. Use pipe protection saddles that are formed from carbon steel, 1/8 inch minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inch must have center support rib.

2.6 FINISHES

A. Indoor Finishes

1. Use hangers and clamps for support of bare copper piping that are coated with copper colored epoxy paint, B-Line Dura-Copper. Include PVC coating of the epoxy painted hanger where necessary.
2. Use hangers for other than bare copper pipe that are zinc plated in accordance with ASTM B 633 - SC3 or have an electro-deposited green epoxy finish, B-Line Dura-Green.
3. Use strut channels that are pre-galvanized in accordance with ASTM A 653 G90 or have an electro-deposited green epoxy finish, B-Line Dura-Green.

B. Outdoor, Crawlspace and Corrosive Area Finishes

1. Use hangers and strut located outdoors that are hot dip galvanized after fabrication in accordance with ASTM A 123. All hanger hardware must be hot-dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
2. Use hangers and strut located in corrosive areas that are Type 304 (316) stainless steel with stainless steel hardware.

PART 3 - EXECUTION

3.1 PIPE HANGERS AND SUPPORTS

A. Support piping adequately to maintain line and grade, with due provision for expansion and contraction. Metal channel framing members attached directly to the structure may be used to support more than one system, so long as each system so supported may be removed or modified without affecting the support of the remaining systems.

B. Place a hanger within 12 in. of each elbow, tee, valve, strainer, etc. It is not necessary to support both the main line and the branch line at tees within 12 in. of the tee unless otherwise indicated.

C. Support vertical risers with steel strap pipe clamps of approved design and size, properly supported at every floor. Support piping assemblies in chases adequately enough to be rigid and self-supporting before the chase is closed.

D. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.

E. Where several pipes can be installed in parallel and at the same elevation, use trapeze hangers as specified above. Space trapeze hangers according to the smallest pipe size, or install intermediate supports according to schedule below.

F. Install standard metal framing members and appurtenances for pipe support where indicated and/or required. Hot-dip galvanize all such members and appurtenances.

G. Include a means of preventing dissimilar metal contact such as plastic coated hangers, copper colored B-Line Dura-Copper epoxy paint, or non-adhesive isolation tape (B-Line Iso-Pipe). Galvanized felt isolators sized for copper tubing may also be used, B-Line B3195CT.

H. Install hangers to provide a minimum of 1/2 inch space between finished covering and adjacent work.

I. Size hangers for insulated pipes to accommodate insulation thickness so hanger is outside the insulation jacket.

J. Design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section.
K. Perforated bar hangers, straps, wires or chains are not permitted. Plastic support brackets may be used in accordance with the manufacturer's recommendations.
L. Support piping independently of other piping, ductwork, conduits, etc. Do not support piping from other pipes, ductwork or other equipment which is not building structure.
M. Support horizontal steel piping in accordance with maximum spacing requirements as set forth in MSS SP-69 Table 3, excerpts of which follow below:

NOMINAL PIPE SIZE	MAXIMUM SPACING
3/8" - 1-1/4"	7'-0"
1-1/2”	9’-0”
2”	10’-0”
2-1/2”	11’-0”
3”	12’-0”
4”	14’-0”
6”	17’-0”
8”	19’-0”
10”	22’-0”
12”	23’-0”
14”	25’-0”
16”	27’-0”

N. Support horizontal copper piping in accordance with maximum spacing requirements as set forth in MSS SP-69 Table 4, excerpts of which follow below:

NORMAL PIPE SIZE	MAXIMUM SPACING
1/4” - 3/4”	5'-0"
1”	6’-0”
1-1/4”	7’-0”
1-1/2”	8’-0”
2”	8’-0”
2-1/2”	9’-0”
3”	10’-0”
4”	12’-0”

NORMAL PIPE SIZE	MAXIMUM SPACING
6”	14’-0”
8”	16’-0”

O. Select support rod diameter to accommodate maximum pipe weight when filled with water for given size(s) and spacing, including a safety factor of 5. Use threaded rods conforming to physical and chemical requirements of ASTM A307, SAE J429, or ASTM 563, which have unified inch screw threads.

3.2 CONCRETE INSERTS

A. Coordinate placement of inserts in formwork before concrete is poured.
B. Include inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
C. Where concrete slabs form finished ceilings, set inserts flush with underside of slab surface.
D. Include hooked rods to concrete reinforcement section for inserts carrying pipe over 4 inch.

END OF SECTION 22 05 33

SECTION 22 17 00 - NATURAL GAS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the furnishing and installation of gas piping, including arrangement with the serving utility for upgraded service, service lines to gas equipment and appliances, termination of the service line with a valve, and final connection to equipment and appliances.

1.2 RELATED SECTIONS

A. Section 22 05 00 Common Work Results for Plumbing
B. Section 22 05 50 Plumbing Painting
C. Section 22 10 00 Plumbing Piping - General

1.3 PERMITS

A. Obtain and pay for all permits and inspections as required by the serving utility and the Authority Having Jurisdiction..

1.4 UTILITY SERVICE

A. Natural gas service is existing to remain.
B. Give proper notice to the serving utility, allowing adequate time for the serving utility to perform engineering and make arrangements for the work required.
C. Coordinate with the serving utility to provide connection to the natural gas utility main and service to a new meter / regulator assembly.
D. Arrange with the serving utility to replace existing gas meters, serving line and/or pressure regulators with a new meter, serving line and/or pressure regulator of capacity and pressure as indicated on the Drawings.
E. Fees charged by the serving utility are to include all costs relating to any service line and meter work associated with the project.
F. Include the cost of all fees as part of the Work.

1.5 SUBMITTALS

A. Product Data
   1. Valves
   2. Pressure regulators

1.6 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Perform work in accordance with applicable statutes, ordinances, codes, and regulations of National Fire Protection Association (NFPA), Underwriters Laboratories (UL) and any governmental authorities having jurisdiction.
   2. Resolve any code violation discovered in contract documents with the Engineer prior to award of the contract. After award of the contract, make any correction or additions necessary for compliance with applicable codes as part of the Work.

1.7 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping
   1. Deliver properly packaged in factory fabricated containers.
B. Acceptance at Site
   1. Inspect for damage upon receipt.
C. Storage and Protection
   1. Store in a clean, dry space in original packaging.
   2. Store outside; block so at least 4" above ground.

3. Keep covered with weather resistant material.
4. Protect from weather, damaging fumes, construction debris, and traffic.
5. Handle carefully to avoid damage.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Furnish pipe and pipe fittings of domestic manufacturers only. Coat and wrap underground steel piping to 6 in. above finished floor level.
   1. Above ground pipe 2 in. and smaller. Furnish Schedule 40, ASTM A53 black steel with Class 150 (300-pound water, oil and gas) malleable iron fittings. Furnish welded fittings for all concealed piping.
   2. Above ground pipe larger than 2 in. Furnish Schedule 40 ASTM A53 black steel pipe with long radius weld fittings.
   3. Underground Piping. Furnish high density PE-2406, ASTM-D2513, SDR-11 (Iron Pipe Size), polyethylene plastic pipe and pipe fittings with heat fusion weld joints (ASTM-D2683 for socket fusion fittings and ASTM D3261 for butt fusion fittings). Furnish a single strand, 14 gauge, copper tracer wire for all underground piping.
   4. For all gas line risers to finished grade, furnish factory fabricated steel risers coated, wrapped and cathodically protected in accordance with Section 22 10 00.
   5. Flanges. Furnish Class 125 ANSI cast iron flanges.
   6. Furnish galvanized piping and pipe supports for all materials exposed to view in food preparation areas.

B. Furnish sleeves of Schedule 40 wrought iron or black steel pipe and pipe fittings. Use Zurn No. ZANB-1471 four-point contact Tru-lock nickel bronze air inlet fittings or equivalent for venting sleeves.

2.2 VALVES

A. Furnish valves of one manufacturer only (for each type specified).
   1. 2 in. and smaller. Furnish AGA approved, UL listed, Class 175, gas duty valves with ASTM B 584 cast bronze composition body, stainless steel disc and stem, bronze packing gland, Viton disc seal, full flow, cadmium plated steel handle, screwed end, bronze butterfly valves with flat grip vinyl handle. Milwaukee “BUTTERBALL” No. BB2-100 or equivalent.
   2. 2 in. and smaller for installation outside. Furnish Class 175-200 CWP, threaded, wrench operated, 350-400 psig, iron body, 2-bolt cover type, short pattern, lubricated, tapered plug valves. Use valves listed and recommended by the manufacturer for natural gas service. Nordstrom Figure 142, or equivalent.
   3. 2½ in. and larger. Furnish Class 175-200 CWP, flanged, wrench operated, 350-400 psig, iron body, 2-bolt cover type, short pattern, lubricated, tapered plug valves. Use valves listed and recommended by the manufacturer for natural gas service. Nordstrom Figure 143, Homestead 612, or equivalent.

2.3 GAS PRESSURE REGULATOR

A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as indicated on Drawings.
B. Direct-operated pressure reducing
C. Internal registration requiring no down-stream control line.
D. Cast iron body.
E. Maximum design inlet pressure - 100 psig.
F. Maximum design outlet pressure - 15 psig.
G. Gasket - composition or Neoprene.
H. Control spring, control spring seat, split ring, diaphragm plate - plated steel
I. Diaphragm and O-rings - Nitrile (NBR)
J. Orifice, pusher post, pusher post connector, lever assembly, stem , pilot tube - aluminum or

stainless steel.

K. Disk assembly - Nitrile (NBR) or Fluoroelastomer and stainless steel

L. Furnish Fisher Series S200 or Y692 regulators or approved equivalent, suitable for outdoor installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation Standards. Install gas piping in accordance with recommendations of the National Fire Protection Association and Texas Department of Health, Division of Food and Drugs.

B. Drip Legs. Install a full size, capped drip leg 6 in. long at the base of each vertical riser and at each equipment connection.

C. Coating and Wrapping and Cathodic Protection. Refer to Section 22 10 00.

D. Minimum Cover. For piping located below finished grade, install piping in trench to the required depth to ensure two feet minimum cover over pipe.

E. Underground piping. Include a tracer wire directly above the piping. Extend both ends of the tracer wire to above grade and strap tracer wire to the risers above grade.

F. Weld all gas piping run in concealed spaces, including but not limited to piping in partitions or walls, crawl spaces, and above ceilings.

G. Do not route gas piping in masonry walls where prohibited by the Authority Having Jurisdiction.

H. Install all valves, unions and appurtenances shown on Drawings, Details, Schematics and Risers. Use line-size shut-off valves, unions and dirt legs for each equipment connection to main branches of each floor level and at all branch connections to mains.

I. Do not use semi-rigid or flexible metal gas connectors. Make all connections to appliances using rigid IPS piping. An exception is for kitchen equipment, furnished with flexible connectors, where the flexible connectors may be used. Locate all line size shut-off valves within three feet of the appliance served.

J. Paint all piping located outside or in a crawl space with one coat of rust inhibiting primer and two coats of epoxy paint as specified in Division 22 05 50.

K. Exposed Piping. For exposed piping in food preparation areas, install piping such that it is supported a minimum of 4 in. from the adjacent wall and a minimum of 6 in. above the finished floor (for sanitation). Include all supports as required to maintain minimum distance.

L. Include all fittings and appurtenances required for a complete and working system.

M. Sleeves.

1. Encase gas piping running below a slab on grade in a sleeve made of coated and wrapped standard weight wrought iron or black steel pipe or Schedule 40 PVC pipe and pipe fittings, minimum size two pipe sizes larger than gas pipe. Vent sleeve to outside through grade beam or with a 2 in. vent with return bend 18 in. above finish grade outside of building.

2. Make gas sleeves absolutely air tight.

3.2 TESTING LOW PRESSURE GAS PIPING (7 IN. W.C. AND LESS)

A. Apply 50 psig air pressure.

B. Test all joints with a soap solution while lines are under pressure.

C. Repair all leaks.

D. Make a final 24 hr. standing pressure test with air at 20 psig before connecting equipment.

E. Have Architect/Engineer or appointed Owners Representative observe the testing. At Architect's/ Engineer's discretion, the General Contractor may observe and document the test results. Document test findings in writing and forward to the Architect.

3.3 TESTING HIGH PRESSURE GAS PIPING (GREATER THAN 7 IN. W.C.)

A. Apply 100 psig air pressure.

B. Test all joints with a soap solution while system is under pressure.

C. Repair all leaks.

D. Retest the system until it is proven free of leaks.

E. Have Architect/Engineer or appointed Owners Representative observe the testing. At Architect's/ Engineer's discretion, the General Contractor may observe and document the test results. Document test findings in writing and forward to the Architect.

END OF SECTION 22 17 00

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work covered by Division 23 includes all materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for, and the complete installation of, all HVAC work required by the Contract Documents (the Work).

B. The intent of the Contract Documents is to provide an installation that is functionally complete in every respect. If additional details or special construction are required for the work indicated or specified in Division 23, or work indicated or specified in other portions of the Contract Documents, include all such additional Work as is usually furnished with or reasonably inferable as being required for such systems, to make the installation complete and operational.

C. Coordinate and properly relate the work of Division 23 to the building structure and to the work of other trades. Verify all dimensions and visit the site to become thoroughly familiar with the existing conditions that affect the Work.

D. Advise the Architect/Engineer in writing of any discrepancy prior to bidding. The submission of a bid is deemed evidence of the Contractor's site visit, the coordination of all existing conditions, and the inclusion of all consideration for existing conditions.

1.2 CODES AND STANDARDS

A. Comply with the latest edition of the applicable standards, rules, and regulations of the ASTM, ASHRAE, ASME, UL, SMACNA, ANSI, AWWA, IBC, UMC, IFC, NEC, IECC, Americans with Disabilities Act (ADA) and Texas Accessiblility Standards (TAS), and any other authorities that may have lawful jurisdiction concerning the work specified. None of the terms or provisions of this specification waive any of the rules, regulations, or requirements of these codes or authorities.

B. Perform work in accordance with applicable statutes, ordinances, codes, and regulations of governmental authorities having jurisdiction.

C. Materials that are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplement in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where capacities, size or other features of equipment, devices or materials exceed these minimums, meet listed or shown capacities.

D. Material and equipment for electrical work must bear an approval label or be listed by Underwriter's Laboratories.

E. Resolve any code violation discovered in the Contract Documents with the Architect/Engineer prior to award of the Contract. After award of the Contract, make any correction or additions necessary for compliance with applicable codes as part of the Work.

F. In any instance where the Drawings or Specifications call for materials of a better quality or larger size than required by the codes, those provisions of the Drawings or Specifications shall take precedence. The codes shall govern in case of direct conflict between the codes and the Drawings or Specifications.

1.3 RELATED DOCUMENTS

A. The Drawings and Specifications, the General Conditions, Supplementary General Conditions and other requirements of Division 1 apply to the work specified in Division 23. Comply with these Documents in every respect. Examine all of the documents that make up the Contract Documents and coordinate them with the HVAC work on the Drawings and in Division 23 of these Specifications.

1.4 DRAWINGS AND SPECIFICATIONS

A. Drawings for the project and details of the installations accompany these Specifications, to indicate the locations of equipment, piping, ductwork, outlets, controls, etc. Schedules incorporated into the Drawings and/or Specifications tabulate performance characteristics of equipment and other devices. The Drawings, Schedules, and Specifications are complementary to each other, and what is required by one is as binding as if required by all.
B. If the Contractor deems any departures from the Contract Documents necessary, submit details of such departures and the reasons therefore in writing to the Architect/Engineer for review. Make no departures from the Contract Documents without prior written approval of the Architect/Engineer.
C. The interrelation of the Specifications, Drawings, and Schedules is as follows: The Specifications determine the nature and quality of the materials, the Drawings establish the quantities, dimensions and details, and the Schedules give the performance characteristics. Should the Drawings disagree in themselves, or with the Specifications, include the better quality or greater quantity of work or materials unless otherwise directed by the Architect/Engineer in writing. In case the Specifications do not fully agree with the Schedules, the latter shall govern. Figures shown on Drawings govern scale measurements and large scale Details govern small scale Drawings. In case of disagreement between Specifications and Drawings, see Division 1 of these specifications for clarification.
D. Furnish and install all items specifically mentioned in the Specifications but not indicated on the Drawings and/or items shown on the Drawings but not specifically mentioned in the Specifications under the appropriate section of work as if they were both specified and indicated.
E. In the event of a discrepancy between a manufacturer's product number and the description of that product, either on the Drawings or in the Specifications, the description shall take precedence over the product number.

1.5 PERMITS
A. Obtain and pay for all permits and inspections.

1.6 BUILDING CONSTRUCTION
A. Review all the Contract Drawings and Specifications so as to thoroughly become familiar with the type and quality of construction to be provided on this project.
B. The Drawings are diagrammatic in character and cannot show every connection in detail or every pipe or duct in its exact location. Carefully investigate structural and finish conditions and coordinate with all other trades to avoid interference between the various phases of Work.
C. The approximate location of HVAC items is indicated on the Drawings. These Drawings are not intended to give complete and exact details regarding location of outlets, apparatus, etc. Determine exact locations by taking actual measurements at the job site; locations are subject to the review of the Architect/Engineer. The Architect/Engineer reserves the right to make any reasonable changes in the locations indicated as part of the Work.

1.7 BUILDING DEMOLITION
A. Unless indicated otherwise, remove all HVAC materials and equipment from areas designated for demolition.
B. Remove all equipment, piping, ductwork, valves, trim, air devices, hangers, supports, and other items of HVAC material not required to remain as part of the remodeled Work. Remove any abandoned HVAC materials, equipment, etc. encountered during the demolition phase. Ensure that systems serving adjacent areas of the building, not part of the demolition and renovation, are kept in service.
C. Patch all wall, floor, or other openings created as a result of the demolition.
D. Remove any materials or equipment to be relocated and/or reinstalled as part of the renovation. Protect all such items from damage during the removal, storage, and reinstallation process. Clean all such items before reinstallation.
E. Wherever new connections are made to existing HVAC systems, include all materials (e.g.,

piping, ductwork, fittings, wiring, etc.) and labor required to make the connections.

F. Keep all existing HVAC systems in full operation during construction, as required to maintain in a fully functional condition all areas of the existing facility that are still in use. Include any and all temporary piping, ductwork, power, etc. required to comply with this provision, as part of the Work.

1.8 CONTRACTOR QUALIFICATIONS

A. An acceptable contractor for the work under this Division must be a specialist in this field and have the personal experience, training, skill and the organization to furnish a practical working system. If required, furnish acceptable evidence of having contracted for and installed not less than three systems of comparable size and type to this one, that have served their owners satisfactorily for not less than three years.

B. Provide a foreman for this Work who has experience in installing not less than three such systems. Provide adequate and competent supervision to ensure first class construction and installation.

C. Execute the work and install all materials in accordance with the best practice of the trades in a thorough, substantial, workmanlike manner using competent workmen, so that the Work presents a neat appearance when completed. Perform all work using mechanics skilled in the trade.

D. Accept responsibility for all construction techniques required for all HVAC systems specified and indicated on the Drawings.

1.9 OBSERVATION OF THE WORK

A. Architect/Engineer's and/or Owner's authorized representatives have the right to observe the work at any time. Provide a representative to be present when the Work is being observed, and give assistance, as may be required, to the Architect/Engineer's representative. Promptly correct all deficiencies noted by Architect/Engineer. Replace, rework, and/or repair all unsatisfactory material and/or workmanship to the satisfaction of the Architect/Engineer.

B. Periodic observation of the work by Architect/Engineer is only for the express purpose of verifying compliance with the Contract Documents. Observation by the Architect/Engineer does not relieve Contractor, any Subcontractor, and/or Material Supplier of responsibility for deviation from requirements of Contract Documents nor for errors or omissions in the performance of work.

1.10 SUBMITTALS

A. Comply with the requirements of Section 01 33 00
   1. Submit information in .pdf format
      a. With a cover sheet for each Section of the specifications having the following information
         i. Project name
         ii. Architect's name
         iii. Consultant's name
         iv. Contractor's name
         v. Sub-contractor or supplier's name
         vi. Index of materials included in submittal
      b. With a separate file name for each Section of the specifications followed by a number identifying submission number; example: 23 05 00-01.pdf for original submittal and 23 05 00-02.pdf for first resubmittal

B. Product data
   a. Clearly indicate proposed products where more than one product is shown on data sheet
   b. Clearly indicate where products of different manufacturers are proposed for the same purpose

C. Shop drawings
   1. Prepare shop drawings

a. On sheets no larger than the project drawings
b. Of Mechanical rooms and portions of rooms where mechanical equipment is installed
i. In AutoCAD .dwg format
ii. At a minimum scale of 1/2" = 1'-0"
iii. Showing location of proposed mechanical equipment to scale
iv. Showing the location of other equipment in proximity to mechanical equipment, when space is shared with non-mechanical equipment

D. Contract Closeout Submittals
1. Operation and Maintenance Data
2. Warranties
3. Project Record Documents
4. Test Reports

E. Resubmittals
1. Submissions that require corrections and/or additional information shall be resubmitted in their entirety
2. Data that has been revised and or added to the original submission shall be clearly marked on the Index of Materials

F. Scope of review
1. Review is only for
a. General conformance with the design concept of the Project
b. General compliance with the Contract Documents
2. The Contractor is responsible for
a. Confirming and correlating equipment dimensions at the Site
b. Information that pertains to fabrication processes or construction techniques
c. Coordination of the Work of all Trades
3. Review and acceptance of submittals does not relieve the Contractor, any Subcontractor and/or Material Supplier of responsibility for
a. deviation from the requirements of the Contract Documents
b. Errors or omissions in submittals
c. Failure to coordinate with Work required by other trades

1.11 SUBSTITUTIONS AND PRODUCT OPTIONS
A. Comply with the requirements of Division 1, Material and Equipment.

1.12 DELIVERY, STORAGE, AND HANDLING
A. Order all materials and equipment adequately in advance of the scheduled installation date to avoid construction delays.
B. Do not deliver any equipment to the job site until the equipment is ready to be installed or until there is suitable space provided to properly protect equipment from weather, humidity, dust, and physical damage.
C. Protect all equipment in accordance with the manufacturer's recommendations.
D. Keep all materials and equipment a minimum of 4 in. off the ground.
E. If insulation materials become damp or wet and are not completely dry within 48 hours of getting damp or wet, whether raw materials or part of equipment, replace the insulation; do not just dry out the insulation.
F. Keep openings to the interior of equipment capped to protect the equipment from weather, humidity, dust, and debris until such time as the equipment is installed and the openings are covered by the connecting work.
G. For equipment not specifically designed for outdoor installation, either store equipment inside, protected from the weather, or completely cover the equipment with tarps, plastic sheeting, etc. until such time as the equipment is moved indoors. Maintain the covering for as long as the equipment is kept outdoors.

H. Keep ends of all ductwork and piping capped to protect the interior of such work from weather, humidity, dust, dirt, debris, etc. until such time as the piping is joined together or connected to equipment.
I. Replace all equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being erected and installed, and while being tested, until time of final acceptance.

1.13 PROJECT RECORD DOCUMENTS
A. Comply with the requirements of Division 1, Contract Closeout.

1.14 OPERATION AND MAINTENANCE DATA
A. Comply with the requirements of Division 1, Contract Closeout.
B. Submit a separate Operation & Maintenance (O&M) Manual for the work of each Subcontractor for Division 23 work.
C. Include the following in each O&M Manual as a minimum.
1. Summary of the scope of work included in the Manual.
2. Name of Subcontractor who performed the work.
3. Warranty information as defined in this Section.
4. Table of Contents, organized by Specification Section.
5. Listing of each major item of equipment furnished as part of the work, including equipment mark as identified on the Drawings, manufacturer, model number, serial number, capacity in tons, gpm, cfm, Btuh, hp, etc. as appropriate, and where the O&M information for that item is contained in the O&M Manual.
6. A copy of the final submittal information including all revisions and submittal reply comments from the Engineer.
7. Manufacturer's brochures for installation, operation, and maintenance wherever available.
8. Manufacturer's list of recommended spare parts.
9. For each item of equipment as appropriate, a listing of replaceable parts by part number, size, quantity, etc. as appropriate, e.g., belts, filters, sheaves, fuses, motors.
10. For each item of equipment as appropriate, a listing of the control setpoints as established during startup, testing, and balancing. Permanently record the field-determined setpoints on control drawings, at control devices, or in DDC system programming comments, as appropriate.
11. For each HVAC system as appropriate, a written narrative of how each system is intended to operate, a summary of normal startup and shutdown procedures, as well as emergency shutdown procedures.
12. Valve chart indicating valve locations. Refer to Section 23 05 53.

1.15 GUARANTEE
A. Guarantee Work for one year from the date of final acceptance of the project; during that period make good any faults or imperfections that may arise due to defects or omissions in materials or workmanship.
B. Provide written warranties to the Owner, as part of the O&M Manual, that identify, for each Subcontractor performing Division 23 work, the portion of the Work performed by that Subcontractor, the effective date of the warranty, names of at least two contact persons for obtaining warranty service, and a number by which the Owner can obtain 24 hours, seven days per week emergency service.

1.16 FINAL ACCEPTANCE
A. Final acceptance of project: As part of the final acceptance procedure by Owner, representatives of the Maintenance Department will make a physical inspection of all mechanical and electrical work involved. The following items shall have been completed, and signed off by the maintenance department and the Project Manager, before acceptance is complete:

1. Operational training of Owner personnel.
2. Receipt of shop drawings and submittal data manuals.
3. Receipt of contractor's test and balance reports.
4. Receipt of record drawings.

B. User orientation and delivery of User Drawings: The Contractor will walk the users through the building and familiarize them with the permanent hardbound user volumes, described previously, showing them the location of all the switches and equipment and their operation. Receipt of one set of User Drawings will be documented by Owner, for future reference in the operation of the building.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Furnish new and unused materials and equipment of locally represented manufacturers, meeting the requirements of the paragraph in each equipment Specification section regarding Acceptable Manufacturers.

B. Where the specifications list "Acceptable Manufacturers" for a particular product, the listed manufacturers are believed to be capable of building a product which meets the quality standards specified for the applicable product. Notwithstanding the listing of any manufacturer as an "Acceptable Manufacturer", each product submitted for use in the Work of this Project must meet the performance, technical, and service requirements of these specifications.

C. Where two or more units are required of the same type or class of equipment, furnish units of a single manufacturer.

2.2 STANDARD PRODUCTS

A. All materials and equipment must be standard catalog products of domestic manufacturers regularly engaged in the manufacture of products conforming to these Specifications. Materials and equipment must have been in satisfactory use at least two years prior to bid date. Where custom or special items are required, fully describe these in drawings and/or material lists which detail the item proposed for use on this Project.

2.3 RUST PREVENTION

A. Protect all metallic materials from corrosion. Give all exposed metallic parts of outdoor apparatus a rust inhibiting treatment and standard finish by the manufacturer. Protect all parts such as boxes, bodies, fittings, guards, and miscellaneous parts by galvanizing, except where other equivalent protective treatment is specifically approved in writing.

2.4 CAPACITIES AND SPACE LIMITATIONS

A. Verify that the proposed equipment will physically fit within the space indicated on the Contract Documents, that there is adequate width and height along the path of installation / removal for setting / replacing the equipment, and that the required code clearances and maintenance access are maintained. Note any space conflicts in the submittals. Provide scale drawings to the Architect/Engineer indicating proposed solutions to any space conflict, for the Architect/Engineer's review.

2.5 NAMEPLATES

A. Furnish each piece of equipment with a factory-installed nameplate securely attached to the equipment with the following information: name, address, catalog number, voltage, phase, full load amperes or horsepower, and/or other pertinent information. All data on nameplates must be legible at the time of final acceptance of the Project.

B. Furnish all air handling units, fan-coil units, condensing units and rooftop units with an engraved Setonply nameplate, black background, white letters, 1½ in. x 4 in. Include equipment mark (same as indicated on drawings) in white. Attach plates to equipment without using screws, per

manufacturer's recommendations. Furnish all fans with an engraved aluminum plate with black background, white letters, ¾ in. x 2½ in. Include the equipment mark on the first line, a list of rooms or a description of the area served by the fan on the second line, and indicate the service on the third line. Attach to fan per manufacturer's recommendation.

2.6 AIR FILTERS

A. For equipment that contains air filters, furnish the necessary quantity of filters, of the type specified with each piece of equipment, as required to change (or clean in the case of cleanable filters) the filters as often as necessary to satisfy the requirements of the paragraph under Part 3 Execution, dealing with air filters.

B. Provide a new set of filters for installation immediately prior to occupancy.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect all materials and equipment to be installed under this Division from physical and weather damage.

B. Adequately protect work, equipment, fixtures, and materials. At work completion, make all work clean and in good, unblemished condition. Keep ductwork, piping, equipment, etc. capped to prevent construction dust, paint spray, and any other contaminants from entering these items during construction.

C. Remove, round, or protect with ¾ inch Armaflex insulation all sharp corners of pipe, duct, and equipment where such corners pose a hazard to occupants or maintenance personnel.

3.2 MANUFACTURER'S INSTRUCTIONS

A. Accept full responsibility for furnishing the proper HVAC equipment and/or material and for installing it as intended by the manufacturer's written instructions. Request advice and assistance from a representative of the specific manufacturer, if needed for proper installation, operation, or start up. Follow the manufacturers' published instructions for preparing, assembling, installing, erecting, and cleaning all materials and equipment. If any conflict arises between the requirements of the Contract Documents and the manufacturer's directions, promptly notify the Architect/Engineer in writing and request the Architect/Engineer's instructions before proceeding with the work. Bear all costs arising in connection with correcting any deficiencies due to failure to perform the Work in accordance with these manufacturer's directions and/or Architect/Engineer's instructions.

3.3 COORDINATION

A. Contract Documents are diagrammatic in showing certain physical relationships to other trades. Interfacing and coordinating with other Work including utilities and electrical Work is the exclusive responsibility of the Contractor.

B. Coordinate with Division 26 and other divisions as required. This includes but is not limited to verification of power, voltage, phase and other characteristics as being compatible with that called for on the Electrical Drawings and Division 26 Specifications, as well as that called for in Division 23 Drawings and Specifications or other Divisions requiring electrical connections or interface with this Division. Perform this coordination before placing orders for equipment.

C. Arrange HVAC work in a neat, well-organized manner, with services running parallel to the primary lines of the building construction, and with the maximum overhead clearance possible.

D. Locate operating and control equipment properly to allow easy access. Arrange entire HVAC work with adequate access for operation and maintenance of all components requiring access. If any equipment or components are shown in such a position that proper access cannot be provided, resolve the problem by coordinating with the General Contractor before installation. In the event access still cannot be provided, advise Architect/Engineer and request review of the situation.

E. Advise other trades in advance of the relevant construction of openings required in their work for the subsequent move-in of large units of HVAC work.
F. Verify exact locations of existing equipment and determine exact requirements for connections before routing services to equipment.
G. Contract Drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work or show all offsets or required fittings. Determine exact locations from field measurements. Making adjustments to field conditions is considered a part of the Work.
H. Before installing HVAC equipment and other mechanical items, obtain Architect/Engineer review as to the exact method and exact placement and location of equipment in the various areas shown on the drawings. Do not determine location by scaling the Drawings. Relocate equipment and devices and pay all costs of modifying work of all trades required by failure to comply with this requirement as part of the Work.
I. The Drawings show diagrammatically the location of the various outlets and apparatus. Determine exact locations of these outlets and apparatus by reference to the Drawings and to all detail Drawings, equipment drawings, rough-in drawings, etc., by taking measurements at the building, and in cooperation with the other trades. The Owner reserves the right to make any reasonable change in location of any outlet or apparatus before installation, as part of the Work.

3.4 OBSTRUCTIONS
A. The Drawings indicate certain information pertaining to surface and subsurface obstructions taken from available drawings. However, such information is not guaranteed as to accuracy of location or completeness.
B. Before any cutting or trenching operations are begun, verify with Owner's representative, utility company, municipalities, and other applicable parties that all available information has been provided. Verify locations given.
C. Should obstruction be encountered, whether indicated or not, alter routing of new Work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever Work is necessary to satisfy the purpose of the new Work and leave existing services and structures in a satisfactory and serviceable condition.
D. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are indicated.

3.5 OPENINGS
A. Framed, cast or masonry openings for piping or equipment are specified under other Divisions. Provide all drawings and layout work for exact size and location of all such openings as part of the Work.
B. Place all equipment, piping, sleeves, etc. to avoid cutting new construction.

3.6 AIR FILTERS
A. Once air handling units with cooling or heating coils are running, replace disposable type air filters and/or clean permanent type at least every 30 days or once the pressure drop across the filters is equal to 0.5 in. static pressure, whichever comes first. Immediately before occupancy, and when substantial completion is certified, replace/clean filters a final time, so Owner begins the warranty period with clean filters.
B. Clean the evaporator coils and the return air ductwork, if required as a result of the filters not being properly maintained during construction as reasonably determined by the Engineer.

3.7 OPERATING TESTS
A. After all HVAC systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual Specification sections.

3.8 LUBRICATION, REFRIGERANT AND OIL

A. Furnish a complete charge of correct lubricant for each item of equipment requiring lubrication.

B. Furnish complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify it for proper operation as required.

3.9 HOISTING, SCAFFOLDING, AND TRANSPORTATION

A. Include all hoisting, scaffolding and ladders as required to set all materials and equipment in place.

B. Include all necessary transportation required for the delivery of all materials, equipment, tools, and labor to the job.

3.10 USE OF AIR SYSTEMS FOR TEMPORARY HEATING AND COOLING DURING CONSTRUCTION

A. Provide written documentation to Owner from Mechanical Subcontractor affirming Subcontractor's acceptance of using the air conditioning systems installed as part of the Work, as of the date of the documentation, to provide temporary heating and cooling for finishing operations that require tempered conditions for proper installation per manufacturer's recommendations.

B. Request written permission from Owner to Contractor allowing use of these systems for temporary conditioning of the Work.

C. Include temporary filters on each and every return air opening of any systems used for temporary conditioning of the Work.

D. Prior to turning over such systems to Owner, arrange with Owner to observe the interior of such systems.

E. Clean and repair any damage to such systems to the reasonable satisfaction of the Owner, as part of the Work.

F. Arrange with Owner to observe the interior of such systems after cleaning and repair is completed, and obtain Owner's written acceptance of such systems.

G. Warranty period on such systems commences on Owner acceptance, or as otherwise specified herein, whichever is later.

3.11 CLEANING AND TOUCH-UP PAINTING

A. At all times, keep the premises free from accumulations of waste material or rubbish resulting from Division 23 Work. Remove debris not only from the building, but also from the site and from any public areas adjacent to the site.

B. At the completion of the project, remove all tools, scaffolding, and surplus materials.

C. Touch-up or repaint to match original color, any finished surfaces scratched or discolored.

3.12 CUTTING, SEALING, AND PATCHING

A. Perform any required operations when it becomes necessary to cut through any wall, floor, or ceiling to install any Work under this Contract, or to repair any defects that may appear up to the expiration of the guarantee period. Do not cut or modify any structural members without the written permission of the Architect/Engineer.

B. Patch all openings cut by the Contractor, and repair any damage to the Work of other trades caused by cutting or by the failure of any part of the Work installed.

C. Furnish and install suitable covers over any openings cut through exterior walls or roofs, while they are left open, to protect the property or materials involved. Properly protect any openings cut through walls below grade to prevent entrance of water or other damaging elements. Waterproof all openings upon completion of the work.

D. Seal any openings through fire rated walls or floors to maintain the minimum fire rating of wall or floor penetrated, using fire barrier penetration sealing, "3M" Fire Barrier Caulk Type CP-25, type 303 Putty Fire-Stop Sealant, and "3M" Fire Barrier Penetration Sealing Systems, or approved equivalent.

3.13 EXISTING FACILITIES

A. Assume responsibility for loss or damage to the existing facilities used by workers, and for repairing or replacing such loss or damage. Send proper notices and receive written permission from the Owner to enter existing areas. Before beginning work in existing areas, make the necessary arrangements and perform other services required for the care, protection, and in-service maintenance of all electrical, communication, plumbing, heating, air conditioning, and ventilating services for existing facilities. Erect temporary barricades with necessary safety devices as required to protect personnel from injury, removing all such temporary protection upon completion of the Work.

B. Provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted because of the Work being accomplished under this project.

C. Where existing construction is removed to provide working and extension access to existing utilities, remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork, and equipment, etc., to provide this access; reinstall same upon completion of Work in the areas affected.

D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed and equipment in those areas is required to remain in operation, remove and reinstall all equipment required for the operation of the remaining HVAC systems.

3.14 MOCK UPS

A. The following items and assemblies shall be mocked up for Engineer/Architect/Owner review and approval:
   1. Fan Coil Units
   2. Condensing Units and piping
   3. Heat Pump Units and piping
   4. Rooftop units
   5. Heat Recovery Units
   6. Sample installation of duct insulation.
   7. Sample installation of pipe insulation for each system.

B. The mock ups should be complete in almost every respect as far as Division 15 is concerned. The work associated with other divisions that are adjacent to or a part of the mock up and necessary to evaluate the mock up should be complete enough that the mock up can be evaluated completely. All mock ups shall be approved before any work is started on the remainder of these items. Any fabrication of parts, assemblies etc. prior to approval of the mock up is at the contractors own risk. The contractor is responsible for the project schedule and shall schedule the completion and review of mock ups to allow for timely installation of systems. The contractor should allow one week from notice of a completed mock up to review and approval or reject mock up.

3.15 OUTAGES

A. Outages of services as required by the project will be permitted only at times approved in writing by the Owner. Notify the Owner in writing two weeks before the requested outage to schedule required outages. The time allowed for outages may not be during normal working hours unless otherwise approved by the Owner. Include all costs of outages, including overtime charges, in the Work.

3.16 VIBRATION ISOLATION

A. Furnish and install vibration isolation means for all equipment and materials furnished as part of the Work to prevent the transmission of perceptible vibration, and structure-borne or airborne noise to occupied areas.

B. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration

is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions as part of the Work.

3.17 SUBSTITUTIONS REQUIRING CHANGES

A. Manufacturers and power requirements indicated on the Drawings are the basis of design. If changes are required for the equipment submitted, such as changes in connection sizes and/or locations, supports, housekeeping pads, orientation, routing of piping and/or ductwork, conduit size, conductors, breakers, disconnects, etc., make such changes as part of this Work.

3.18 OPERATING INSTRUCTIONS TO OWNER

A. Prior to startup and substantial completion of work, and at a time designated by the Architect, arrange to provide services of a competent representative of the Contractor and/or Manufacturers as appropriate, to instruct Owner's representative in the operation and maintenance of each system.

B. Refer to the individual sections of this Division for requirements specific to each section.

END OF SECTION 23 05 00

SECTION 23 05 29 - HVAC EQUIPMENT SUPPORTS

PART 1 GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of concrete equipment pads for all direct and isolated floor mounted HVAC equipment, and structural equipment supports for floor mounted and suspended mechanical equipment, where required.

1.2 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00 Common Work Results for HVAC.

1.3 DELIVERY, STORAGE AND HANDLING

A. Deliver equipment supports properly packaged in crates or on skids.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging equipment supports.

PART 2 PRODUCTS

2.1 Not applicable.

PART 3 EXECUTION

3.1 CONCRETE PADS

A. Pour 5½ in. pads on roughened floor slabs unless otherwise indicated. Reinforce concrete using #3 mild steel rebar at 12 in. centers each way, located 2 in. from top of surface of the pad, unless otherwise indicated. Extend outer edges of pads a minimum of 2 in. beyond equipment. Secure equipment with anchor bolts in accordance with equipment installation instructions.

3.2 STRUCTURAL SUPPORTS

A. Construct floor stands of structural members or steel pipe. For fan coil units, air handling units, heat recovery units and outside air units use stub columns, beams channels or other suitable structural members to elevate the unit to a sufficient height for the condensate drain and trap. Bolt floor stands to the floor.
B. Install ceiling-mounted equipment from suitable brackets, platform framing or similar supports fabricated of structural members.

END OF SECTION 23 05 29

SECTION 23 05 33 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE
A. This section specifies the furnishing and installation of hangers and supports for all HVAC piping systems.

1.2 APPLICABLE PROVISIONS
A. Refer to Section 23 05 00, Common Work Results for HVAC.

1.3 REFERENCE STANDARDS
A. ASTM B 633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
B. ASTM A 123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
C. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
D. ASTM A 1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability.
E. MSS SP-58 - Manufacturers Standardization Society: Pipe Hangers and Supports - Materials, Design, and Manufacture.
F. MSS SP-69 - Manufacturers Standardization Society: Pipe Hangers and Supports - Selection and Application.

1.4 SUBMITTALS
A. Submit manufacturer's technical product data for all hangers and supports, including shields and attachment methods. Product data to include, but not be limited to materials, finishes, approvals, load ratings, and dimensional information. Include sufficient data to substantiate that materials conform to the requirements of this section.

1.5 DELIVERY, STORAGE AND HANDLING
A. Deliver hangers and supports properly bundled and fittings properly packaged in factory-fabricated containers.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging hangers and supports.

1.6 QUALITY ASSURANCE
A. Steel pipe hangers and supports shall have the manufacturers name, part number, and applicable size stamped in the part itself for identification.
B. Hangers and supports shall be designed and manufactured in conformance with MSS SP-58.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Anvil International
B. Cooper B-Line, Inc.
C. ERICO / CADDY
D. Thomas & Betts

2.2 PIPE HANGERS AND SUPPORT
A. Hangers
1. Uninsulated pipes 2 inch and smaller:
a. Adjustable steel swivel ring (band type) hanger, B-Line B3170.

b. Adjustable steel swivel J-hanger, B-Line B3690.
c. Malleable iron ring hanger, B-Line B3198R or hinged ring hanger, B3198H.
d. Government type hanger, B-Line B3225 or B3226.
e. Adjustable steel clevis hanger, B-Line B3104 or B3100.

2. Uninsulated pipes 2-1/2 inch and larger:
   a. Adjustable steel clevis hanger, B-Line B3100.
   b. Pipe roll with sockets, B-Line B3114.
   c. Adjustable steel yoke pipe roll, B-Line B3110.
3. Insulated pipe - Hot piping:
   a. 4 inch and smaller pipes: use adjustable steel clevis with galvanized sheet metal shield, B-Line B3100 with B3151 or B3153 series.
   b. 2-1/2 inch and larger pipes:
      i. Adjustable steel yoke pipe roll with pipe covering protection saddle, B-Line B3110 with B3160 - B3165 series.
      ii. Pipe roll with sockets with pipe covering protection saddle, B-Line B3114 with B3160 - B3165 series.
4. At Contractor's option, non-bolted clevis hangers conforming to MSS SP-58 and SP-69 Type 1, CADDY Slot Lock or equivalent.

B. Pipe clamps.
1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, B-Line B3140 or B3142 with B3200. For insulated lines use double bolted pipe clamps, B-Line B3144 or B3146 with B3200.

C. Multiple or trapeze hangers.
1. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A 1011 SS Gr. 33 structural steel channel, 1 5/8" x 1 5/8" minimum, B-Line B22 strut or stronger as required.
2. Mount pipes to trapeze with two piece pipe straps sized for outside diameter of pipe, B-Line B2000 series.
3. For pipes subjected to axial movement:
   a. Strut mounted roller support, B-Line B3126. Use pipe protection shield or saddles on insulated lines.
   b. Strut mounted pipe guide, B-Line B2417.
4. At Contractor's option, use spin-in style strut clamps for piping 2" and under, suitable for use in air plenums, UL listed for fire and smoke, as well as having UV inhibitors for exterior application, CADDY Swift Clip or equivalent.

D. Wall supports.
1. Pipes 4 inch and smaller:
   a. Carbon steel hook, B-Line B3191.
   b. Carbon steel J-hanger, B-Line B3690.
2. Pipes larger than 4 inch:
   a. Welded strut bracket and pipe straps, B-Line B3064 and B2000 series.
   b. Welded steel brackets, B-Line B3066 or B3067, with roller chair or adjustable steel yoke pipe roll. B-Line B3120 or B3110. Use pipe protection shield or saddles on insulated lines.

E. Floor supports.
1. Hot piping under 6 inch and all cold piping:
   a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation, B-Line B3093 and B3088T or B3090 and B3088. Screw or weld pipe saddle to appropriate base stand.
2. Hot piping 6 inch and larger:
   a. (Adjustable) Roller stand with base plate, B-Line B3117SL (or B3118SL).
   b. Adjustable roller support and steel support sized for elevation, B-Line B3124

F. Vertical supports.
1. Steel riser clamp sized to fit outside diameter of pipe, B-Line B3373 or B3374.

2. At Contractor's option, slotted designed riser clamps conforming to MSS SP-58 and SP-69 Type 1 or Type 8. CADDY EZ Riser or EZ Riser CQ, or equivalent.

G. Copper tubing supports.
1. Use hangers sized to fit copper tubing outside diameters.
a. Adjustable steel swivel ring (band type) hanger, B-Line B3170CT.
b. Malleable iron ring hanger, B-Line B3198CT or hinged ring hanger B3198HCT.
c. Government type hanger, B-Line B3225CT or B3226CT.
d. Adjustable steel clevis hanger, B-Line B3104CT.

H. Supplementary structural supports.
1. Design and fabricate supports using structural quality steel bolted framing materials. Use channels that are roll formed, 12 gauge ASTM A 1011 SS Grade 33 steel, 1-5/8" x 1-5/8" or greater as required by loading conditions. Submit designs for pipe tunnels, pipe galleries, etc., to engineer for approval. Use clamps and fittings designed for use with the strut system.

2.3 UPPER ATTACHMENTS

A. Beam clamps.
1. Use Beam clamps where piping is to be suspended from building steel. Select clamp type on the basis of load to be supported, and load configuration.
2. Use C-Clamps which have locknuts and cup point set screws, B-Line B351L, or B3036L. Top flange C-clamps shall be used when attaching a hanger rod to the top flange of structural shapes, B-Line B3034 or B3033. Refer to manufacturers' recommendation for setscrew torque. Use retaining straps to maintain the clamp's position on the beam where required.
3. Use center loaded beam clamps where specified. Steel clamps - - B-Line B3050 or B3055. Malleable iron or forged steel beam clamps with cross bolt - - B-Line B3054 or B3291 - B3297 series as required to fit beams.
4. At Contractor's option, non-threading beam clamp, anchor screws and hardware with Push To Install Technology, CADDY Rod Lock System or equivalent.

B. Concrete inserts.
1. Use cast in place spot concrete inserts where applicable, either steel or malleable iron body, B-Line B2500 or B3014. Use spot inserts which allow for lateral adjustment and have means for attachment to forms. Select insert nuts to suit threaded hanger rod sizes, B-Line N2500 or B3014N series.
2. Use continuous concrete inserts where applicable. Use channels that are 12gauge, ASTM A 1011 SS Grade 33 structural quality carbon steel, complete with styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert must have a load rating of 2,000 lbs/ft. in concrete, B-Line B22I, B32I, or B52I (B52I is limited to 1,500 lbs/ft.). Select channel nuts suitable for strut and rod sizes.

2.4 VIBRATION ISOLATION AND SUPPORTS

A. For hydraulic, pneumatic, and other vibrating system applications, use a clamp that has a vibration dampening insert and a nylon inserted locknut. For copper and steel tubing use B-Line BVT series VibraClamps, for pipe sizes use BVP series.
B. For larger tubing or piping subjected to vibration, use neoprene or spring hangers as required.
C. For base mounted equipment use vibration pads, molded neoprene mounts, or spring mounts as required.
D. Vibration isolation products as manufactured by B-Line, VibraTrol systems.

2.5 ACCESSORIES

A. Use hanger rods that are threaded both ends, B-Line B3205, or continuous threaded rods of circular cross section. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

B. Use shields that are 180˚ galvanized sheet metal, 12 inch minimum length, 18 gauge minimum thickness, designed to match outside diameter of the insulated pipe, B-Line B3151.
C. Use pipe protection saddles that are formed from carbon steel, 1/8 inch minimum thickness, sized for insulation thickness.

2.6 FINISHES
A. Indoor Finishes.
1. Use hangers and clamps for support of bare copper piping that are coated with copper colored epoxy paint, B-Line Dura-Copper. Include PVC coating of the epoxy painted hanger where necessary.
2. Use hangers for other than bare copper pipe that are zinc plated in accordance with ASTM B 633 - SC3 or have an electro-deposited green epoxy finish, B-Line Dura-Green.
3. Use strut channels that are pre-galvanized in accordance with ASTM A 653 G90 or have an electro-deposited green epoxy finish, B-Line Dura-Green.
B. Outdoor, Crawlspace and Corrosive Area Finishes
1. Use hangers and strut located outdoors that are hot dip galvanized after fabrication in accordance with ASTM A 123. All hanger hardware must be hot-dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
2. Use hangers and strut located in corrosive areas that are Type 304 (316) stainless steel with stainless steel hardware.

PART 3 - EXECUTION

3.1 PIPE HANGERS AND SUPPORTS
A. Support piping adequately to maintain line and grade, with due provision for expansion and contraction. Metal channel framing members attached directly to the structure may be used to support more than one system, so long as each system so supported may be removed or modified without affecting the support of the remaining systems.
B. Place a hanger within 12 in. of each elbow, tee, valve, strainer, etc. It is not necessary to support both the main line and the branch line at tees within 12 in. of the tee.
C. Support vertical risers with steel strap pipe clamps of approved design and size, properly supported at every floor. Support piping assemblies in chases adequately enough to be rigid and self-supporting before the chase is closed.
D. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.
E. Where several pipes can be installed in parallel and at the same elevation, use trapeze hangers as specified above. Space trapeze hangers according to the smallest pipe size, or install intermediate supports according to schedule above.
F. Install standard metal framing members and appurtenances for pipe support where indicated and/or required. Hot-dip galvanize all such members and appurtenances.
G. Include a means of preventing dissimilar metal contact such as plastic coated hangers, copper colored B-Line Dura-Copper epoxy paint, or non-adhesive isolation tape (B-Line Iso-Pipe). Galvanized felt isolators sized for copper tubing may also be used, B-Line B3195CT.
H. Install hangers to provide a minimum of 1/2 inch space between finished covering and adjacent work.
I. Size hangers for insulated pipes to accommodate insulation thickness so hanger is outside the insulation jacket.
J. Design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section.
K. Perforated bar hangers, straps, wires or chains are not permitted. Plastic support brackets may be used in accordance with the manufacturer's recommendations.
L. Support piping independently of other piping, ductwork, conduits, etc. Do not support piping from other pipes, ductwork or other equipment which is not building structure.

M. Support horizontal steel piping in accordance with maximum spacing requirements as set forth in MSS SP-69 Table 3, excerpts of which follow below:

NOMINAL PIPE SIZE	MAXIMUM SPACING
3/8" - 1-1/4"	7'-0"
1-1/2”	9’-0”
2”	10’-0”
2-1/2”	11’-0”
3”	12’-0”
3-1/2”	13’-0”
4”	14’-0”
5”	16’-0”
6”	17’-0”
8”	19’-0”
10”	22’-0”
12”	23’-0”
14”	25’-0”
16”	27’-0”

N. Support horizontal copper piping in accordance with maximum spacing requirements as set forth in MSS SP-69 Table 4, excerpts of which follow below:

NORMAL PIPE SIZE	MAXIMUM SPACING
1/4” - 3/4”	5'-0"
1”	6’-0”
1-1/4”	7’-0”
1-1/2”	8’-0”
2”	8’-0”
2-1/2”	9’-0”
3”	10’-0”
4”	12’-0”
6”	14’-0”

NORMAL PIPE SIZE	MAXIMUM SPACING
8”	16’-0”

O. Select support rod diameter to accommodate maximum pipe weight when filled with water for given size(s) and spacing, including a safety factor of 5. Use threaded rods conforming to physical and chemical requirements of ASTM A307, SAE J429, or ASTM 563, which have unified inch screw threads.

3.2 CONCRETE INSERTS

A. Coordinate placement of inserts in formwork before concrete is poured.
B. Include inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
C. Where concrete slabs form finished ceilings, set inserts flush with underside of slab surface.
D. Include hooked rods to concrete reinforcement section for inserts carrying pipe over 4 inch.

END OF SECTION 23 05 33

SECTION 23 05 53 - IDENTIFICATION FOR HVAC DUCTWORK, PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes
   1. Engraved plastic laminate plates
   2. Engraved aluminum plates
   3. Engraved stainless steel plates
   4. Snap-around markers
   5. Strap-around markers
   6. Self-sticking vinyl duct markers
   7. Detectable underground marking tape
   8. Brass valve tags and chains
   9. Anodized aluminum chart frames

B. Related Sections
   1. Section 23 05 00 Common Work Results for HVAC
   2. Section 23 05 33 Hangers and Supports for Piping and Equipment

1.2 REFERENCES

A. ASME A13.1, “Scheme for Identification of Piping Systems”

1.3 SUBMITTALS

A. Product Data

B. Shop Drawings
   1. None required

C. Samples
   1. None required

D. Quality Control Submittals
   1. None required

E. Contract Closeout Submittals
   1. Project Record Documents
      a. On the record drawings, indicate the locations and valve numbers of all valves included in the valve chart.
   2. Operations and Maintenance
      a. In the manual, include a copy of the valve chart.

1.4 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping
   1. Deliver identification materials properly packaged in factory fabricated containers.

B. Acceptance at Site
   1. Inspect identification materials for damage upon receipt.

C. Storage and Protection
   1. Store in a clean, dry space in original packaging.
   2. Protect from weather, damaging fumes, construction debris, and traffic.
   3. Handle carefully to avoid damage.

1.5 WARRANTY

A. Include per Section 01 78 36

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Brady (W. H.) Co.; Signmark Division
B. Craftmark
C. Seton Identification Products
D. Engraved plastic laminate plates
    1. Brady
    2. Craftmark
    3. Seton Setonflex
E. Engraved aluminum plates
    1. Brady
    2. Craftmark
    3. Seton Style M45xx
F. Engraved stainless steel plates
    1. Brady
    2. Craftmark
    3. Seton Style 80xxx or 97xxx
G. Snap-around markers
    1. Brady
    2. Craftmark
    3. Seton Setmark
H. Strap-around markers
    1. Brady
    2. Craftmark
    3. Seton Setmark
I. Self-sticking vinyl duct markers
    1. Brady
    2. Craftmark
    3. Seton
J. Detectable underground marking tape
    1. Brady
    2. Craftmark
    3. Seton
K. Brass valve tags and chains
    1. Brady
    2. Craftmark
    3. Seton Style 37xxx
L. Anodized aluminum chart frames
    1. Brady
    2. Craftmark
    3. Seton Style 68624

2.2 MANUFACTURED UNITS
A. General
    1. Conform to ASME A13.1
B. Engraved plastic laminate plates
    1. 1/16" thick, beveled edges
    2. Two layers, contrasting color engraved wording
    3. Two holes for screw mounting, nickel or stainless steel screws
C. Engraved aluminum plates
    1. 0.020" thick
    2. Colored background
    3. Two holes for screw mounting, nickel or stainless steel screws
D. Engraved stainless steel plates
    1. 0.020" thick

2. Two holes for screw mounting, nickel or stainless steel screws

E. Snap-around markers
1. Vinyl pre-coiled to snap into place without adhesives
2. Printed with UV fade-resistant ink for outdoor use
3. Arrows included on every marker
4. Comply with ASME 13.1

F. Strap-around markers
1. Vinyl pre-coiled to snap into place without adhesives
2. Nylon tie-wraps to strap markers into place
3. Printed with UV fade-resistant ink for outdoor use
4. Arrows included on every marker
5. Comply with ASME 13.1

G. Self-sticking vinyl duct markers
1. Self sticking vinyl
2. Color coded
3. Detachable arrows
4. Minimum size 2" wide x 13" long
5. Minimum 1" high lettering
6. Black text on yellow background for “EXHAUST” or “RELIEF”
7. White text on blue background for “SUPPLY AIR”, “RETURN AIR” or “OUTSIDE AIR”

H. Detectable underground marking tape
1. 5-mil polyethylene tape with aluminum backing
2. 3" wide
3. Color coded, with service warning wording

I. Brass valve tags and chains
1. 19-gauge brass with 3/16" top mounting hole
2. 1-1/2" diameter
3. Stamped, black-filled wording

J. Anodized aluminum chart frames
1. Extruded, anodized aluminum frame
2. Clear plastic cover
3. Sized for framing 8-1/2" x 11" paper

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Identification applied to surfaces which require insulation, painting, or other covering or finish: Apply identification after covering or finish work is completed.

B. Identification applied to items concealed behind acoustical ceilings or similar removable concealment: Apply identification prior to installing removable concealment.

3.2 HVAC EQUIPMENT IDENTIFICATION

A. Equipment nameplates
1. Metal, with data engraved or stamped
2. Basic information.
   a. Manufacturer
   b. Product name
   c. Model number
   d. Serial number
3. Operating information
   a. Capacities
   b. Power characteristics
   c. Included accessories

4. Listings and standards compliances
5. Locate so nameplate is accessible and visible without opening equipment
6. Fasten in a permanent manner

B. Equipment markers
1. Equipment located indoors: Engraved plastic laminate plates
2. Equipment located outdoors: Engraved aluminum or stainless steel plates
3. Minimum size: 3" x 1"
4. Color: Black with white wording
5. Lettering: ½" for equipment mark, 1/4" for other wording
6. Equipment mark: Include, same as on drawings, for all scheduled HVAC equipment
7. Fan-coil units, VAV boxes, fans, or other HVAC equipment located above ceilings
   a. Include an additional marker
   b. Adhere marker using double stick adhesive foam tape to the underside of the ceiling grid
   c. Locate marker immediately adjacent to the ceiling tile required to be removed to obtain best access to the equipment

3.3 HVAC DUCTWORK IDENTIFICATION

A. Duct markers
1. Ductwork exposed in mechanical rooms: self-sticking vinyl duct markers
2. Apply markers where they can be readily seen from a person standing on the floor
3. Apply a marker in each main and in each branch duct exceeding 5' in length
4. Apply a marker within 2' of each duct penetration through the wall into the mechanical room
5. Apply to supply air, return air, outside air, exhaust, and relief ductwork
6. Apply over external duct insulation where applicable

3.4 HVAC PIPING SYSTEM IDENTIFICATION

A. Piping
1. Include flow indication arrows with proper direction indicated.
2. Size pipe markers to snugly fit pipe outside diameter (OD), including insulation where appropriate.
3. Pipe / insulation OD less than 6": Snap-around markers
4. Pipe / insulation OD 6" or greater: Strap-around markers
5. Service: Identify per ASME A13.1
6. HVAC systems to include
   a. Chilled water supply/return
   b. Heating water supply/return
   c. Condensing water supply/return
   d. Cooling tower filter loop
7. HVAC systems to exclude
   a. Refrigerant suction, liquid, hot gas
   b. Condensate drains from cooling coils
   c. Equipment drains
   d. Makeup water piping
8. Locations
   a. Applicable where exposed or in accessible plenums or chases
   b. Oriented so view of wording on marker is unobstructed to the reader
   c. At every point of pipe entry or exit through a floor, wall, or roof
   d. At intervals not exceeding 50 ft.
   e. At all branches where flow pattern is not obvious
   f. Near each valve and control device
   g. At access doors where concealed piping can be viewed
9. Underground piping

a. Include detectable underground marking tape

B. Valve tags
1. Tag each valve with a numbered valve tag, affixed to the valve stem or handle with a chain.
2. Where concealed above a ceiling or within a chase, include engraved plastic laminate plate, green w/ white lettering, minimum 2" x 3/4", 1/4" high lettering, with service (e.g. “CHS” = chilled water supply) and valve number on tag. Affix plate to bottom of ceiling grid, adjacent to valve location above the ceiling or inside of access door where applicable.

C. Valve schedules
1. On the record drawings, mark the symbols and furnish a valve schedule properly identifying the valve number and service with the exact location, the material being piped, and the room number of area the valve services. Furnish the schedule on 8-1/2" x 11" bond paper.
2. Mount the valve schedule in one or more anodized aluminum chart frames as needed for the number of pages of the valve schedule.

3.5 ADJUSTING

A. Relocate any identification device which becomes blocked from view by the Work.

3.6 CLEANING

A. Clean the face of any identification device which becomes dirty prior to Substantial Completion of the Work.

B. Clean covers of framed valve charts.

END OF SECTION 23 05 53

SECTION 23 05 91 - SYSTEM PREPARATION FOR HVAC T&B AND COMMISSIONING

PART 1 GENERAL

1.1 Summary

A. Perform all work required to prepare the building HVAC systems for testing, adjusting and balancing indicated by the Contract Documents as follows:

1. Responsibilities of project Contractor.
2. Preparation for balancing of air systems.

B. The scope of the TAB work as defined in Section 23 05 93 is indicated in order that the Contractor will be advised of the coordination, adjustment, and system modification which will be required under the project work in order to complete the Owner's requirements for final TAB. The TAB firm will not have a contractual relationship with any Contractor referred to herein, but will be responsible to the Architect and the Owner for the satisfactory execution of the TAB work. The Contractor in his original bid must allow for the costs required to cover all work which may be required in the TAB phases as defined herein and as may be necessary for the completion of the TAB work as defined by the TAB firm.

1.2 RELATED SECTIONS

A. Division 23 Mechanical

1.3 SCOPE OF WORK

A. Testing, adjusting, and balancing (TAB) of the air conditioning systems and related ancillary equipment will be performed by an impartial technically qualified TAB firm selected and employed directly by the Owner, separate and apart from the Construction Contract. However, the preparation for and corrections necessary for the Testing, Adjusting and Balancing of these systems, as described herein, are the responsibility of the Contractor.

B. As a part of this project Construction Contract, the Contractor must make any changes or replacements to the sheaves, belts, dampers, valves, etc. required for correct balance as advised by the TAB firm, at no additional cost to the Owner.

C. The Contractor must provide and coordinate the services of qualified, responsible Subcontractors, suppliers and personnel as required to correct, repair, and/or replace any and all deficient items or conditions found during the course of this project, including the testing, adjusting and balancing period.

D. In order that all systems may be properly tested, balanced, and adjusted as required herein by these Specifications, the Contractor must operate said systems at his expense for the length of time necessary to properly verify their completion and readiness for TAB. This length of time must be subject to the approval of the Construction Inspector.

E. Project Contract completion schedules must allow for sufficient time to permit the completion of TAB services prior to Owner occupancy. The contractor must allow adequate time for the testing and balancing activities of the owner provided services, during the construction period, and prior to Substantial Completion as defined in the General Conditions of this Construction Document.

F. The Drawings and Specifications indicate dampers and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions, and it will be the responsibility of the Contractor to install these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, the Contractor must provide access as requested by the TAB firm. Also, any malfunction encountered by TAB personnel and reported to the Contractor or the Construction Inspector must be corrected by the Contractor immediately so that the balancing work can proceed with the minimum of delays.

1.4 RESPONSIBILITIES OF THE PROJECT CONTRACTOR:

A. The Contractor must:

1. Provide the latest version (including addenda, RFIs, C.O., amendments etc) of the

mechanical Drawings, provide a complete set of the mechanical equipment submittals including controls and controls schematics and sequence of operation for each type of system and a copy of the project specifications.

2. Have the building and air conditioning systems in complete operational readiness for TAB work to begin.
3. The contractor must allow sufficient time for the TAB firm to perform his contracted work within the construction schedule. The contractor must complete his work by systems or floors, whichever is the most efficient for scheduling. After awarding of the contract and the contractor has developed a construction schedule, a TAB coordination meeting must be held at the owner's office with the TAB agency, the general contractor and his primary subcontractors (i.e. mechanical, electrical, building automation etc.) to develop a testing schedule for the project. The contractor must submit copies of the proposed schedule two (2) weeks prior to this meeting to the Owner and TAB Agency.
4. Promptly correct deficiencies of materials and workmanship identified as delaying completion of TAB work.
5. Be responsible for any added costs to the Owner resulting from his failure to have the building and air conditioning systems ready for TAB when scheduled, or from his failure to correct deficiencies promptly.

B. Complete operational readiness of the building requires that construction status of the building must permit the closing of doors, windows, ceilings installed, etc., to obtain simulated or projected operating conditions.

C. Complete operational readiness of the air conditioning systems also requires that the following be accomplished:

1. Air Distribution Systems:
   a. Verify installation for conformity to design. All supply, return and exhaust ducts terminated and pressure tested for leakage as required by the Specification.
   b. All volume, smoke and fire/smoke dampers are properly located and functional. Dampers serving requirements of minimum and maximum outside, return and relief air must provide tight closure and full opening, smooth and free operation.
   c. All supply, return, exhaust and transfer grilles, registers, diffusers and terminal devices installed.
   d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., must be blanked and/or sealed to eliminate excessive bypass or leakage of air.
   e. All fans (supply, return and exhaust) operating and verified for freedom from vibration, proper fan rotation and belt tension; heater elements in motor starters to be of proper size and rating; record motor amperage and voltage on each phase at start-up and running, and verify they do not exceed nameplate ratings.
2. Automatic Controls:
   a. The Contractor must schedule a meeting with the Engineer, Control Contractor, TAB firm and Owner's representative for a pre-submittal review to establish that his interpretation of the sequences of operation are correct.
   b. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, dampers sequences, air resets, fire and freeze stats, high and low temperature thermostats, safeties, etc.
   c. Verify that all controlling instruments are calibrated and set for design operating conditions with the exception of room thermostats or sensors, which must be calibrated at the completion of TAB services with cooperation between the TAB firm and Control Contractor.
   d. The Automatic Temperature Control Contractor must thoroughly check all controls, sensors, operators, sequences, etc. before notifying the TAB agency that the Automatic Temperature Controls are operational. The Automatic Temperature

Contractor must provide technical support (technicians and necessary computers) to the TAB agency for a complete check of these systems.

4. Tabulated Data: The motor amperages, voltages must be recorded showing "actual" and "nameplate" voltage and amperage and submitted and actual RPM. This applies to each piece of electrically driven air conditioning equipment in the system including supply and exhaust fans, fans of fractional horsepower, etc.

D. Notification of System Readiness:

1. After completion of the work in Paragraph 1.4 A through C above, the Contractor must notify the Owner in writing, certifying that the work has been accomplished and that the building and the air conditioning systems are in operational readiness for testing, adjusting, and balancing. He must include a copy of the tabulated data above.
2. The Owner will, in turn, must notify the TAB firm of the readiness for balancing and forward copies of the Contractor's certification and the tabulated voltages and currents.
3. Should the TAB firm be notified as described above, and the TAB work commenced and the systems are found NOT to be in readiness or a dispute occurs as to the readiness of the systems, the Contractor must request an inspection be made by duly appointed representative of the Owner, Architect, TAB firm and the Contractor. This inspection will establish to the satisfaction of the represented parties whether or not the systems meet the basic requirements for TAB services. Should the inspection reveal the TAB services notification to have been premature, all cost of the inspection and wasted work accomplished by the TAB firm must be reimbursed to the appropriated parties by the Project Contractor.

1.5 RESPONSIBILITIES OF THE TAB FIRM

A. TAB/Commissioning Agency must provide Architect & Contractor with tentative schedules for each area, floor and/or system to be included in this section.

B. Refer to Section 23 05 93.

END OF SECTION 23 05 91

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies final air balance operations during and after construction of the air and water systems.

1.2 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00, Common Work Results for HVAC.
B. Refer to Section 23 09 23 Direct-Digital BACnet Control System for HVAC.

1.3 SUBMITTALS

A. Submit a written report of each interim review of the project, documenting in particular any circumstances observed in the construction that would impede proper air and/or water balancing operations. Submit report within one week of the date of the observations.
B. Submit final written test report as further described herein.

1.4 GENERAL

A. Testing Agency. Secure the services of an independent air balance and testing agency to perform complete balance, adjustment and testing of air moving equipment and air and water distribution systems, including terminal units. Agency must have on its staff at least one certified member of NEBB who has been a member in good standing for at least 3 years, and the balancing agency must be NEBB certified for a period of at least three years; or agency must be a member of AABC for at least 1 year.
B. Testing Agency. The testing agency will be retained by the Prime Contractor to perform complete balance, adjustment and testing of air moving equipment and air and water distribution systems, including terminal units. Cooperate and coordinate with this separate Contractor as further outlined herein.
C. Testing Agency.
   1. The Prime Contractor shall include the T&B bid in the final bid amount.
D. HVAC systems will be tested and balanced (T&B) by an independent firm not associated with the design engineer or installation contractor of the systems to be tested and balanced. This Contractor will be a qualified and certified member of the Associated Air Balance Council (AABC), or the National Environmental Balancing Bureau (NEBB).
E. Equipment. Use accurately calibrated and maintained equipment, in good working condition. Use equipment as listed by the Associated Air Balance Council or NEBB for this type work.
F. Perform tests to demonstrate the specified capacities and operation of all equipment and materials comprising the systems. Make such tests other than as described herein, which are deemed necessary by the Engineer to indicate the fulfillment of the contract. Make available to the Engineer such instruments and technicians as are required for spot checks of the system.
G. The drawings and specifications indicate valves, dampers, sheaves and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions. It is the responsibility of the Mechanical Subcontractor to install these devices in a manner that will leave them accessible and readily adjustable. Consult the Balancing Contractor if there is a questionable arrangement of a control or adjustment device.
H. Inspect, balance, adjust, test and log the data of the performance of fans, all dampers in the duct systems, all air distribution devices or heat exchangers and the flows of water through all coils.
I. The General Contractor, the Mechanical Subcontractor and the suppliers of the equipment installed must cooperate with the Balancing Contractor to provide all necessary data on the design and proper application of the system components, and provide all labor and material required to eliminate any deficiencies.
J. The Balancing (HVAC) Contractor will provide the following services:
   1. During construction, inspect the installation of heating and cooling pipe systems, sheet

metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems. The inspection of the work will cover that part relating to proper arrangement and adequate provisions for the testing and balancing. The inspections will be performed periodically as the work progresses. The minimum inspections required are as follows:

a. When 60% of the piping is installed in each building.
b. When 60% of ductwork is installed in each building.
c. When 90% of ductwork is installed in each building.

2. Submit a brief written report of each inspection to Architect/Engineer, with copies to Contractor and Owner's Representative.
3. Upon completion of the installation and start-up of the mechanical equipment by the Mechanical Subcontractor, the Balancing Contractor will balance, test and adjust the system components to obtain optimum conditions in each conditioned space in the building. If construction deficiencies are encountered which preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the Contractor within a reasonable period of time, cease TAB services and advise the Architect/Engineer in writing with a copy to the Owner's Representative. The Balancing Contractor is advised that deficiencies in HVAC construction are often encountered during final TAB services; include all time required to identify the deficiencies to the Mechanical Contractor and to await their correction.
4. Fourteen (14) days, or earlier, prior to the Owner's Final Inspection, as requested by the General Contractor, prepare seven (7) copies of the completed Balancing (HVAC) Test and Balance Report. The Report will be complete with logs, data, and records as required herein and all logs, data, and records shall be typed, produced on white bond paper, and bound with plastic spiral. The Reports shall be certified accurate and complete by a principal Engineer of the Balancing Contractor. Transmit one (1) copy direct to the Owner's Representative and the remaining six (6) copies to the Architect/Engineer. The Architect will, in coordination with the Engineer, review the report. Upon approval, two (2) copies will be submitted to the Owner's Representative and two (2) copies transmitted to the Contractor.
5. The Report must contain the following general data in a format selected by the TAB Agency for clarity and ease of reference.
   a. Project No.
   b. Contract No.
   c. Project Title:
   d. Project Location:
   e. Project Mechanical Engineer: (Name)
   f. TAB Field Test Engineer: (Name)
   g. TAB Testing Diagnosis and Analysis by : (Name)
   h. TAB Agency: (Firm name and address)
   i. Mechanical Subcontractor: (Name and address)
   j. General Contractor: (Name and address)
   k. Inclusive dates tests were performed and date of Report
   l. Test Certification Number:
   m. Certification by principal engineer
6. The TAB Report will normally contain the following sections:
   a. Table of Contents
   b. General data and certification
   c. Brief Description of Tests and Test Procedures (including instruments used)
   d. Summary of Test Results (note deficiencies, if any, and action taken for correction)
   e. Logs, Data, and Records

1.5 PROCEDURES

A. Operating Tests. After all mechanical systems have been completed, and prior to air balance,

subject each system to an operating test under design conditions to ensure proper sequence of operation in all operating modes. Make adjustments as required to ensure proper functioning of all systems.

B. Certified Data. Furnish all certified data on fans, grilles, coils, filters and other equipment required for proper balancing of the system, to the Balancing Contractor.

C. Adjustment. The Balancing Contractor will supervise or perform necessary adjustments to air flow dampers, fans, sheaves, extractors, splitters, and other controls as required to properly balance the system.

D. Balancing. The Balancing Contractor will follow balancing and testing procedures published by the Associated Air Balance Council, or NEBB.

E. Reports. Compile the test data on report forms as listed in the 1982 "National Standards for Total System Balance". Include data on air volume at supply and return grilles and diffusers. Include exhaust air volume.

PART 2 - PRODUCTS

2.1 DRIVES

A. Furnish new drive(s) if necessary to accomplish proper air flow on belt driven air handling equipment. Replace drives with like kind; i.e. adjustable or non-adjustable drives.

PART 3 - EXECUTION

3.1 AIR BALANCE (BY AIR BALANCE AGENCY)

A. General Requirements.
   1. Do all work required for complete testing and adjusting of all HVAC systems.
   2. Provide all instruments and equipment required to accomplish necessary testing, adjusting, and as required by the engineer to verify performance. All instruments shall be in accurate calibration and shall be calibrated in ranges that will be expected.
   3. Prior to final observation, submit to the owner a letter certifying:
      a. That all balancing is complete.
      b. That all controls are calibrated and functioning properly.
      c. That all parts of the various systems are complete and ready to be turned over to the owner for continuous operation. Submit with letter a report tabulating data requested by the Engineer.

B. Design Conditions. The HVAC systems have been designed to maintain the inside conditions indicated below when operating with the outside conditions stated. Install, test and adjust the systems so that they will produce the inside conditions for design; however, contractor must be prepared to provide a suitable test to prove that equipment is producing capacities scheduled.
   1. Inside Conditions.
      a. Summer: 75 F.D.B. 50% R.H.
      b. Winter: 72 F.D.B.
   2. Outside Conditions.
      a. Summer: 97 F.D.B. 77 F.W.B.
      b. Winter: 25 F.D.B.

C. Adjust all air system dampers and volume controllers to obtain proper air balance throughout the conditioned area. The air quantities shown on the drawings for individual outlets may be changed to obtain uniform temperature within each zone, but the total air quantity shown for each zone must be obtained. Maximum temperature variation within a zone to be 2°F.

D. Where a motorized damper is installed without a separate manual balancing damper, use software setpoints to determine air quantities.

E. Adjust all blower drives to obtain proper total amounts of air. Change drive if necessary to accomplish proper air flow.

F. Calibrate, set and adjust all automatic temperature controls.

G. After balancing is complete and before calling for final observation, record, and submit for record,

following data:

1. For each energy recovery unit:
   a. Suction and discharge air static pressure, and total air static.
   b. Fan rpm, measured by tachometer; verify rotation.
   c. Motor nameplate F.L.A., actual amps, voltage.
   d. Measured cfm for total supply, return and outside air on each side of each wheel.
   e. Entering and leaving air temperature for each coil (dry bulb and wet bulb on cooling coils).
   f. Entering and leaving water temperatures for each water coil.
   g. Entering and leaving water pressures for each water coil.
   h. Entering and leaving dry bulb and wet bulb temperatures for each total energy wheel.
   i. Entering and leaving dry bulb temperatures for each sensible wheel, heat pipe or plate heat exchanger.
   j. For DX units, suction and discharge pressures, and temperature for each circuit.
2. For each packaged rooftop unit:
   a. Suction and discharge static pressure, and total static.
   b. Fan rpm, measured by tachometer; verify rotation.
   c. Motor nameplate F.L.A., actual amps, voltage.
   d. Measured cfm for total supply, return and outside air.
   e. Entering and leaving air temperature for each cooling coil (dry bulb and wet bulb).
   f. Entering and leaving air temperature for each heating coil.
   g. Ambient air temperature, condenser discharge temperature.
   h. Motor nameplate F.L.A., actual amp, voltage.
   i. Suction and discharge pressures, temperature for each circuit.
3. For each DX fan coil unit:
   a. Entering and leaving air temperature for each cooling coil (dry bulb and wet bulb) with all stages energized.
   b. Entering and leaving air temperature for each heating coil with all stages energized.
   c. Supply air flow.
4. Each condensing unit:
   a. Ambient air temperature, condenser discharge temperature.
   b. Motor nameplate F.L.A., actual amp, voltage.
   c. Suction and discharge pressures, temperature.
5. For each heat pump unit:
   a. Ambient air temperature on the outdoor coil, air temperature off the outdoor coil.
   b. Motor nameplate F.L.A., actual amp, voltage.
   c. Suction and discharge refrigerant pressures, temperature during each mode of operation.
6. For each unit heater:
   a. Motor nameplate F.L.A., actual amps, voltage.
   b. Measured cfm for total supply air.
   c. Entering and leaving air temperature for the heating coil
   d. Entering and leaving water temperatures for each water coil.
   e. F.L.A. for electric unit heaters with all stages energized.
7. Other reports and forms to be completed and submitted. Provide instrument list, air moving test sheet, exhaust fan data sheet, static pressure profile, return air/outside air data, fan and motor pulley, duct traverse readings, duct traverse zone totals, air monitoring station data, air distribution test sheet, terminal units, pump data sheet, chillers, air cooled condensers, cooling coil data, heating coil data, flow measuring station, duct leak test. All forms shall be as listed in the 1982 "National Standards for Total System Balance", or shall be similar, but must note same information.

H. After Owner Occupancy. After owner has occupied and is using the building, make three additional inspections of the system (at 1 month intervals) to:
   1. Correct any owner observed temperature imbalances.

2. Check correct operation of equipment and verify by letter to the engineer on each trip. List in the letter corrections made.

I. At Time of Job Completion.

1. Provide such tools, equipment and personnel as required to conduct tests and demonstrate the acceptability of the various systems.
2. Have the authorized representatives of the various manufacturers available if requested.

END OF SECTION 23 05 93

SECTION 23 07 00 - HVAC INSULATION - GENERAL

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies general requirements for the furnishing and installation of piping. These requirements apply to all other Division 23 specification sections specifying such insulation.

B. The intent of the insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Furnish and install insulation in strict accordance with the specifications for each type of service and apply as recommended by the manufacturer.

1.2 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00 Common Work Results for HVAC.

1.3 SUBMITTALS

A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used in the work. Include sufficient data to substantiate that materials conform to the requirements of this section.

B. Sample Application. Make an application of each type of insulation to display the material, quality and application method. Obtain acceptance of the sample application before proceeding with the work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation products properly packaged in factory-fabricated containers.

B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic. If insulation gets damp or wet, do not use it; replace it.

C. Handle carefully to avoid damaging insulation products. If insulation is torn or otherwise damaged, replace it.

PART 2 - PRODUCTS

2.1 FIRE HAZARD RATING

A. All insulation used on the project must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements.

2.2 GLASS FIBER PIPE INSULATION

A. Pipe Insulation.

1. Furnish pre-molded glass fiber pipe insulation, with a permanent k-factor of 0.23 Btu-in. per hr. per sq. ft. per °F at 75°F mean temperature. Furnish insulation which is 3 lb. per cu. ft. density, with factory-applied, all-service reinforced vapor barrier jacket, having integral laminated aluminum vapor barrier. Johns Manville Micro-Lok, Knauf Pipe Insulation, Owens Corning SSL, or equivalent.

2.3 FLEXIBLE BOARD INSULATION.

1. Furnish pre-molded glass fiber pipe insulation, with a permanent k-factor of 0.24 Btu-in. per hr. per sq. ft. per °F at 75°F mean temperature. Furnish insulation which is 2.5 lb. per cu. ft. density, with factory-applied, all-service reinforced vapor barrier jacket, having integral laminated aluminum vapor barrier. Johns Manville Micro-Flex, or equivalent.

2.4 FLEXIBLE CELL INSULATION

A. Pipe insulation. Furnish elastomeric, closed-cell, pre-molded pipe insulation, permanent k-factor of 0.255 Btu-in. per hr. per sq. ft. per °F at 75ºF mean temperature, with water vapor transmission equal to 0.08 perm-inch. Furnish insulation which is 6 lb. per cu. ft. density, suitable temperature range -40ºF to 220ºF, 25/50 flame/smoke spread rating per ASTM E84, passing ASTM D1171 zone resistance test. Armstrong Armaflex AP or Rubatex Insul-Tube or equivalent.

2.5 VALVE AND FITTING INSULATION

A. Furnish insulation to full thickness of adjacent piping.

B. Glass Fiber: Furnish pre-molded, glass fiber, half shell fitting insulation, or mitered pipe insulation, for flanges, valves, and fittings.

C. Covers. Use pre-molded PVC covers at flanges, valves, and fittings.

2.6 PIPING INSULATION SUPPORT AND SHIELDS

A. Field Fabricated.

1. Use sections of high density glass fiber insulation that will support the bearing area at hangers and supports.
2. Further support insulation at hangers and supports with a shield of galvanized metal extending not less than 6 in. on either side of the support bearing area, covering at least half the pipe circumference, and conforming to the schedule below.
3. When pipe is guided top and bottom, metal shields must cover the whole pipe circumference.
4. Adhere metal shield to insulation so that metal will not slide with respect to insulation.

Pipe Diameter	Insulated Section Length in Inches	Minimum U.S. Standard Gage of Metal Shield
3" and Smaller	12	18
4" to 6"	12	16
8" to 16"	18	14
18" and Larger	24	12

B. Factory-fabricated (at Contractors option). Use factory-made insulation shields as made by Pipe Shields, Inc., or equivalent. Insulation must extend at least 1 in. beyond metal. Select proper shield for service and pipe span.

2.7 ADHESIVE, FINISH, SEALANT AND CEMENT

A. Glass fiber:

1. Adhesive. Furnish Childers CP-82, Foster 85-20, Marathon Industries 225 SURE-STIK, or equivalent to seal longitudinal laps of the vapor barrier jacket and to adhere butt joint covers. Use where self-sealing laps and butt strips are not allowed.
2. Adhesive. Use insulation with self-sealing laps and butt strips where indicated above.
3. Finish. Use Childers CP-30 Low Odor (solvent based), Childers CP-35 (water based), or Foster 30-35 (solvent based), Foster 30-80 (water based), Marathon Industries 501 F-R, or equivalent with glass fabric reinforcement.
4. Sealant. (Low-temperature applications). Use Childers CP-76 or Foster 95-44 or equivalent at valve and fitting covers.
5. Cement. (High-temperature applications). Use Ramco Insulation Inc. RAMCOTE 1200 or equivalent at valve and fitting covers.

B. Closed-cell:

1. Adhesive. Use Armstrong 520 adhesive or K-Flex 320.
2. Finish. Use minimum 2-coats of Armstrong WB Armaflex Finish, Rubatex Protective

Coating 67 x 944, RBX Industries RBX 374, or equivalent per manufacturer's recommendations.

2.8 ALUMINUM JACKETING

A. Piping. Furnish for jacketing insulated pipe, a self-fastening jacket of type 3003-H14 aluminum alloy, 0.016 in. thick.

B. Valves, Fittings and Flanges. Furnish for covering all valves, fittings and flanges, formed aluminum covers, 0.024 in. thick, Type 3003-H14 aluminum alloy.

C. Straps and seals. Furnish aluminum strapping seals for jackets and covers according to manufacturer's recommendations.

2.9 WIRE

A. Use galvanized wire of gage and spacing specified below for securing insulating materials (other than glass fiber pipe insulation) to pipe, valves, fittings, vessels, and other items.

Installation	Wire Gage	Loop Spacing
Pipe, 4" and smaller	16	9" intervals
Pipe, 4" to 8"	14	9" intervals
Pipe, 8" and larger	12	6" intervals
Pumps, vessels, and other large items	12	As required to prevent over stressing

2.10 ACCEPTABLE MANUFACTURERS

A. Glass Fiber: Certainteed, Knauf, Owens-Corning, Johns Manville.

B. Flexible Closed-Cell: Aerocel, Armstrong, Halstead, Rubatex.

C. Sealants and Adhesive: Childers, Foster, Marathon Industries, Ramco Insulation Co., RBX Industries

D. Aluminum Jacketing: Childers, Preformed Metal Products Company, Johns Manville.

PART 3 - EXECUTION

3.1 WIRE

A. Draw wire loops tight over vapor barrier jacket, with ends of wire bent down. Take care not to puncture vapor seal.

3.2 INSTALLATION

A. Comply with all manufacturer’s recommendations.

B. Piping.

1. Apply insulation to clean, dry pipes. Butt insulation joints firmly together.
2. Seal longitudinal laps and butt strips with sealant, where self-sealing laps and butt strips are not allowed, or where additional sealing of self-sealing systems is required.
3. Where allowed elsewhere in this section, seal longitudinal laps and butt strips using self-sealing laps and butt strips furnished as part of the pipe insulation. Keep adhesive strips clean and dry. Carefully clean the surface receiving the self-sealing strips immediately prior to their application. Staple laps and butt strips with outward cinching staples on 6 in. centers. Replace any strips that do not securely adhere.
4. Insulate valves, fittings, flanges, and special items to the full thickness required for corresponding piping.

C. Do not insulate any item until all pressure tests have been performed in accordance with specifications.

D. Replace insulation damaged by either moisture or other means. Insulation which has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also, repair any damage caused by condensation.
E. Where existing insulated piping, ductwork or other surfaces are tapped or damaged, remove existing insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

3.3 VALVES, FLANGES AND FITTINGS
A. Insulate all valves, flanges and fittings with factory pre-molded or mitered insulation, maintaining insulation thickness equivalent to that of adjoining piping. Do not use mitered fittings for chilled water service.
B. Mitered fitting insulation.
1. Pipe 2 in. and smaller. Install mitered covers that are minimum 3-pieces to the side.
2. Pipe 2½ in. and larger. Install mitered covers that are minimum 6-pieces to the side.
3. Rasp the fitting or otherwise form to have a smooth appearance.
4. Secure covers with wire.
5. Apply ¼ in. layer of Foster 30-35 or equivalent reinforced with white 20 in. x 20 in. glass fabric.
C. Covers. Install PVC fitting covers in accordance with manufacturer's recommendations. Adhere all joints with adhesive to make a vapor tight enclosure.

3.4 SHIELDS AND HANGERS
A. When the insulation is jacketed in aluminum, install a length of 40-pound roofing felt ½ in. longer than the insulation shield between jacket and shield.

3.5 ALUMINUM JACKETING
A. Install per manufacturer's recommendations.
B. Locate longitudinal joints on the bottom side of horizontal piping
C. Overlap circumferential joints at least 2 in.

END OF SECTION 23 07 00

SECTION 23 07 13 - EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of external insulation for air ducts, both concealed and exposed.
B. Exposed ducts include those not concealed by ceilings or chases.
C. Ducts inside mechanical rooms are to be insulated as concealed ducts.

1.2 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00 Common Work Results for HVAC.
B. Refer to Section 23 31 00 HVAC Ducts.

1.3 SUBMITTALS

A. Submit manufacturer's technical product data for insulation products. Include sufficient data to substantiate that materials conform to the requirements of this section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation products properly packaged in factory-fabricated containers.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic. If insulation gets damp or wet, do not use it; replace it.
C. Handle carefully to avoid damaging insulation products. If insulation is torn or otherwise damaged, replace it.

PART 2 - PRODUCTS

2.1 INSULATION

A. Duct Wrap.
   1. Furnish flexible glass fiber insulation with factory-applied, reinforced, foil-scrim-kraft (FSK) facing, with maximum water vapor permeance of 0.02 perms, which complies with specification ASTM C 1136 Type II.
   2. Minimum installed thermal resistance of R-6 at 75°F, minimum 2 in. thick, minimum 1.0 lb./cu. ft. (pcf) density insulation, which complies with ASTM C 553-92, Type I, II , and III.
   3. Acceptable Manufacturers
      a. Johns Manville Microlite Standard Duct Wrap
      b. Knauf Friendly Feel Duct Wrap.
      c. Owens Corning SOFTR™ All-Service Fiber Glass Duct Wrap
      d. Equivalent.
B. Semi-rigid Duct Board.
   1. Furnish flexible, semi-rigid glass fiber insulation with factory-applied, reinforced, foil-scrim-kraft (FSK) facing, with maximum water vapor permeance of 0.02 perms, which complies with specification ASTM C 1136 Type II.
   2. Minimum installed R-6 inside
      a. Minimum 1½ in. thick with thermal conductivity "K" factor $\leq$ 0.25.
      b. Minimum 2 in. thick with thermal conductivity "K" factor $\geq$ 0.26 $\leq$ 0.33.
   3. Minimum installed R-8 outside
      a. Minimum 2 in. thick with thermal conductivity "K" factor $\leq$ 0.25.
      b. Minimum 2 ½ in. thick with thermal conductivity "K" factor $\geq$ 0.26 $\leq$ 0.31.
   4. Acceptable manufacturers
      a. Johns Manville Micro-Flex Large Diameter Pipe and Tank Wrap
      b. Knauf Pipe and Tank Insulation
      c. Owens Corning Fiberglas® Pipe and Tank Insulation

d. Equivalent.

C. Rigid Duct Board (Indoors).
1. Furnish rigid board duct glass fiber insulation with factory-applied, reinforced, foil-scrim-kraft (FSK) facing with maximum water vapor permeance of 0.02 perms, which complies with specification ASTM C 1136 Type II.
2. Minimum installed R-6
a. Minimum 1½ in. thick with thermal conductivity "K" factor ≤ 0.25.
b. Minimum 2 in. thick with thermal conductivity "K" factor ≥ 0.26 ≤ 0.33.
3. Treat the airstream surface of duct board with an antimicrobial agent specifically registered with the EPA for HVAC applications to resist potential growth of fungus or bacteria on the airstream surface. Conduct microbial resistance testing in accordance with ASTM C 1071, as well as the more stringent ASTM G 21. Conduct bacteria tests in accordance with ASTM G 22.
4. Acceptable manufacturers
a. Johns Manville Mat-Faced Micro-Aire Duct Board
b. Knauf Air Duct Board-AGM
c. Owens Corning nDuraGold Fiber Glass Duct Board
d. Equivalent.

D. Rigid Duct Board (Outdoors).
1. Furnish rigid board duct glass fiber insulation with factory-applied, reinforced, foil-scrim-kraft (FSK) facing with maximum water vapor permeance of 0.02 perms, which complies with specification ASTM C 1136 Type II.
2. Minimum installed R-8
a. Minimum 2 in. thick with thermal conductivity "K" factor ≤ 0.25.
b. Minimum ½ in. thick with thermal conductivity "K" factor ≥0.26 ≤ 0.33.
3. Treat the airstream surface of duct board with an antimicrobial agent specifically registered with the EPA for HVAC applications to resist potential growth of fungus or bacteria on the airstream surface. Conduct microbial resistance testing in accordance with ASTM C 1071, as well as the more stringent ASTM G 21. Conduct bacteria tests in accordance with ASTM G 22.
4. Acceptable manufacturers
a. Johns Manville Mat-Faced Micro-Aire Duct Board
b. Knauf Air Duct Board-AGM
c. Owens Corning EnDuraGold Fiber Glass Duct Board
d. Equivalent.

E. Insulation Blanket. Furnish flexible glass fiber insulation as specified under Duct Wrap, above.

2.2 COATING AND ADHESIVE

A. Indoors.
1. Low Temperature. Use Childers CP-30 solvent based low odor, Childers CP-35 water based , Foster 30-35, Marathon Industries 501 F-R, or equivalent with glass fabric reinforcement.
2. High Temperature. Use Childers CP-50, Foster 30-36, Marathon Industries 102 PERM-SURE, or equivalent.

B. Outdoors.
1. Low Temperature. Use Childers ENCACEL V or X, Foster MONO-LAR, Marathon Industries 570 M-O-H, or equivalent with glass fabric reinforcement.
2. High Temperature. Use Childers CP-11, Foster 45-00/48-00, Marathon Industries 550 IIVI-AC, or equivalent. Indoors. Use Childers CP-30 Low Odor (solvent based), Childers CP-35 (water based), or Foster 30-35 (solvent based), Foster 30-80 (water based), Marathon Industries 501 F-R or equivalent vapor barrier coating.

C. External Wrap (Outdoors). Furnish Polyguard Products, Alumaguard 60, or approved equivalent. This is a rubberized bitumen membrane, with an aluminum finish, designed specifically to be

installed over insulation on ductwork and equipment. Furnish a membrane that is “peel and stick”, self-healing if punctured, UV stable, and will expand and contract with the mechanical system. Furnish product that is minimum 0.060 in. thick, has a maximum water vapor transmission of 0.0022 grains/(hr-ft2), and has a maximum permeance rating of 0.035 perms.

D. Adhesive. Furnish Foster 85-20, Childers CP-82, Marathon Industries 225 SURE-STIK vapor barrier adhesive or equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Defer insulation of ductwork requiring pressure testing until duct testing has been successfully completed.

3.2 SCOPE

A. Supply ductwork. Insulate. This includes pretreated outside air ductwork.

B. Return ductwork. Insulate where installed below a roof, in a plenum, or exposed to outside temperatures.

C. Transfer Ducts. Do not insulate. Refer to Section 23 31 00 HVAC Ducts for lining of this ductwork.

D. Exhaust ductwork. Do not insulate.

E. Outside air ductwork. Do not insulate except where downstream of an outside air pretreatment unit.

3.3 FIRE SAFETY REQUIREMENTS

A. Do not extend duct coverings through walls or floors required to be fire stopped or required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heaters.

3.4 CONCEALED DUCT, ROUND OR RECTANGULAR

A. Use duct wrap insulation.

B. Install insulation wrapped tightly on the ductwork, with all circumferential joints butted and longitudinal joints overlapped a minimum of 2 in. Adhere insulation to ductwork with 4 in. wide strips of adhesive at 8 in. on center. In addition, secure insulation to the bottom of rectangular ductwork over 24 in. wide by the use of mechanical fasteners at no more than 18 in. on center. Do not use adhesive systems employing release paper.

C. On circumferential joints, staple the 2 in. flange on the facing with 9/16 in. flare-door staples on 6 in. centers, and cover with a minimum 3 in. wide strip of glass fabric and coating, or a 3 in. wide strip of 8 ounce canvas adhered with adhesive. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with glass fabric.

3.5 EXPOSED ROUND DUCT

A. Use semi-rigid duct board insulation.

B. Apply insulation to dry duct. Firmly butt all joints together. Seal longitudinal laps of factory-applied vapor barrier jacket with adhesive. Cover butt joints with a 3 in. wide strip of factory-supplied vapor barrier jacket adhered with adhesive. Do not use adhesive systems employing release paper.

3.6 EXPOSED RECTANGULAR DUCT

A. Use rigid duct board insulation.

B. Fill and point up all joints, perforations and exposed edges with coating reinforced with glass fabric or a 3 in. wide strip of 8-ounce canvas adhered with adhesive. Securely fasten insulation to metal surface with adhesive and mechanical fasteners on 12 in. centers on center on bottom of duct or elsewhere as required. Use a mechanical fastener that does not penetrate the sheet

metal duct. Do not use adhesive systems employing release paper. Do not use adhesive systems employing release paper.

3.7 RECTANGULAR DUCTWORK EXPOSED TO WEATHER

A. Use rigid duct board insulation. Taper the insulation on the top surfaces of all ductwork exposed to the weather, pitching either one or both ways, 1 in. from ridge to eave, or 2%, whichever is greater.

B. Fill and point up all joints, perforations and exposed edges with coating reinforced with glass fabric or a 3 in. wide strip of 8-ounce canvas adhered with adhesive. Securely fasten insulation to metal surface with adhesive and mechanical fasteners on 12 in. centers. Use sheet metal screws and discs or other approved fasteners. Do not use adhesive systems employing release paper.

C. Apply an additional weather resistant outdoor coating as specified above or external wrap as specified. Install according to the manufacturer's installation instructions.

3.8 SUPPLY AIR DEVICES

A. Insulate all concealed supply air diffusers, grilles, and registers with the same insulation as the connecting duct. Vapor seal the outer jacket to the frame of the air device.

3.9 STANDING SEAMS, DAMPER OPERATORS, AND STIFFENERS

A. Insulate standing seams, damper operators, and stiffeners which protrude through the insulation with an additional layer of insulation extending 6 in. on either side of the seam, etc. Cover the insulation with 8 ounce canvas coated with vapor barrier coating. Install insulation to allow full access to and adjustment of damper operators..

END OF SECTION 23 07 13

SECTION 23 07 19 - HVAC LOW TEMPERATURE PIPING INSULATION

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of low temperature piping insulation of glass fiber, or flexible closed cell insulation as indicated below. Applicable low temperature applications include chilled water, refrigerant piping and related drain bodies, any makeup piping located outside or in locations subject to freezing, and condensate drains.

1.2 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00 Common Work Results for HVAC.
B. Refer to Section 23 07 00 HVAC Insulation – General.
C. Refer to Section 23 20 00 HVAC Pipe and Fittings – General

1.3 SUBMITTALS

A. Submit manufacturer's technical product data for insulation products. Include sufficient data to substantiate that materials conform to the requirements of this section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation products properly packaged in factory-fabricated containers.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging insulation products.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

A. Furnish in accordance with the requirements of Section 23 07 00 HVAC Insulation – General.
B. Supply in type and thickness as tabulated below:

Insulated Unit	Thickness (Inches)	Type
Refrigerant Suction Piping	1	Closed Cell
Condensate Drain Lines	½	Closed Cell

PART 3 - EXECUTION

3.1 PIPE

A. Install in accordance with the requirements of Section 23 07 00 HVAC Insulation – General.

3.2 SHIELDS AND HANGERS

A. Install pipe hangers as specified in Section 23 20 00 HVAC Pipe and Fittings – General.
B. Install pipe shields as specified in Section 23 07 00 HVAC Insulation – General.

3.3 ALUMINUM JACKETING

A. Apply to all refrigerated suction piping located outdoors.
B. Apply to all condensate piping located outdoors.

END OF SECTION 23 07 19

SECTION 23 09 23 - FACILITY MANAGEMENT SYSTEM - HVAC BACnet

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of a complete direct digital control (DDC) facility control and management system (FCMS).

B. Furnish a totally native BACnet system. Furnish a system in which the operator's terminal(s), all global controllers, logic controllers, and all input/output devices communicate using the protocols and local area network (LAN) standards as defined by ANSI/ASHRAE™ Standard 135-95 (BACnet). In other words, all workstations and controllers, including unitary controllers, shall be native BACnet devices. Do not use gateways for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed undqser other sections.

C. The lighting control system to be provided by 23 09 23.1 must seamlessly communicate with the FCMS and all panels shall reside on FCMS communication network. Controls Contractor to fully coordinate with Electrical Contractor and jointly commission system to insure seamless communication with FCMS and provide a complete operational system.

D. Furnish a control system that allows operator access via the Internet as follows:
   1. For Automated Logic, furnish WebCtrl.

E. Acceptable manufacturers are Automated Logic.

F. Alternate manufacturers are Automated Energy Solutions.

G. No other manufacturers will be considered.

1.2 REFERENCE STANDARDS

A. Design and install the system in accordance with the latest edition of the following standards and codes in effect and amended as of the bid date, and any applicable subsections thereof:
   1. ANSI/ASHRAE Standard 135-1995, BACnetTM
   2. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
   3. National Fire Protection Association (NFPA 70 – National Electrical Code (NEC).
   4. FCC Part 15, Subpart J.
   5. EMC Directive 89/336/EEC.

1.3 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00, Common Work Results for HVAC.

B. Refer to Section 23 05 93, Testing, Adjusting, and Balancing for HVAC

C. Refer to Section 23 31 00, HVAC Ducts.

D. Refer to Section 23 09 93 Control Sequences

E. Refer to Section 26 05 00 Common Work Results for Electrical

F. Refer to Division 26 05 33 Raceways for Electrical Systems.

1.4 SUBMITTALS

A. Submit a minimum of 7 copies of shop drawings to consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Include complete wiring, routing, schematic diagrams, tag number of devices, software descriptions, calculations, sequences, panels, and any other details required to demonstrate that the system will function properly. Show proposed layout and installation of all equipment and the relationship to other parts of the work.

B. Shop drawings must be approved before any equipment is installed. Therefore, shop drawings must be submitted in time for Architect's review so that all installations can be completed per the project's completion schedule. Allow a minimum of fifteen working days for submittal review.

C. Provide an accurate graphic flow diagram for each software program proposed to be used on the

project as part of the submittal process.

D. System documentation. Include the following documentation as part of the submittal.
   1. System configuration diagrams in simplified block format.
   2. All input/output object listings and an alarm point summary listing.
   3. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
   4. Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
   5. Complete description and documentation of any proprietary services and/or objects used in the system.

1.5 CODES

A. Perform all wiring, mechanical installations, and control sequence implementation in accordance with applicable mechanical and electrical codes.

1.6 ELECTRICAL COORDINATION

A. Electrical Contractor installs and connects electrical power to all motors, starters, and DDC system control panels. Controls Contractor performs all other electrical work required for proper operation of the control system.

1.7 QUALITY ASSURANCE

A. The controls systems contractor must have been in business a minimum of five years and be the authorized installing contractor for the manufacturer of the system.

B. Employ only competent mechanics, regularly employed by the system installer with full responsibility for proper operation of the control system including debugging and proper calibration of each component in the entire system.

C. Contractor must have local support within 60 miles of the job site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.

1.8 OPERATION AND MAINTENANCE DATA

A. Comply with the requirements of Section 23 05 00.

B. Upon completion of the installation and prior to acceptance and owner training, furnish the engineer with three (3) copies of project-specific installation and operation manuals for the complete system. Each manual must include the following as a minimum:
   1. "As Built" drawings, including plan layout, conduit runs, interconnection between devices, and panel wiring diagrams as finally installed.
      a. Furnish complete line to line drawings. Point wiring diagrams, numbering of wire ends between devices on the drawings will not be acceptable, except for connections to terminals on the DDC modules.
      b. Furnish drawings complete with all relays switches, etc. of the entire control system including electrical interlocks with the air conditioning equipment and any fire alarm system, complete with specification data sheets for all instrumentation shall be submitted within 90 days after the contract is awarded and prior to starting any controls work.
      c. Furnish layouts that show all control equipment and the function of each for the total control system. In addition, operating instructions and system flow diagrams shall be prepared, laminated and left in a frame of hardback binder in the mechanical equipment room. Furnish a separate schematic drawing for each floor of each building showing the actual routing of the communication loop. Identify each valve, relay, switch, motor and item of equipment, etc., with a number or mark identical to one that is tagged on each item. Large items of equipment may be identified by a symbol listed in a legend on the control diagram.
   2. Furnish a complete application description, address location, and I/O summary for each controller installed in the system.

3. Furnish system reference material, which contains as a minimum, an overview of the system, its organization, the concepts of networking and operator workstation/field hardware relationships as well as the following:
   a. Activating the operator workstation.
   b. Using the mouse.
   c. Operator Workstation screen menus and their definitions.
   d. Establishing setpoints and schedules.
   e. Uploading and downloading software, setpoints, schedules, operating parameters and status between the operator workstation and field hardware.
   f. Collecting trend data and generating trend plots.
   g. Enabling alarms and messages.
   h. Report generation.
   i. Backing up software and data files.
   j. Using the operator workstation with 'third party' software.
4. Engineering manual, including the following information as a minimum:
   a. Hardware – cutsheets and product descriptions.
   b. Engineering – design requirements for initial installations and/or additions to existing systems.
   c. Installation – mounting and connection details for field hardware, accessories and operator workstation equipment.
   d. Field hardware set-up, checkout and tuning techniques.
   e. Operator Workstation set-up, software loading and checkout techniques.
   f. A listing of basic terminology, standard alarms and messages, error messages and frequently used commands.
5. Software documentation, including as a minimum descriptions of the control software programs used in the system:
   a. Diagrams and listings showing maximum input/output point configurations for controlled equipment.
   b. A description of the control elements and sequences available for the equipment.
   c. A listing of the information which is displayed to the operator for each piece of controlled equipment.
   d. A listing of the alarm and message conditions which may be detected for each piece of controlled equipment and the standard alarm and message texts which can be displayed when those conditions exist.
   e. A graphic flow diagram for each software application program provided as part of this project.
6. Before final payment, furnish the OWNER with a complete set of as built control mylars and CAD discs. Furnish the mylars on 3 mil mylar, matt finish both sides, printed on back of the film. Furnish the CAD discs in "Microstation or AutoCAD 14 +" furnished to the owner on CD-ROM. Keep one copy of backup diskettes for the system archived in a software storage vault at the Contractor's business location.

1.9 DELIVERY, STORAGE AND HANDLING
   A. Deliver control components properly packaged in factory-fabricated containers.
   B. Store in a clean, dry place in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
   C. Handle carefully to avoid damaging control components.

1.10 GUARANTEES AND WARRANTIES
   A. Comply with the requirements of Section 23 05 00.
   B. Guarantee the system and all manufacturer and contractor supplied components, parts and assemblies, hardware and software, against defects in material and workmanship, under normal use, for one (1) year from the date of written acceptance of the system by the Owner. Provide all required warranty service with a maximum response time to the site of 24 hours after

notification by the Owner.

C. Maintain a local office staffed with trained, full-time employees who can perform testing, inspection, repair and maintenance services for the system, for the duration of the warranty period.

PART 2 - PRODUCTS

2.1 BACnet CONFORMANCE

A. The system must be fully BACnet at the time of installation. This means that the system must use BACnet as the native communication protocol between distributed controllers communicating on the controller network (i.e. Field Bus) and must, as a minimum, be Conformance Class 4 and support the following Objects:
   1. Binary Input
   2. Binary Output
   3. Binary Value
   4. Analog Input
   5. Analog Output
   6. Analog Value

B. The communication network between controllers connected on a controller network must be at least 100 kbps using ARCNET, BACnet MS/TP protocol, or Ethernet at the Data Link Layer.

2.2 GATEWAY CONTROLLER (GC)

A. General.
   1. Furnish Gateway controller that provides battery-backed real-time (hardware) clock functions and communications via BACnet standard protocols to all field controllers. Interface gateway controller with operator terminal(s) via BACnet protocols for information display.
   2. Furnish Gateway controller that incorporates as a minimum, the functions of a 3-way BACnet router. Design controller to route BACnet messages between the high-speed LAN (Ethernet and/or ARCNET), master slave token passing (MS/TP), and point-to-point (PTP) or modem ports. Design GC to have capability to easily function as a 4-way router with the addition of simple plug-in modules.
   3. Design GC that is capable of deciding global strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the controller or by another controller. The program that implements these strategies must be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable. Program execution at Gateway controller must be a minimum of once per second.
   4. Programming must be object-oriented using control program blocks, or a simple Question/Answer format for developing applications. Furnish documentation in flowchart form for all programming as part of the final system as-built documentation. Include samples of flowchart documentation in submittals. All flowcharts shall be generated and automatically downloaded to controller. Furnish controllers that do not require reentry of database information.
   5. Furnish means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's terminal, field computer, or modem.
   6. Controller must have a minimum of 4 MB battery-backed static RAM, along with 64K of EPROM. Battery must retain static RAM memory and clock functions for a minimum of 1 year. Battery must be a field-replaceable (non-rechargeable) lithium type.
   7. Furnish a gateway controller that includes a display for network setup and

monitoring. Back light the LCD display with 2-line by 20-character display. Include 8-key keypad for operator entry of data.

B. BACnet Conformance.
1. Gateway Controller must as a minimum support Point-to-Point (PTP), MS/TP, and either Ethernet or ARCNET BACnet LAN types. It must communicate directly via these BACnet LANs as a native BACnet device and must support simultaneous routing functions between all supported LAN types. Gateway controller must be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
   a. Clock Functional Group.
   b. COV Event Initiation.
   c. Files Functional Group.
   d. Device Communications Functional Group.
   e. Time Master.
2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, must be thoroughly documented and provided as part of the submittal data. Supply all necessary tools for working with proprietary information.
3. Standard BACnet object types supported must include as a minimum: Analog Value, Binary Value, Calendar, Command, Device, File, Group, Notification Class, Program and Schedule object types. Thoroughly document all proprietary object types, if used in the system, furnish them as part of the submittal data. Supply all necessary tools for working with proprietary information.

C. Remote Communications.
1. Furnish all functions that will allow remote communications via modem to off-site locations. Include modem along with all cabling necessary for installation.
2. Provide Windows software for off-site computer that allows operator to view and change all information associated with system on color graphic displays. Allow the operator to be able to change all parameters in this section from off-site location including all programming of Gateway controllers and all programmable logic controllers including all terminal unit controllers.
3. Furnish Gateway controllers that are capable of calling out alarm conditions automatically. Send alarm message and site description to off-site computer or serial printer. If desired, controller may also send encoded message to digital pager. If an alphanumeric pager is in use by the operator, Gateway controller is to be capable of sending a text or numeric string of alarm description. All Gateway controllers connected to the local LAN must be capable of calling out alarm messages through one or more shared modems connected to one or more of the Gateway controllers on the local LAN.
4. Gateway controller must have capability to call a minimum of 20 different phone numbers. Numbers called may be controlled by type of alarm, time schedule, holiday schedule, or other selectable program parameters.
5. Owner will provide standard voice-grade phone line or DSL connection for remote communication function.
6. Gateway controller and supplied modem must be capable of modem-to-modem baud rates of 56 Kbps minimum over standard voice-grade phone lines. Lower baud rates shall be selectable for areas where local phone company conditions require them.

D. Schedules.
1. Each Gateway controller must support a minimum of 100 BACnet Schedule Objects and 100 BACnet Calendar Objects.
2. Each schedule object (Weekly or Exception) must be capable of performing an optimum start. Optimum start calculation must be based on outside air temperature,

zone air temperature, deviation from zones, daytime heating and cooling setpoints, and individual zone adaptive heating and cooling coefficients that are adjusted each day based on performance parameters of the individual zone.

E. Logging Capabilities.
1. Each Gateway controller must log as a minimum 150-user selectable object properties. Multiple properties may be logged for each object with a minimum of 100 samples per object. Any object in the system (real or calculated) may be logged. Sample time interval must be adjustable at the operator's terminal. Start of sampling may be by one of the following: Selectable log beginning and ending by using BACnet Calendar and Schedule Objects.
a. Object change of value (all types of analog objects).
b. Object change of state (all types of binary objects).
2. Logs may be viewed both on-site or off-site via remote communication.
3. Design the gateway controller to periodically upload trended data to operator's terminal for long term archiving if desired.
4. Archived data stored in database format must be available for use in third-party spreadsheet or database programs.

F. Alarm Generation.
1. Object change of values and change of states may be identified as alarm conditions. When such conditions exist, the Gateway controller identifies each alarm through BACnet Get Alarm Summary Service. This summary of active alarms (Event State property value not equal to NORMAL) is presented to and displayed at the operator's terminal for system user action.
2. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failure.
3. Each alarm may be dialed out as noted above.
4. Furnish alarm log for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.

G. Demand Limiting.
1. Design the system to monitor energy demand. Energy demand may be from any type of energy source such as electrical or gas. Furnish a demand-limiting routine which will shed appropriate system objects to prevent the demand from exceeding preset limits. Demand-limiting routine must be a priority shed type allowing automatic override of specified object type sheds when assigned analog object (temperature sensor) exceeds limits as set by system user at operator's terminal. Routine must be able to change between sets of demand limit and restore setpoints based on BACnet Schedule Objects or system user manual commands at operator's terminal.
2. Zone shed method must be by either preventing zone heating and cooling operations, or by shifting zone heating and cooling setpoints.
3. All parameters of the demand limiting routine must be modifiable from the operator's terminal or via remote communications.

2.3 ROUTER, CONVERTER, REPEATER

A. Perform all routing functions using only BACnet standard protocols as defined by ANSI/ASHRAE Standard 135-1995. The converter interconnects a standard computer serial port with an MS/TP LAN. Repeater functions shall be handled by a device designed to selectively interconnect 4 (four) portions of MS/TP LAN as a minimum.
1. ROUTERS: The router must perform the BACnet definition functions of interconnecting two or more BACnet LANs together, forming a BACnet internetwork. The router must have optional plug-on boards permitting the following BACnet communication methods:
a. The router must have the routing functionality of interconnecting BACnet

Ethernet and/or ARCNET high-speed LAN to BACnet MS/TP LAN and one or more PTP LANs.

b. The router must have capability of interconnecting BACnet Ethernet high-speed LAN to BACnet ARCNET high-speed LAN.

c. BACnet PTP (RS-232 point-to-point) communication must be available on the global controller by including an (optional) modem. The PTP/modem option shall operate under the BACnet half router communication protocol.

d. BACnet messages may be routed to all LANs installed on the router at the same time with no operator intervention.

2. CONVERTER: A converter must (optionally) be provided to interface an (optional) portable field service computer from its serial port (RS-232) to the BACnet MS/TP LAN (RS-485) or using Bluetooth wireless technology to interface the portable field service computer to the BACnet MS/TP LAN (RS-485).

3. REPEATERS: BACnet repeaters must provide selective interconnection to 4 segments of MS/TP LAN as a minimum. The repeater must be an active device, containing logic capable of detecting and repeating signals from one MS/TP LAN segment to all other segments. Repeaters must permit additional nodes to be added to the MS/TP LAN, up to a maximum of 100 nodes.

2.4 LOCAL CONTROL PANELS

A. Furnish enclosed, unitized, front access type containing all relays. controllers, alarms, P.E. and E.P. switches, etc. Furnish aluminum cabinets and/or steel construction with full-fronted, hinged doors. Furnish panels with external handle 120V and higher power disconnect switch.

B. Furnish long life, neon or L.E.D. type pilot lights. Furnish push buttons that are no larger than 1/2" in diameter.

C. Furnish permanently mounted tags for all panels.

2.5 CONTROLLERS GENERAL:

A. Design each controller to have the capability of having the program as well as schedules reside in its own memory and not be dependent on any other control modules to perform its intended function. Furnish each controller with the capability to operate "stand alone". If communications are lost, the controller shall perform its normal sequence of control. All control modules must reside on the site local area network interface modules.

B. Furnish all Central Plant modules that are the expandable type. Do not use sub network. Furnish a control module for each piece of air handling equipment unless otherwise approved by OWNER. Mount it in or adjacent to the unit.

C. Exception - small units listed below may be controlled by unitary control modules residing on a sub network with an interface module to the campus local area network.

D. Unless otherwise approved by OWNER, the use of unitary Controllers on a sub network shall be limited to:

1. Fan and coil units serving one room.
2. Split systems.
3. Unit ventilators serving one room.
4. Unit heaters.

2.6 CENTRAL PLANT AND AIR HANDLER LOGIC CONTROLLERS

A. Furnish one or more native BACnet logic controllers for each air handler and provide native BACnet logic controllers as needed for central plant control that adequately cover all objects listed in object list. Interface all controllers global controller via MS/TP LAN using BACnet protocol. Do not use gateways. Furnish controllers that include input, output and self-contained logic program as needed for complete control of units. Furnish fully programmable controllers using graphical programming blocks. Do not use auxiliary or non-BACnet controllers.

B. BACnet Conformance

1. As a minimum, logic controllers are to support MS/TP BACnet LAN types. Design them to communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Logic controllers must be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
   a. Files Functional Group.
   b. Reinitialize Functional Group.
   c. Device Communications Functional Group.
2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, must be thoroughly documented and provided as part of the submittal data. All necessary tools must be supplied for working with proprietary information.
3. Standard BACnet object types supported must include as a minimum—Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, Program and Schedule object types. All proprietary object types, if used in the system, must be thoroughly documented and provided as part of the submittal data. All necessary tools must be supplied for working with proprietary information.

C. Logic controllers must include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0–10VDC, 0–5 VDC, 4–20 mA and dry contact signals. Any input on controller may be either analog or digital. Controller must include binary and analog outputs on board. Analog outputs must be switch selectable as either 0–10VDC or 0–20mA. Software must include scaling features for analog outputs. Logic controller must include 24VDC voltage supply for use as power supply to external sensors.

D. Store all program sequences on board logic controller in EEPROM. Design the system so batteries are not needed to retain logic program. All program sequences must be executed by controller 10 times per second and capable of multiple PID loops for control of multiple devices. All calculations must be completed using floating-point math and system must support display of all information in floating-point nomenclature at operator's terminal.

E. Programming of logic controller must be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator must program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Logic controller must be programmed using programming tools as described in operator's terminal section.

F. Furnish all programming tools as part of system. Furnish documentation in flowchart form of all programming as part of the final system as-built documentation. Include samples of flowchart documentation in submittals.

G. Include software scheduling functions on board in logic controllers without depending on any external device. Scheduling must be via a BACnet schedule object for seven-day of-the-week scheduling. Controller must include interface capability for optional plug-in hardware clock with battery back up. Provide optional hardware clock as shown on object list given in drawing set.

2.7 UNITARY CONTROLLERS (Heat Pumps, AC Units, Fan Coils)

A. Furnish one native BACnet logic controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. Interface all controllers to global controller via MS/TP LAN using BACnet protocol. Do not use gateways. Controllers must include input, output and self-contained logic program as needed for complete control of unit.

B. BACnet Conformance .
   1. Logic controllers shall as a minimum support MS/TP BACnet LAN types. They must communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Logic controllers must be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:

a. Files Functional Group.
b. Reinitialize Functional Group.
c. Device Communications Functional Group.

2. Please refer to section 22.2, BACnet Functional Groups in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, must be thoroughly documented and provided as part of the submittal data. All necessary tools must be supplied for working with proprietary information.
3. Standard BACnet object types supported must include as a minimum–Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. Thoroughly document and furnish all proprietary object types, if used in the system, as part of the submittal data. Supply all necessary tools for working with proprietary information.

C. Include universal inputs with 10-bit resolution and that can accept 3K and 10K thermistors, 0–5 VDC, 4–20 mA and dry contact signals in all logic controllers. Any input on controller may be either analog or digital. Controller must also include support and modifiable programming for interface to intelligent room sensor. Controller must include binary outputs on board.

D. All program sequences must be stored on board logic controller in EEPROM. No batteries must be needed to retain logic program. All program sequences must be executed by controller 10 times per second and must be capable of multiple PID loops for control of multiple devices.

E. Programming of logic controller must be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator must program logic sequences by graphically moving function blocks on screen and tying blocks together on screen, or using a simple Question/Answer format for developing applications, or using a simple Question/Answer format for developing applications. Logic controller must be programmed using programming tools as described in operator terminal section.

F. All programming tools must be provided as part of system. Provide documentation in flowchart form of all programming as part of the final system as-built documentation. Include samples of flowchart documentation in submittals.

G. Logic controller must include software scheduling functions on board without depending on any external device. Scheduling must be via a BACnet schedule object for seven-day of-the-week scheduling. Controller must include interface capability for optional plug-in hardware clock with battery back up. Provide optional hardware clock as shown on object list given in drawing set.

2.8 SENSORS and MISCELLANEOUS DEVICES

A. Temperature Sensors.

1. Furnish all temperature sensors that are factory-calibrated to within 0.5˚F, totally interchangeable. Duct sensors to be electronically identical, housing suitable for the application.

B. Wall-mounted Temperature Sensor.

1. All space sensors must have a temperature range in degrees Fahrenheit and be appropriate for the microprocessor control system.
2. Furnish setpoint adjustment (+/- 3˚F) and override buttons (3 hour, adjustable) on sensors where shown on the Drawings.
3. All space sensors must be installed with foam backing and any cavity behind the sensor filled with insulation to retard air movement to prevent sensing wall temperatures.
4. All Automation Components Incorporated (ACI) sensors must be potted.
5. Space sensors for hallways, restrooms and gym dressing areas must be the stainless steel cover plate type, or the equivalent "Logistat" sensor.
6. All temperature sensors (adjustable and non-adjustable) must be mounted at 46"

(ADA approved height) off the finished floor.

C. Relative Humidity Sensors
   1. All relative humidity sensors must have:
      a. A capacitance type sensor.
      b. An accuracy of ± 3% at 75° F from 5 to 95% R.H. including hysteresis, humidity and repeatability.
      c. A temp effect of less than .005 % per 0° F.
      d. A repeatability of ± 1%.
      e. Annual drift of less than 1%.

D. Combination temperature and relative humidity sensors are/are not allowed.

E. C02 Sensors
   1. Carbon dioxide sensors must be non-dispersive infrared (NDIR) type and have:
      a. A measuring range of 0 - 2000 PPM.
      b. An operating temperature range of 40 to 1 10° F with a 0° F to 140 ft. exposure range without damage.
      c. An operating humidity range of 5 to 95% R.H.
      d. An accuracy of ± 2 1/2% or ± 50 PPM -which every is greater.
      e. A repeatability of ± 20 PPM.
      f. A maximum drift of ± 25 PPM per year.

F. Immersion Sensors
   1. All chilled and hot water temperature sensors must have a temperature range in degrees Fahrenheit suitable for the application. Furnish separate wells for each sensor located in a piping system. Furnish stainless steel sensor wells with suitable contact medium. Furnish sensors that are capable of being removed without draining the system. Furnish immersion sensors that are compatible with the microprocessor system.

G. Duct and Plenum Sensors
   1. Mounting Tabs for Easy Installation
   2. Probe Lengths: 4”, 8”,12”, and 18”
   3. Averaging Lengths: 8’, 12’, and 24’
   4. Series 300 Stainless Steel Probes
   5. Double Encapsulated Sensors
   6. Medical-Grade Foam Padding
   7. Etched Teflon Lead wires
   8. Weatherproof Enclosure where exposed to the weather.
   9. Furnish all duct/plenum sensors with a temperature range in degrees Fahrenheit suitable for the application.
   10. Averaging Sensors. Use averaging sensors wherever there is a chance for stratified layers of hot and cold air, or where indicated on the drawings.
      a. Manufacturer from bendable copper tubing
      b. Design so that they measure temperature along their entire length.
      c. Furnish freeze stats which allow remote reset.

H. Outside Air Sensors
   1. Furnish weatherproof enclosures for all outside sensors

I. Water Flow Transmitters
   1. Furnish brass flow sensor, Data Industrial Model 220B or 226B. The 226B allows insertion or removal under pressure it comes with the valve in the saddle. Furnish 225H insertion foal with each 226B, to insert or remove the sensor while under pressure.
   2. Furnish Data Industrial Model 310 analog flow transmitter with each flow sensor, that converts frequency to analog, and is designed to operate in conjunction with the Data Industrial insertion flow sensor. Furnish unit with a 4-20MA signal proportional to the sensors specific flow range.

J. Energy Consumption Meter

1. Digital electronic circuitry
2. Conforms to ANSI C12.1 metering accuracy standards. Meets UL and cUL specifications as listed in 3111-1.
3. Consists of a meter and included CT(s) calibrated together as a system.
4. Accuracy +/- 1% from 2 % to 100 % of the rated current over a temperature range of 0-50˚ C.
5. Requires no annual recalibration by users in the field.
6. Derives operating power from its metering connections, and does not require a separate control power connection.
7. Automatically correct for CT phase reversal.
8. Factory assembled Cts.
9. Backlit LCD display that shows accumulated kWh on the top half of the display while the bottom half of the display scrolls through Amps, Voltage, PF, KVAR, KVA, KW Real Power, as stated below.
10. Directly accept any voltage input from 120-480 VAC, internally isolated to 2500 VAC, and available for amperage ranges of 100-2400 Amps.
11. N.O. pulse output with selectable pulse output rates of 0.10, 0.25, 0.50, or 1.00 kWh per pulse.
12. N.C. phase-loss alarm output operating at 100mA @ 24VAC/DC.
13. Using the optional Communications Board, the Energy Meter must be networkable via an RS485 connection to a Modbus RTU network.
14. Include the following information and capabilities:
    a. Current, per phase & three-phase total
    b. Voltage, per phase & three-phase total, phase-to-phase & phase-neutral
    c. Real Power (kW), per phase & three-phase total
    d. Reactive Power (kVAR), three phase total
    e. Apparent Power (kVA), three phase total
    f. Power Factor, per-phase & three-phase total
    g. Real Energy (kWh), three phase total
15. Acceptable Manufacturer. Veris Industries model H8163 or approved equivalent.

2.9 Valves and Actuators.

A. Valve Specifications.

1. Select the valves for a pressure drop equal to the pressure drop of the coil or 3 psi, whichever is greater.
2. Indicate the valve constant (CV rating) on the control drawings of all valves used so that the valve pressure drop may be used for balancing and performance tests.
3. Ball Valves for Isolation
    a. Pipe 2 in. and smaller. Furnish 150 lb. screwed, two piece; bronze body, bronze/chrome plated ball and bronze stem, teflon seats, teflon packing bronze gland follower, adjustable stuffing box, steel lever type handle with plastic encased steel operating handle, quarter turn stops, and stem extension to allow valve body to be insulated (with insulation of same thickness as adjacent piping) and operator to be extended above insulation.
        i. Acceptable manufacturers: Nibco T-580-70, Milwaukee BA100, Hammond 8301, or approved equivalent.
4. Ball Valves for Control (up to 2 in.)
    a. Furnish 150 lb., 2-way or 3-way valves as indicated on the drawings with brass bodies, brass female NPT threads. Valve bodies may also be stainless steel.
    b. Furnish full and reduced port valves that have circular, straight- through flow passages. Furnish a single-piece parabolic port insert that is permanently press-fit into the ball, which allows the flow capacity of each valve to be

changed.

c. Furnish a single-piece, leak-proof, blow-out proof stem fitted with 2 EPDM O-rings.

d. Furnish nickel plated brass or stainless steel ball.

5. Globe Valves for Control (up to 2 in.)

a. Furnish Class 150, 2-way or 3-way valves with bronze body as indicated on the drawings rated at 250 lbs. maximum working pressure for water and steam with female NPT threads.

b. Furnish valves with stainless steel and highly polished stems to decrease friction and improve response. Furnish brass valve plugs with guides to insure a perfect seating.

c. Furnish stem packing that have EPDM O-rings for water application, and Teflon V-rings for steam applications.

d. Furnish 2-way flow type that are equal percentage for water and modified equal percentage for steam. Furnish 3-way type that is lenier.

6. Globe Valves (2-1/2 to 4 in.)

a. Furnish cast iron flanged valves rated at 200 lb. maximum working pressure for 2-1/2 through 4 in. and 175 lb. for 5 in. and 6 in..

b. Furnish valve stems that are stainless steel and highly polished to decrease friction and improve response. Furnish brass valve plugs with guides to ensure a perfect seating. Stem packing must be spring loaded PTFE Cone-rings.

7. Butterfly Valves.

a. Furnish these valves larger than 4 in.

b. Furnish full lug-wafer style valves, drilled and tapped for isolation and removal of downstream piping. Furnish flanges that meet ANSI Standards 125 and 150. Furnish extended neck body to allow for sufficient flange and piping insulation clearance.

c. Valves must feature a single, through-shaft design for high strength and positive disc control.

d. Furnish heavy duty disc seats with molded-in O-rings, creating a positive seal between flange face and valve body. Gaskets between the valve and flange faces are not allowed. The resilient must provide a tight flow shutoff in either direction with the disc closed. Seat isolates body and stem from flowing liquid. The seat must be easily replaceable in the field.

e. Stem bearings must be isolated from flowing liquid.

f. Butterfly valves are not acceptable, except for cooling tower bypass and two-position, dead-end service, such as chiller isolation.

8. Modulating Valves:

a. Furnish modulating valves with electronic operators unless otherwise noted, to produce the required capacity at a pressure loss not exceeding 3 psig unless otherwise approved for more sensitive control. Furnish valves with a nominal body rating not less than 125 psig. Design the valve body and packing to withstand the maximum pump head and the maximum temperature of the controlled medium (chilled water, or hot water).

b. Furnish single-seated valves with close-off ratings equal to or in excess of the system pressure encountered (that is the maximum upstream pressure). Furnish 3-way modulating valves must having close-off ratings equal to or in excess of maximum pressure difference, at any load condition, between the outlet and either of the two inlets for mixing valves or the pressure difference between the inlet and either of the two outlets for diverting valves.

c. Furnish diaphragm type valves to eliminate the need for stem packing.

9. Non-modulating Valves

a. Furnish electrically operated non-modulating valves unless otherwise noted

and sized by the control manufacturer to produce the required capacity at a pressure loss not exceeding 3 psig unless otherwise approved for more sensitive control. Furnish valves with a nominal body rating not less than 125 psig. However, the valve body selected must be designed to withstand the maximum pump head and the maximum temperature of the controlled medium (chilled water or hot water).

b. Furnish valves with close-off ratings equal to or in excess of the system pressure encountered (that is the maximum upstream pressure).

c. Furnish valves that are pilot solenoid type pilot operated type with low voltage electric activator coils capable of functioning with 1 psi differential. Valve must be Parker Type IV model GP or approved equal.

d. Furnish all pilot operated valves with a 20 mesh Y strainer on their inlet.

e. Furnish pilot operated valve and strainer with an isolation valve upstream with a union between the isolation valve and the Y strainer. Furnish with threaded connections so that the strainer and pilot operated valve can be removed without the use of heat.

B. Electronic Valve Actuator Specification for indoor applications.

1. Furnish fully modulating actuators, floating (tri-state), 2-position, and/or spring return as indicated in the control sequences. Furnish fail safe actuators with a spring return.
2. Furnish positive positioning valves, responding to a 2-10VDC or 4-20mA signal. Furnish with a visual valve position indicator.
3. Furnish actuator with the capability of adding auxiliary switches or feedback potentiometer if specified.
4. Furnish actuator capable of providing minimum torque required for proper valve close-off. Design actuator with a current limiting motor protection. Furnish a release button, clutch or handle on the actuator, to allow for manual override (except when actuator is spring return type).
5. Furnish UL listed actuators.
6. Acceptable Manufacturers: (No others are acceptable than those listed below.)
   a. Delta
   b. Belimo

C. Electronic Valve Actuator Specification for outdoor applications.

1. Furnish motor that has a 100% duty cycle rating for modulating applications (at 100 degrees F.).
2. Furnish positive positioning valves, responding to a 2-10VDC or 4-20mA signal. Furnish with a visual valve position indicator.
3. Furnish actuator with the capability of adding auxiliary switches or feedback potentiometer.
4. Furnish actuator capable of providing minimum torque required for proper valve close-off. Design actuator with torque switches. Furnish a release button, clutch or handle on the actuator, to allow for manual override.
5. Furnish unit suitable for use with 120/220 VAC (50/60Hz) with built in, automatic resetting, thermal overload protection.
6. Furnish actuator complete with integrated declutchable manual override hand wheel (with automatic power cutout switch to provide functionality for the manual override as well as local emergency shutdown capability), micro processor based controller for modulating service (Input signal 4-20madc or 0-10vdc), metal oxide varistor (MOV) for transient voltage suppression, gear driven 5kOhm potentiometer for positive indication of output shaft position, 2 SPDT-DB travel limit switches, 2 SPDT-DB torque limiting switches, heater and thermostat for prevention of internal condensation and a highly visible valve status position indicator.
7. Furnish actuator that has direct mount capability to the butterfly valve.
8. Furnish UL listed actuators. Furnish actuator enclosure that is a die cast aluminum

alloy with corrosion resistant polyester coating, in accordance with NEMA 4/4X specifications

9. Acceptable Manufacturers: (No others are acceptable than those listed below.)
   a. Bray R4 Series 73
   b. Delta
   c. Belimo.
   d. Johnson Controls

2.10 DAMPERS and ELECTRONIC DAMPER ACTUATORS.

A. Dampers.

1. Furnish parallel blade dampers for mixing and opposed blade dampers for control.
   a. For galvanized ductwork, construct frames of 13-gage galvanized sheet metal with provisions for duct mounting. Furnish damper blades not exceeding 8 inches in width, of corrugated-type construction, fabricated from two sheets of 22-gage galvanized sheet metal spot welded together or a single 16-gage sheet. Make shafts of ½ inch zinc-plated steel. Furnish blades suitable for high velocity performance. Construct damper so that leakage does not exceed ½ percent based on 2000 fpm and 4-inch static pressure. Furnish replaceable resilient seals along top, bottom and sides of frame and along blade edge. Submit leakage and flow characteristic data with shop drawings.
   b. For stainless steel ductwork, construct dampers of stainless steel. Furnish for use with externally-mounted actuators unless otherwise indicated.

B. Electronic Damper Actuators.

1. Furnish actuator that is direct coupled (over the shaft), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. Design the actuator-to-shaft clamp to use a “V” bolt and “V” shaped, toothed cradle to attach to the damper shaft for maximum holding strength. Single bolt or set screw type fasteners are not acceptable.
2. Furnish actuator with electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. End switches to deactivate the actuator at the end of rotation or magnetic clutch are not acceptable.
3. For power-failure/safety applications, a mechanical, use aspring return mechanism.
4. Furnish actuators with spring return mechanisms capable of either clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
5. Furnish proportional actuators that accept a 2–10VDC, 4–20mA signal, or be of the 2-point floating type and provide a 2–10VDC actuator position feedback signal.
6. All actuators must have an external manual gear release (clutch) or manual crank to aid in installation and for allowing manual positioning when the actuator is not powered.
7. Furnish all actuators with an external direction of rotation switch to aid in installation and to allow proper control response.
8. Furnish actuators with a factory-mounted 3-foot electrical cable and conduit fitting to provide easy hook-up to an electrical junction box.
9. Actuators must be listed under Underwriters Laboratories Standard 873 and Canadian Standards Association.
10. Acceptable Manufacturers: (No others are acceptable than those listed below.)
    a. Delta
    b. Belimo
    c. Bray
    d. Johnson Controls

2.11 GRAPHICS

A. All graphics are to be an accurate 3 dimensional representations of the actual equipment. Design graphics to show all points being monitored and only those points. Fill in all associated data fields. If "canned" graphics and data sheets are used, remove all non-applicable points and fields.

B. Maintain a parent/child relationship in all graphics. Example: Furnish a “button” in the air handler graphics to take the operator to the cool source (chiller plant) and one to its heat source (boiler plant).

C. Color Code. Generate one of seven colors to represent the comfort conditions in the space, and display them graphically at the operator station.

1. If the actual space temperature is in the dead band between the heating setpoint and the cooling setpoint, the color displayed to be green for the occupied mode, representing ideal comfort conditions. If in the unoccupied mode, the color displayed to be gray representing 'after-hours' conditions.
2. If the space temperature rises above the cooling setpoint, change the color to yellow. Upon further rise beyond the cooling setpoint plus an offset, change to orange. Upon further rise beyond the cooling setpoint plus the yellow band offset, plus the orange band offset, change the color to red indicating unacceptable high temperature conditions. At this point an alarm to be generated to notify the operator.
3. When space temperature falls below the heating setpoint, the color to change to light blue. Upon further temperature decrease below the heating setpoint minus an offset, the color to change to dark blue. Upon further space temperature decrease below the heating setpoint minus the light blue band offset minus the dark blue band offset the color to change to red indicating unacceptable low temperature conditions. At this point an alarm to be generated to notify the operator.

D. Design the graphics package to include the following in sequence:

1. Elevation graphic of the front of the campus or site. (Digital photo may be substituted.)
2. Schematic diagram of the entire campus or site.
3. Schematic diagram of the building floor plan.
4. 3 dimensional representation of the actual equipment.

E. Each graphic (campus level and below) will have the following: (if applicable)

1. Outside Air Temperature.
2. Outside Air % RH.
3. Outside air C02 if incorporated.

F. Each equipment graphic will have the following: (if applicable)

1. Outside Air Temperature.
2. Outside Air % RH.
3. Outside air CO2 .
4. All sensor inputs for the specific equipment.
5. Set point adjustment capability.
   a. All points noted on control sequence schematic plus
      i. Room temperature setpoint
      ii. Chilled water supply setpoint
      iii. Discharge air setpoint .
6. CFM setpoint.
7. Actual room number if it is zone equipment or specific equipment number if it serves more than one zone. Example: AHU # …, Chiller # …, Boiler # … .

PART 3 - EXECUTION

3.1 APPLICATION SOFTWARE

A. Furnish the following application software for the purpose of optimizing energy consumption while maintaining occupant comfort:

1. Time of Day Scheduling (TOD)
    a. Schedule by building, area, zone, groups of zones, individually controlled equipment and groups of individually controlled equipment.
    b. Each schedule to provide beginning and ending dates and times (hours: minutes).
    c. Weekly repeating schedule, i.e. between 8:00 a.m. and 5:00 p.m., Monday through Friday to constitute one schedule, not five.
2. Dated schedules to be entered up to 9 (nine) years in advance.
3. System to self-deleting when effective dates have passed.
4. Provide for automatic leap year adjustment.
5. Provide for automatic daylight savings time adjustment.

B. Optimum Start/Stop (OSS)/Optimum Enable/Disable (OED)
1. Start and stop equipment on a sliding schedule based on the individual zone temperature and the heating/cooling capacity in ˚F/hour of the equipment serving that zone.
2. Heating/cooling capacity value to be operator adjustable.
3. Temperature compensated peak demand limiting to remain in effect during morning start up to avoid setting a demand peak.

C. Source Temperature Optimization (STO)
1. Automatically perform source optimization for all air handling units, chillers and boilers in response to the needs of other downstream pieces of equipment, by increasing or decreasing supply temperature setpoints, i.e. chilled water, discharge air, etc. using owner defined parameters.
2. Provide for starting and stopping primary mechanical equipment based on zone occupancy and/or zone load conditions.
3. Setpoint Reset.
    a. Allow setpoints for various equipment in the heating/cooling chain to be reset between an operator defined maximum and a minimum setpoint based on the actual requirements of the building zones.
    b. Calculate actual setpoint based on the number of heating or cooling requests which are currently being received from the equipment or zones served.
    c. Once every update period, the STO program to survey the network to see if any piece of equipment requires any additional heating or cooling from its source. As an example, a VAV air handler is the source of cold air for a number of VAV boxes. Assume that the STO program for the air handler has the following parameters established for it by the owner:
        i. Optimized setpoint description
            a) Initial setpoint is 60.00
            b) Max. setpoint is 65.00
            c) Min. setpoint is 55.00
            d) Every 2.0 minutes, trim by 0.25 and respond by -0.50 but no more than 2.0.
        ii. Every two minutes, total up all of the requests and calculate a new setpoint:
            a) New setpoint = prev setpoint + 'trim by' + ('respond by' x no. of req.). Assuming four requests were received and the previous setpoint was 57.00 degrees, the new setpoint would be:
            b) New setpoint = 57.00 + 0.25 + (-0.50 x 4) = 55.25 Deg F.
            c) If (the number of requests received) x (the 'respond by' value) > (the 'but no more than' value), use the 'but no more than' value inside the parenthesis in the above calculation.

D. Demand Limiting (DL) - Temperature Compensated
   1. Program DL application for a minimum of six separate time of day KW demand billing rate periods.
   2. System to be capable of measuring electrical usage from multiple meters serving one building and each piece of equipment being controlled on the LAN to be programmable to respond to the peak demand information from its respective meter.
   3. Utilize a sliding window method with the operator being able to establish the kilowatt threshold for a minimum of three adjustable demand levels. The sliding window interval to be operator selectable in increments of one minute, up to 60 minutes. Systems that incorporate rotating shed tables are not acceptable.
   4. Operator to be able to set the individual equipment temperature setpoints for each operator defined demand level. Equipment is not to be shed if these reset setpoints are not satisfied; rather the setpoint is to be revised for the different established demand levels. The system to have failed meter protection, such that when a KW pulse is not received from the utility within an operator adjustable time period, an alarm will be generated. The system software will automatically default to a predetermined fail-safe shed level.
   5. Information Archiving. The system to have ability to archive demand and usage information for use at a later time. System to permit the operator access to this information on a current day, month to date and a year to date basis.

E. Day/Night Setback (DNS)
   1. The system to allow the space temperature to drift down [up] within a preset [adjustable] unoccupied temperature range. The heating [cooling] shall be activated upon reaching either end of the DNS range and shall remain activated until the space temperature returns to the DNS range.
   2. Outside & Exhaust Air. The system to be capable of closing all outside air and exhaust air dampers during the unoccupied period, except for 100% outside air units.
   3. Unoccupied Space Temperature. Unoccupied space temperature to be monitored by the DDC temperature sensors located in the individual zones being controlled or within a representative room.
   4. Parameter Changes. Operator to be able to define, modify or delete the following parameters.
      a. DNS setpoint temperature(s)
      b. Temperature band for night heating operation
      c. Period when the DNS is to be activated

F. Timed Local Override (TLO)
   1. TLO input points that permit the occupants to request an override of equipment that has been scheduled OFF.
   2. System to turn the equipment ON upon receiving a request from the local input device. Local input devices to be push button (momentary contact), wind-up timer, or ON/OFF switches as detailed in the I/O summary.
   3. Equipment On Time. If a push button is used the system operator to be able to define the duration of equipment ON time per input pulse and the total maximum ON time permitted. The input point will cancel override time already entered. If a wind-up timer is used the equipment will stay in override mode until the timer expires. Year to date, month-to-date and current day override history to be maintained for each TLO input point. History data shall be accessible by the operator at any time and shall be capable of being automatically stored on hard disk and/or printed on a daily basis.

G. Space Temperature Control (STC)
   1. Two space temperature setpoints, one for cooling and one for heating, separated by a dead band. Only one of the two setpoints to be operative at any time. The cooling setpoint is operative if the actual space temperature has more recently been equal

to or greater than the cooling setpoint. The heating setpoint is operative if the actual space temperature has more recently been equal to or less than the heating setpoint. Provide two modes of operation for the setpoints, one for the occupied mode (example: heating = 72˚F or 22˚C, cooling = 76˚F or 24.4˚C) and one for the unoccupied mode (example: heating = 55˚F or 12.7˚C, cooling = 90˚F or 32˚C).

2. Schedule. The occupied/unoccupied modes may be scheduled by time, date, or day of week.
3. Operator Definable. All setpoints and offsets to be operator definable. When in the occupied mode, start-up mode, or when heating or cooling during the night setback unoccupied mode, a request to be sent over the network to other equipment in the HVAC chain, such as to an AHU fan that serves the space, to run for ventilation. The operator to be able to disable this request function if desired.
4. Additional Cooling. When comfort conditions are warmer than ideal, indicated by the colors yellow, orange, and high temperature red, a request for additional cooling to be sent over the network to other cooling equipment in the HVAC chain, such as a chiller. This information is to be used for optimization of equipment in the HVAC chain. The operator to be able to disable this function if desired.
5. Additional Heating. When comfort conditions are cooler than ideal; indicated by the colors light blue, dark blue, and low temperature red; a request for additional heating to be sent over the network to other heating equipment in the HVAC chain, such as a boiler. This information is to be used for optimization of equipment in the HVAC chain. The operator to be able to disable this function if desired.
6. Cooling/Heating Setpoints. The cooling [and heating] setpoints may be increased [decreased] under demand control conditions to reduce the cooling (heating) load on the building during the demand control period. Up to three levels of demand control strategy to be provided. The operator may predefine the amount of setpoint increase [decrease] for each of the three levels. Each space temperature sensor in the building may be programmed independently.
7. Optimum Start. An optimum start-up program transitions from the unoccupied setpoints to the occupied setpoints. The optimum start-up algorithm considers the rate of space temperature rise for heating and the rate of space temperature fall for cooling under nominal outside temperature conditions; it also considers the outside temperature; and the heat loss and gain coefficients of the space envelope (AI: Space Temperature).
8. PID Loop. A PID control loop, comparing the actual space temperature to its setpoint, to modulate the dampers [and heating coil valve or heating stages in sequence] to achieve the setpoint target.

3.2 CONTROL SEQUENCES AND POINTS LIST (Refer to Section 23 09 93 Control Sequences)

3.3 SCHEDULE AND COORDINATION

A. Furnish a detailed project design and installation schedule with time markings and details for hardware items and software development phases.
B. Show on the schedule all the target dates for transmission of project information and documents and indicate timing and dates for system installation, debugging, and commissioning.
C. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.
D. Notify the owners representative in writing of conditions detrimental to the proper and timely completion of the work.
E. Do not begin work until all unsatisfactory conditions are resolved.

3.4 GENERAL INSTALLATION

A. Install all sensors furnished under this section and other Division 15 sections.

B. Install in accordance with manufacturer's instructions.
C. Install all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

3.5 LOCATION AND INSTALLATION OF COMPONENTS
A. Locate and install components for easy accessibility; in general, mount wall sensors 46 inches above floor with minimum 3'-0" clear access space in front of units. Obtain approval on locations from owner’s representative prior to installation.
B. Avoid mounting temperature sensors in a location that are located in the direct air path from a grille or register.
C. Install outside sensors on the north side of the building out of direct sunlight.
D. Suitably wire and mount all instruments, switches, transmitters, etc., to protect them from vibration, moisture and high or low temperatures.
E. Identify all equipment and panels. Install permanently mounted tags for all panels.
F. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections—sized to suit pipe diameter without restricting flow.

3.6 INTERLOCKING AND CONTROL WIRING
A. Include all interlock and control wiring. Install all wiring neatly and professionally, in accordance with Specification Division 16 and all national, state and local electrical codes.
B. Include wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions.
C. Wire all damper and valve actuators not specifically indicated to be wired on the Electrical Drawings.
D. Plenum-rated control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.
E. Include auxiliary pilot duty relays on motor starters as required for control function.
F. Include power for all control components from nearest electrical control panel or as indicated on the electrical drawings—coordinate with electrical contractor.
G. Install all control wiring in the mechanical, electrical, telephone and boiler rooms in raceways. Install all other wiring neatly and inconspicuously per local code requirements.
H. For control wiring to outdoor devices, install conduit with drip loop so moisture will not flow to the device.
I. Sensor wiring and communication loop wiring, may be installed without using conduit, if approved by owner.
J. Conceal all wiring and raceways within walls, attics, ceiling spaces, etc. except in mechanical rooms or other areas where other raceways and piping, systems are exposed.
K. Color-code all wiring and terminate it on numbered terminals strips in accordance with the temperature control manufacturer’s drawings. Install all wiring in accordance with NFPA 70 (N.E.C.), and prevailing local codes
L. Use manufacturer’s instructions or size all line and low voltage wiring for the particular application, but in no case shall line voltage wire be less than 14 gauge or low voltage less than 18 gauge. Use stranded low voltage wire sensor wire that is twisted pair, stranded, 18 gauge. Furnish "Communication loop" wiring, and sensor wiring that is in accordance with the manufacture's recommendations. Exception - furnish wires to temperature sensors using pin connectors that is the maximum size permitted by the connectors.
M. Control wire colors shall be as follows:
1. Sensor wires - white jacket.
2. Communication loops - yellow jackets

3.7 CONTROL WIRE SUPPORT

A. J-Hooks: Panduit J-Pro JP2**, or approved equivalent with proper mounting methods required for pathways.

3.8 DDC OBJECT TYPE SUMMARY

A. Provide all database generation.

B. Displays:

1. design system displays that show all analog and binary object types within the system. Lay them out logically for easy use by the owner. Provide outside air temperature indication on all system displays associated with economizer cycles.

C. Run Time Totalization:

1. At a minimum, incorporate run time totalization for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Enter warning limits for each point for alarm and or maintenance purposes.

D. Trendlog:

1. All binary and analog object types (including zones) shall have the capability to be automatically trended.

E. Alarm:

1. Prioritize and route all analog inputs (High/Low Limits) and selected binary input alarm points (locally or remotely) with alarm message per owner's requirements.

F. Database Save:

1. Provide back-up database for all stand-alone logic controllers on disk.

3.9 FIELD SERVICES

A. Prepare and start logic control system under provisions of this section.

B. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

C. Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. Owner shall provide phone line for this service for 1 year or as specified.

D. Provide Owner's Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.10 GRAPHICS

A. Install the graphics software package on the work station at the central office and all of the Laptops of the maintenance personnel as designated by the Owner.

3.11 TRAINING

A. Provide application engineer to instruct owner in operation of systems and equipment.

B. Provide system operator’s training to include (but not limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide this training to a minimum of 3 persons.

C. Provide training above as required, up to 40 hours as part of this contract.

3.12 DEMONSTRATION

A. Provide systems demonstration to the reasonable satisfaction of Owner.

B. Demonstrate complete operating system to owner's representative.

C. Provide certificate stating that control system has been tested and adjusted for proper operation.

END OF SECTION 23 09 23

SECTION 23 09 93 - CONTROL SEQUENCES

PART 1 - GENERAL

1.1 SCOPE

A. The HVAC system will operate in either the occupied or unoccupied modes. The time schedule shall reside in each unit's respective controller. Optimum start/stop energy management functions shall be provided. The BAS/ATC' time schedule shall determine the proper mode of operation.

1.2 Heat Pump Units (FCU/HP) – D/X Cooling, Heat Pump, Electric Supplemental Heating Coil, Supply Fan.

A. Each FCU/HP shall utilize a stand-alone DDC controller dedicated only for control of its respective unit. Each DDC controller shall be located in a NEMA 3R enclosure at the unit it serves.

B. The FCU/HP shall be started and stopped by an optimum start/stop schedule located in the unit controller. When either the optimum start/stop schedule or HMI override function energizes the FCU/HP control system, the DDC system shall enable the system.

C. An override feature on the space sensor shall allow the unit to operate after hours when the DDC time schedule has them scheduled off.

D. The DDC system shall control the compressor(s) to maintain set point. Upon a rise in space temperature compressor(s) shall stage on.

E. The DDC system shall control the and operate the reversing valve and electric heater to maintain set point. Upon a drop in space temperature the evaporator blower shall start, reversing valve shall reverse and the compressor(s) shall stage on. Upon a continual drop in space temperature, the electric heating coil shall be energized to maintain setpoint

F. The supply air smoke detectors (provided by Div. 26) shall de-energize the RTU if the products of combustion are detected. See Div 26 for location and quantity of units with smoke detectors. When the supply air smoke detectors de-energizes the unit, a smoke detector shut down alarm shall be displayed at the HMI

G. Unit fan shall run continuously when the unit is allowed to operate by the DDC system in the occupied mode. Unit fan shall cycle on and off when in the unoccupied mode or when overridden by the override feature on the space sensor

H. The DDC system shall monitor FCU/HP runtime. When the FCU/HP has operated for an owner defined time period, the HMI shall notify maintenance personnel that service/inspection is required

I. Upon any fire alarm activation a relay (provided by Div. 26) shall de-energize the FCU/HP. When the FCU/HP de-energizes a shut down alarm shall be displayed at the HMI

1.3 Rooftop Units (RTU) – D/X Cooling, Hot Gas Reheat, Gas Heating, Supply Fan

1. Each RTU shall utilize a stand-alone DDC controller dedicated only for control of its respective unit. Each DDC controller shall be located in a NEMA 3R enclosure at the unit it serves.
2. The RTU shall be started and stopped by an optimum start/stop schedule located in the unit controller. When either the optimum start/stop schedule or HMI override function energizes the RTU control system, the DDC system shall enable the system.
3. An override feature on the space sensor shall allow the unit to operate after hours when the DDC time schedule has them scheduled off.
4. The DDC system shall control the compressor(s) to maintain temperature set point. Upon a rise in space temperature, the compressor(s) shall stage on.
5. The DDC system shall control the compressor(s) and bypass valves for reheat to maintain humidity set point. Upon a rise in space humidity, the compressor(s) shall

stage on, cycle the valves to utilize hot gas reheat.

6. The DDC system shall control the gas heater to maintain set point Upon a drop in space temperature The burner shall ignite and stage and the evaporator blower shall start.
7. The return air smoke detectors (provided by Div. 28) shall de-energize the RTU if the products of combustion are detected. See Div 26 for location and quantity of units with smoke detectors. When the return air smoke detectors de-energizes the unit, a smoke detector shut down alarm shall be displayed at the HMI.
8. Unit fan shall run continuously when the unit is allowed to operate by the DDC system in the occupied mode. Unit fan shall cycle on and off with the compressor when in the unoccupied mode or when overridden by the override feature on the space sensor.
9. The DDC system shall monitor RTU runtime. When the RTU has operated for an owner defined time period, the HMI shall notify maintenance personnel that service/inspection is required.
10. Upon any fire alarm activation a relay (provided by Div. 28) shall de-energize the RTU. When the RTU de-energizes a shut down alarm shall be displayed at the HMI.

1.4 Heat Recovery Unit (HRU) – Direct Expansion Cooling, Electric Heating Coil, Supply and Exhaust Fan, Heat recovery Wheel, Outside and Exhaust Air Damper.

A. The controls contractor shall provide a DDC controller to control all functions of the HRU. The program shall reside in this controller and accomplish all sequences. The controller shall be equipped with a BACNET communications port to communicate all outputs back to the building DDC controls
B. Each HRU shall utilize a building DDC controller dedicated only for control of its respective unit. Each DDC controller shall be located in a NEMA 1 enclosure at the unit it serves.
C. The HRU shall be started and stopped by a start/stop schedule located in the building DDC controller. When either the start/stop schedule, a unoccupied hours override or HMI override function calls for the HRU to start a start command shall be sent to the condensing unit to start, and after a two minute(adj.)delay the DDC system shall enable the system.
D. The unit DDC system shall open the outside and exhaust air dampers. The exhaust and supply fans shall not start until a limit switch on each damper is made.
E. The exhaust fans shall start first. After proof of flow the energy recovery wheel shall then start.
F. After a one minute delay and proof of wheel rotation (amp probe) the supply fan shall start.
G. The unit DDC system shall cycle the compressors to maintain 54 degrees F if the ambient temperature is above 55 degrees F.
H. The unit DDC system shall control the stages of electric heat to maintain 60 degrees F if the ambient temperature is below 55 degrees F and 65 degrees if ambient temperature is below 40 degrees F.
I. The supply air smoke detectors (provided by Div. 26) shall de-energize the HRU if the products of combustion are detected. See Div 26 for location and quantity of units with smoke detectors. When the supply air smoke detectors de-energizes the unit, a smoke detector shut down alarm shall be displayed at the HMI
J. The unit DDC system shall monitor HRU runtime. When the HRU has operated for an owner defined time period, the HMI shall notify maintenance personnel that service/inspection is required
K. Upon any fire alarm activation a relay (provided by Div. 26) shall de-energize the HRU. When the HRU de-energizes a shut down alarm shall be displayed at the HMI
L. The unit DDC control system shall monitor the HRU leaving air temperature and fan status. If leaving air temperature is greater than 20 degrees from set-point 10 minutes after startup, de-energize the unit. If the leaving air temperature is greater than 5 degrees from set-point for 10 minutes, within any 30 minute period, the unit shall be de-energized.

1.5 Outside Air Unit(OAU) – Direct Expansion Cooling, Gas Heating, Supply Fan, Outside Air Damper.

A. The OAU shall be supplied by a unit manufacturer BACNET DDC controller. The program shall reside in this controller and accomplish all sequences. The controller shall be equipped with a BACNET communications port to communicate all outputs back to the building DDC controls

B. Each OAU shall utilize a stand-alone DDC controller dedicated only for control of its respective unit. Each DDC controller shall be located in a NEMA 3R enclosure at the unit it serves. The building DDC controller shall enable and disable the unit by a schedule or by override due to the energize of kitchen exhaust fan(s).

C. The OAU shall be started and stopped by a start/stop schedule located in the building controller.

D. The DDC system shall open the outside air dampers. The supply fans shall not start until a limit switch on the damper is made.

E. The supply fan shall start.

F. The unit DDC system shall cycle the compressors to maintain 54 degrees F if the ambient temperature is above 55 degrees F.

G. The unit DDC system shall control the stages of gas heat to maintain 60 degrees F if the ambient temperature is below 56 degrees F and 65 degrees if ambient temperature is below 40 degrees F.

H. The supply air smoke detectors (provided by Div. 26) shall de-energize the OAU if the products of combustion are detected. See Div 26 for location and quantity of units with smoke detectors. When the supply air smoke detectors de-energizes the unit, a smoke detector shut down alarm shall be displayed at the HMI

I. The unit DDC system shall monitor OAU runtime. When the OAU has operated for an owner defined time period, the HMI shall notify maintenance personnel that service/inspection is required

J. Upon any fire alarm activation a relay (provided by Div. 26) shall de-energize the OAU. When the OAU de-energizes a shut down alarm shall be displayed at the HMI

K. The unit DDC control system shall monitor the OAU leaving air temperature and fan status. If leaving air temperature is greater than 20 degrees from set-point 10 minutes after startup, de-energize the unit. If the leaving air temperature is greater than 5 degrees from set-point for 10 minutes, within any 30 minute period, the unit shall be de-energized

L. A CO_2 sensor in the cafeteria served by OAU-1 shall energize OAU-1 when the space CO_2 levels are above 900 PPM or when the kitchen hood exhaust fan is energized.

1.6 Fan Coil Units (FCU) - D/X cooling Coil, Supply Fan

A. Each FCU shall utilize a stand-alone DDC controller dedicated only for control of its respective unit. Each DDC controller shall be located in a NEMA 1 enclosure at the unit it serves.

B. The FCU shall operate continuously. The supply fan shall cycle with the condensing unit.

C. The DDC system shall control the compressor to maintain set point. Upon a rise in space temperature the compressor and evaporator blower shall start.

D. A float switch in the secondary pan shall de-energize the entire unit when water is detected in the pan

E. The DDC system shall monitor FCU runtime. When the FCU has operated for an owner defined time period, the HMI shall notify maintenance personnel that service/inspection is required

F. Upon any fire alarm activation a relay (provided by Div. 26) shall de-energize the FCU. When the FCU de-energizes a shut down alarm shall be displayed at the HMI

1.7 Unoccupied Hours

A. During unoccupied hours any room thermostat that senses a space temperature 15 degrees above or below setpoint shall override the schedule and allow that unit to operate until the

space temperature is within 10 degrees of setpoint.

B. A humidity sensor in association with the space thermostat in Rooms 1410 (Zone 1), 1307 (Zone 2), 1113 (Zone 3), 1305 (Zone 4) and 1311 (Zone 5) shall calculate dew point temperature. When the dew point temperature exceeds 60˚ F within that zone, the DDC system shall override the time schedule and enable all units within the zone to operate. The high limit humidistat shall be mounted above the temperature sensor.

Zone 1 HRU- 1	
Zone 1.1	HP- 1.01 thru 1.20, 2.01 thru 2.17
Zone 2 HRU-2	
Zone 2.1	RTU-1, 2 and 3, HP-3.01 thru 3.12
Zone 3 HRU-3	
Zone 3.1	HP-1.21 thru 1.41
Zone 4 HRU-4	
Zone 4.1	RTU- 4, 5 and 6, RTU-8 thru 19
Zone 5 OAU-1	

1.8 Kitchen Hood (Exhaust and Make up Fans, KEF)

A. The make-up air unit consists of a supply fan and motorized dampers. Supply fan is factory interlocked to start when exhaust fans are energized. Exhaust fan shall be energized when switch on hood face is activated. Both the supply and Exhaust fans shall de-activate upon suppression system activation. Motorized dampers are factory wired to open prior to the fans starting.

1.9 Fire alarm interface shall de-energize all units within the facility.

A. The fire alarm contractor will provide a relay at each unit. The controls contractor shall be responsible for wiring between the relay and the unit controls.

1.10 A phase failure relay (by Div 26)

A. Located in Rm. 1603.2 shall de-energize all 3 phase units. Provide a control panel with UPS, relay and controller for this function.

1.11 Cooler and Freezer

1. The DDC system shall monitor the space temperature of each of these.

1.12 Fan Interlocks.

A. Furnish all fan interlocks shown or called for on the plans, scheduled on the Fan Schedule or required for a complete and operating system.

1.13 Fire Alarm

A. Provide wiring required between the fire alarm relay and all controls on all WSHPs, HRUs, RTUs, EFs & Fans and OAUs. A separate fire alarm relay is not required where EFs and Fans are hardwire interlocked with a piece of equipment that has a fire alarm relay.

PART 2 - INTERLOCKS (Hardwired)

A. General: Provide switches, relays, PE switches, wire, conduit and other necessary devices (except motor starters and starter auxiliaries specified in Division 26 requirements and shown on E-series Drawings) necessary to accomplish interlocks specified, shown on Drawings, indicated in schedules, specified in other control sequences or required for proper functioning of various systems. Show such devices in the composite wiring diagram. Fan interlocks shall be hardwired unless noted otherwise in the sequences.

PART 3 - ROOM SENSOR COVERS

A. Furnish covers for all thermostats or room sensors installed in gymnasiums, cafeterias,

corridors, library, stage, kitchen and as noted on the drawings. Furnish KELE AT 1104 metal thermostat cover.

PART 4 - POINTS LIST

A. Refer to the attached tables for the minimum points to be included. The controls contractor shall include in his bid all points required to accomplish the sequences listed and the points listed on the points list.

END OF SECTION 230993

SECTION 23 20 00 - HVAC PIPING - GENERAL

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of pipes and pipe fittings for all piping systems. This section applies to all sections of Division 23 - HVAC, which employ pipe and pipe fittings.

1.2 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00 Common Work Results for HVAC.
B. Refer to Section 23 05 33 Hangers and Supports for HVAC Piping and Equipment.

1.3 SUBMITTALS

A. Submit manufacturer's technical product data for piping and other items specified in this section. Include sufficient data to substantiate that materials conform to the requirements of this section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with ends capped.
B. Store in a clean, dry space. Protect piping from weather, damaging fumes, construction debris and traffic. Keep ends of piping capped at all times except when actually joining ends of piping.
C. Handle carefully to avoid damaging piping.

1.5 WELDERS CERTIFICATION

A. Employ welders qualified to perform welding operations required either by certifications or by submitting to required tests.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Furnish domestically manufactured pipe and pipe fittings (foreign pipe is not acceptable).
B. The particular type of pipe and fittings for each system is specified in the section on that system.

2.2 UNIONS

A. Furnish Class 150 standard malleable iron, ground joint unions with a bronze seat. Furnish flanged union joints on piping larger than 2½ in.

2.3 BRANCH CONNECTIONS

A. Pipe 2½ In. and Smaller. Furnish straight size of reducing tee for threaded piping. When the branch is smaller than the header, a nipple and reducing coupling or a swaged nipple may be used.
B. Pipe 3 In. and Larger. Furnish welding tee for welding piping when branch size is the same as header size. Furnish Weldolet when branch is smaller than the header. Furnish 3000-lb. full coupling welded to the header for threaded branch connections. Do not utilize a tee fititng to serve two branch lines (bull head tee).

2.4 SLEEVES AND ESCUTCHEON PLATES

A. Fabricate sleeves of schedule 40 galvanized steel pipe or galvanized steel sheet metal.
B. For fire-rated construction, use gauges of metal consistent with UL listing requirements for penetrations of the particular construction, in accordance with the firestopping manufacturer's recommendations.
C. Sleeves at non-rated, concealed masonry construction may be square galvanized sheet metal construction, minimum 26 gauge.

D. For sleeves in non-rated construction and not in an air plenum, PVC pipe sleeves may be used at Contractor's option.
E. Furnish chrome-plated cast brass escutcheon plates for exposed penetrations. Polished chrome plated cast iron floor and ceiling plates may be used for piping larger than 3 in. Split escutcheons are not acceptable.

2.5 ACCEPTABLE MANUFACTURERS
A. Escutcheon plates. ITT Grinnell No. 395 Modified, McGuire No. 127, Potter-Roemer No. 4700 Series.
B. Screwed joints, dissimilar metals. Crane Company No. 1259, EPCO as manufactured by EPCO Sales, Inc., or approved equivalent.
C. Unistrut. Mult-A-Frame, Power-Strut.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION
A. Install piping in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work.
B. Give particular attention to piping in the vicinity of equipment. Preserve the maximum access to various equipment parts for maintenance.
C. Do not cut or weaken any structural member.
D. Cut all pipes accurately to measurement determined at the site. Ream pipe after cutting to remove burrs.
E. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Install fittings to make all changes in direction. Field bending and mitering are prohibited. Make all connections to equipment using flanged joints, couplings, or unions. Make reducing connections with reducing fittings only.
F. Install all piping concealed unless specifically indicated to be exposed on the drawings or when located in mechanical rooms, janitors' closets, or unfinished areas. Where piping is exposed, offset piping as required to hold it close to walls and ceilings.
G. For steel or copper piping systems, include unions, flanges, or similar devices to make provisions for removal of valves and other items installed in the piping system, which may require future replacement without the need to cut them item out of the piping system.
H. Expansion Joints. Include "U" bend pipe loops in piping wherever straight runs exceed 100 ft. Make each loop such that the minimum legs of the "U" are 10 ft., and the minimum base of the "U" is 5 ft. Where straight runs exceed 200 ft., add additional pipe loops so there is one pipe loop for every 200 ft., or portion thereof, of straight run. An engineered calculation of expansion joint requirements is acceptable in lieu of this requirement, upon review and acceptance by the Engineer.

3.2 JOINTS
A. Screwed Joints. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. Do not use all-thread nipples.
B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions.
C. Solder Joints.
1. Prior to making joints, cut pipe square and ream to full diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly on the outside, and wipe to remove excess solder.
3. Use silver brazing alloy or Sil-Fos on refrigerant piping. Use 95.5 solder on all other copper

piping, except domestic water piping.

D. Welded Joints.
   1. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Furnish filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. Do not use mitered joints.
   2. Weld and fabricate piping in accordance with ANSI Standard B31.9, latest edition, Building Services Piping. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.
   3. Align piping and equipment so that no part is offset more than 1/16 in. Set all fittings and joints square and true, and preserve alinement during welding operation. Use of alignment rods inside pipe is prohibited.
   4. Use pipe fittings when tapping new into existing piping; do not use saddle fittings unless specifically indicated otherwise in the contract documents.
   5. Do not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
   6. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
   7. Remove dirt, scale and other foreign matter from inside piping before tying in sections, fittings, valves or equipment.

3.3 COORDINATION

A. Making adjustments to field conditions is considered a part of the work required. Do not use contract drawings accompanying these specifications for rough-in locations but only for pipe sizing and general routing.

B. Examine and become familiar with the Architectural, Structural, Electrical and Mechanical drawings to become knowledgeable of all piping connections required and space limitations.

C. The drawings are diagrammatic and are not intended to show all the offsets and fittings required. Include all materials and labor which are not specifically called for in the Drawings or Specifications, but which are required to make for a complete piping installation. Make any and all necessary changes in direction to avoid beams, footings, columns, piers, vents, ducts, equipment or other obstructions.

D. In any case where a pipe indicated on a plan sheet differs from that indicated on a riser, schematic or detail, use the larger of the two sizes.

E. Do not route any piping above electrical control panels and related electrical equipment. Prior to installation of any piping, determine the actual space requirements and the location of all electrical panels and related electrical equipment. Make all offsets and adjustments as required.

F. Install all piping close to walls, ceilings and columns so piping occupies the minimum space. Allow adequate space for covering and removal of pipe, special clearances, and for offsets and fittings.

3.4 PENETRATIONS THROUGH CONSTRUCTION

A. Install escutcheon plates around pipes exposed to view and passing through walls, floors, partitions, or ceilings in finished areas, mechanical rooms and at exterior walls (interior and exterior sides). Size plates to fit pipe or insulation and securely lock in place with a set screw.

B. Caulk all wall and floor penetrations in fire rated construction air tight with fire stop sealant. In non-rated construction, caulk penetrations on one side only, using a sealant suitable for use with the materials being caulked, to minimize noise transmission.

3.5 ISOLATION VALVES

A. Install piping systems with line size shutoff valves at the risers, at branch connections to mains, at all equipment, and at other locations as indicated and/or required for maintenance.

3.6 DRAIN VALVES

A. Install drain valves at all low points of water piping systems so that these systems can be entirely drained. Install a 2 in. drain for 2 in. pipes and larger. Install a line size drain valve for pipes smaller than 2 in.

3.7 CLEANING OF PIPING SYSTEMS

A. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the systems in service. Remove all equipment from piping system during tests, and reconnect upon completions of tests. Use whatever temporary connections are required for cleaning, purging and circulating. Perform all cleaning in the presence of the Owner's Representative.

B. Install temporary strainers in front of pumps, tanks, water still, solenoid valves, control valves, and other equipment where permanent strainers are not indicated. Keep these strainers in service until the equipment has been tested, then remove either the entire strainer or the straining element only. Fit strainers with a line size blow-off valve.

C. Special requirements, if any, are specified in the sections on each type of piping.

END OF SECTION 23 20 00

SECTION 23 20 13 - HVAC PIPING - COLD WATER MAKE-UP AND EQUIPMENT DRAINS

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of piping and piping appurtenances to drain air handling units, fan coil units, rooftop units, heat recovery units and other equipment requiring drains.

1.2 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00 Common Work Results for HVAC.
B. Refer to Section 23 20 00 HVAC Piping - General.

1.3 SUBMITTALS

A. Submit manufacturer’s technical product data for valves and backflow preventors. Include sufficient data to substantiate that materials conform to the requirements of this section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products properly packaged in factory-fabricated containers.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging products.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Furnish seamless, hard-drawn, Type L, copper water tube conforming to ASTM B88, and wrought copper fittings.

2.2 TRAPS

A. On each air handling unit condensate drain, furnish a trap deep enough to overcome the pressure of the unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in strict and complete accordance with manufacturer's recommendations.
B. Refer to Section 23 07 19 HVAC Low Temperature Piping Insulation, for piping insulation.

END OF SECTION 23 20 13

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the furnishing and installation of copper tubing, valves, strainers and sight glass for refrigerant piping.

B. Related sections

1. Section 23 05 00 Common Work Results for HVAC
2. Section 23 20 00 HVAC Piping - General

1.2 SUBMITTALS

A. Submit manufacturer's technical product data for piping and other items specified in this section. Include sufficient data to substantiate that materials conform to the requirements of this section.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with ends capped.

B. Store in a clean, dry space. Protect piping from weather, damaging fumes, construction debris and traffic. Keep ends of piping capped at all times except when actually joining ends of piping.

C. Handle carefully to avoid damaging piping.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Type L-ACR, hard-drawn copper tubing

B. Sweat-type, wrought copper fittings

C. Cast fittings are not permitted.

2.2 SERVICE VALVES

A. Angle or globe service valves, with sweat connections

B. Use packed-type valves with gasketed seal cap and back seat feature.

C. Wrench operated

D. Especially designed for refrigerant service, in conformance with the ARI code.

2.3 SOLENOID VALVES (If required by manufacturer)

A. Pilot-operated, floating piston solenoid valves suitable for operation with refrigerant

B. Bronze body and sweat-type connections

C. Stainless steel stem and plunger assembly; stainless steel piston

D. Sealed and moisture-resistant coils

E. 115 volt, 60 hertz

2.4 SIGHT GLASSES

A. Suitable double-window sight glass

2.5 STRAINERS

A. Y-pattern or angle-type, especially designed for operation with refrigerant specified

B. Constructed to permit removal of filter element without removing strainer from the line

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate service valves at the inlet and outlet of each compressor, on both sides of each strainer and solenoid valve, and as otherwise shown and specified.

B. Locate sight glasses in the liquid line leaving the condenser or receiver.
C. Locate strainers as recommended by compressor manufacturer.

3.2 PRESSURE TEST
A. After all refrigerant equipment and piping are installed, charge the system with the proper refrigerant and dry nitrogen to 300 psig.
B. Test all joints with a Halide torch or an electronic leak detector.
C. Repair all leaks and retest each system until proved absolutely tight.

3.3 EVACUATION AND DRYING
A. After refrigerant system has been pressure tested, connect a suitable vacuum pump, and evacuate piping system, including all lines and equipment.
B. Maintain a vacuum as high as practicable for long enough to evaporate all the moisture in the system (at least 48 hours).
C. Check the humidity within the system with a wet bulb indicator, and maintain the vacuum until the wet bulb temperature is reduced to -40°F. After the system has been evacuated and dried, break the vacuum by charging proper refrigerant into the system.

END OF SECTION 23 23 00

SECTION 23 31 00 - HVAC DUCTS

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of low velocity and high velocity ductwork and all accessories.

1.2 REFERENCE STANDARDS

A. Air Diffusion Council – Flexible Duct Performance & Installation Standards.
B. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
C. NFPA Standard 90A.
D. SMACNA HVAC Duct Construction Standards.

1.3 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00, Common Results for HVAC.
B. Refer to 23 07 13 External Duct Insulation.

1.4 SUBMITTALS

A. Submit manufacturer’s technical product data for flex ducts, duct sealant materials, control devices, volume dampers, fire and smoke dampers, access doors, duct mounted smoke detectors, louvers, flues and flue caps, and duct lining. Include sufficient data to substantiate that materials conform to the requirements of this section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver control devices, dampers, fire and smoke dampers, etc. properly packaged in factory-fabricated containers.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic. Protect the inside of ductwork and all portions of air moving systems from contamination by construction dust, paint overspray, and any other form of contamination by keeping all duct and air equipment openings sealed airtight during the entire course of construction.
C. Handle carefully to avoid damaging materials.

1.6 GUARANTEES AND WARRANTIES

A. Guarantee all ductwork for one year from the date of final acceptance from all noise, chatter, whistling, or vibration. Ductwork must be free from pulsation under all conditions of operation.

PART 2 - PRODUCTS

2.1 DUCT MATERIAL

A. Except for special ducts specified elsewhere, use prime galvanized steel sheets or coils up to 60 in. wide. Stencil each sheet with proper gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10 ft. centers with gauge and manufacturer's name. Engineer may random check duct and strap gauges with a micrometer to verify compliance with these Specifications.

2.2 SEAM AND JOINT SEALANT

A. Water Based Duct Sealant. Furnish water based sealant, formulated to withstand working temperatures of -25°F to 200°F. Sealants must exceed 500 hours under ASTM C 732 (artificial weathering) and pass ASTM C 734 (low temperature flexibility after artificial weathering). Furnish sealants with an elastomeric nature, weigh no more than 12.5 lbs. per gallon, have solids by weight of 75% + or - 2%, and pass UL 723 with a flame spread of 5 and a smoke developed of

5.
1. Smooth texture: Design Polymerics DP 1010, Childers CP146 , Fosters 32-19, Hardcast Flex-grip 550.
2. Fiber Reinforced: Design Polymerics DP 1020, Fosters 32-17, Hardcast 321.
3. Acceptable Manufacturers: Childers, Design Polymerics, Fosters, Hardcast.

2.3 LOW PRESSURE DUCTWORK (LESS THAN 2 IN. STATIC PRESSURE)

A. Rectangular. This typically includes all ductwork downstream of air terminal units; where there are no air terminal units in the system, typically all ductwork is considered low pressure unless otherwise indicated on the drawings. Furnish rectangular low pressure ducts, fabricated of sheet metal in the following minimum gauges:

Largest Dimension	U.S. Gauge
12" and less	No. 26
13" to 30"	No. 24
31" to 54"	No. 22
55" to 84"	No. 20
85" and above	No. 18

B. Round. Furnish round, low-pressure ducts which are spiral wound, such as manufactured by United McGill, or shop fabricated round ducts with Pittsburgh lock longitudinal seams. Use the following gauges for shop fabricated ducts:

Diameter	U.S. Gauge
12" and less	No. 26
13" to 30"	No. 24
31" to 42"	No. 22
43" to 60"	No. 20

1. Acceptable Manufacturers:
   a. Duct Direct
   b. Graco Mechanical
   c. Lewis & Lambert
   d. Lindab
   e. Semco
   f. Spiral Pipe of Texas
   g. United McGill
   h. Approved equivalent.

C. Round Double-Wall.
1. Furnish round, double-wall duct where indicated on the drawings or where specified to be used.
2. Use double wall duct for all sheet metal ducts in gymnasiums.
3. Use double wall duct for all sheet metal ducts exposed in cafeterias.
4. Use double wall duct for all sheet metal ducts exposed in libraries / multi-media centers.
5. Furnish United McGill ACOUSTI-k27 spiral lock seam duct or equivalent.
6. Furnish with 1 in. glass fiber insulation, paint-grip galvanized steel outer shell, and perforated galvanized inner liner.
7. Furnish matching double-wall fittings.
8. Furnish with slip coupling through 36 in. outside diameter, Spiralmate UNI-RING couplings from 37 through 48 in. outside diameter.

9. Furnish with single-strap or double-strap hangers.
10. Furnish with double-wall rectangular shoe-tap takeoffs to air devices where rectangular taps are indicated.
11. Acceptable Manufacturers:
    a. Duct Direct
    b. Graco Mechanical
    c. Lewis & Lambert
    d. Lindab
    e. Semco
    f. Spiral Pipe of Texas
    g. United McGill
    h. Approved equivalent.

D. Low Pressure Insulated Flexible Duct. Furnish factory-fabricated, flexible duct for connections between low velocity trunk ducts and air devices as indicated on the Drawings. Do not use flexible duct in exhaust systems unless specifically indicated on the Drawings. Furnish flexible duct with the following characteristics.
1. Airtight inner liner, insulation and outer jacket. Inner liner of coated steel helix and fabric, substantially bonded together to prevent the duct from collapsing or kinking in short radius bends.
2. Fiberglass insulation with minimum R value of 6.0 installed in accordance with Air Diffusion Council – Flexible Duct Performance & Installation Standards, using ASTM C518 at installed wall thickness on flat insulation only.
3. Sheath the entire assembly with heavy, outer vapor-barrier jacket of reinforced aluminum foil kraft.
4. Rated at a minimum positive working pressure of 1½ in. of water.
5. Listed by UL at flame spread rate of not over 25 and smoke developed rate of not over 50, and complying with NFPA Standard 90A, paragraph 113a.
6. Where specifically indicated on the Drawings, flexible ducts for exhaust application must withstand a negative pressure of 1½ in. of water.
7. Acceptable Manufacturers:
    a. Atco
    b. Cody
    c. Flexmaster
    d. Thermaflex

E. Volume Dampers.
1. For rectangular ducts, furnish opposed-blade volume dampers with an appropriate control device with stand-off for insulation., in accordance with SMACNA Duct Manual. Furnish multi blade dampers when blade width exceeds 12 in.
2. For round ducts, furnish butterfly or radial dampers with an appropriate control device, in accordance with SMACNA Duct Manual.
3. Furnish dampers fabricated from same material as duct.

F. Elbows.
1. Rectangular. Furnish Barber-Colman or equivalent double-wall air foil turning vanes. Job-fabricated turning vanes, if used, must be double thickness vanes of galvanized steel sheets of the same gage metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset. As an alternative, furnish radius elbows with a centerline radius of not less than 1-½ times the duct width in lieu of vaned elbows, where space and air flow requirements permit.
2. Round and Oval Duct. Furnish elbows with a centerline radius of 1-½ times the duct diameter or duct width. For round ducts, furnish smooth elbows or 5-piece, 90° elbows and 3-piece, 45° elbows.

G. Control Devices. For ducts which are not concealed, or ducts which are above lay-in ceiling but accessible, furnish heavy-duty, quadrant-type, adjustable regulators having wing nuts for locking

in position.

H. Remote Operated Dampers. Where volume dampers are located above ceilings, furring, or in other inaccessible locations, furnish factory-fabricated cable operated remote controlled volume dampers with actuator and cable. Either furnish internal actuator and cable that is adjustable through the diffuser face or external actuator and cable that is adjustable at the ceiling line in a concealed ceiling cup secured to the ceiling framing or in a self supporting 2 in. round ceiling cup. Furnish operators that are adjustable with a wrench.
   1. Acceptable Manufacturers:
      a. Metropolitan Air Technology (Rototwist)
      b. Young Regulator

2.4 FABRIC AIR DISPERSION SYSTEM

A. Fabric: Construct of a woven fire retardant fabric complying with the following physical characteristics:
   1. 100% Flame Retardant and treated with a machine wash-able anti-microbial agent from the manufacturer.
   2. Weight: 6.75 oz/yd^2 per ASTM D3776.
   3. Color: Furnish standard color. Include color swatches in submittal for selection by architect.
   4. Color: Furnish custom color. Include color swatches in submittal for selection by architect.
   5. Temperature Range: 0 to 180 degrees F.
   6. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the flame spread/smoke developed requirements of NFPA 90-A and ICC AC167.
   7. Antimicrobial agent shall be proven 99% effective after 10 laundry cycles per AATCC Test Method 100.
   8. SedonaXMCF by Ductsox, Combi 80 by FabricAir, or approved equivalent.

B. System Fabrication
   1. Linear vent consisting of an array of open orifices or mesh slot.
   2. Size and location of vent openings or slot to be determined by manufacturer based on the duct airflow, static pressure, location, and room configuration as indicated on the drawings.
   3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Secure anchor patches to metal duct via. zip screw fastener – supplied by contractor.
   4. Include zipper on inlet connection for easy removal / maintenance.
   5. Include required zippers as specified by manufacturer for length of duct.
   6. Include zipper on end cap for easy removal / maintenance.
   7. Make any deviation from a straight run using a gored elbow or an efficiency tee. Normal 90 degree elbows are 5 gores and the radius of the elbow is 1.5 times the diameter of the straight duct.

C. Suspension System
   1. Single Tension Cable: Use a plastic coated stainless steel tension cable system including a single cable located 3” above top-dead-center of the duct. Include cable, eye bolts, thimbles, cable clamps and turnbuckle(s) as required. Use nylon cable clips spaced 24 inches for system attachment.

D. Acceptable Manufacturers.
   1. Ductsox, FabricAir, KE Fibertec or Nanosox.

2.5 FIRE AND SMOKE DAMPERS

A. Quality Standards.
   1. Furnish fire, fire/smoke, and smoke dampers complying with applicable codes, NFPA Standards, and SMACNA Duct Manual.
   2. Furnish dampers which bear UL label.
   3. Furnish dynamic dampers rated under the latest UL 555 or UL 555S standard as

appropriate.

B. One Manufacturer. All fire, smoke, and combination fire/smoke dampers furnished for the project must be manufactured by the same manufacturer.

C. Fire Dampers. Furnish fire dampers that are suitable for dynamic systems (marked "FOR USE IN DYNAMIC SYSTEMS").
   1. Furnish dampers with a UL fire resistance rating of 1-1/2 hour rated (or greater where required by the rated construction as indicated on the Drawings), with a 165°F fusible link.
   2. Curtain Style.
      a. Furnish with curtain style blades, Type B (blades out of the airstream).
      b. Furnish galvanized steel frame in gauges required by manufacturer's UL listing.
      c. Furnish damper as a single assembly with an integral factory sleeve.
      d. Furnish damper with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing.
      e. Acceptable manufacturers
         i. Ruskin DIBD2
         ii. Greenheck DFD-150
         iii. Nailor D0100
         iv. Pottorff VFD-10D
   3. Multiblade
      a. Furnish galvanized steel frame in gauges required by manufacturer's UL listing.
      b. Furnish with damper blades of 16 ga. galvanized steel strengthened by three longitudinal 1" deep Vee grooves running the entire length of each blade. Close the blades with a spring when the fusible link releases.
      c. Acceptable Manufacturers: Nailor 1250, Pottorff FD-140,
      d. Furnish with damper blades of 16 ga. Galvanized steel airfoil-shaped single-piece.
      e. Furnish damper that is UL rated for dual direction air flow.
      f. Furnish dampers with a maximum pressure drop of 0.07 inches w.g. at 2,000 feet per minute through 24 x 24 inch damper.
      g. Acceptable manufacturers
         i. Ruskin DFD-60
         ii. Greenheck DFDAF-310
         iii. Nailor D1200
         iv. Pottorff FD-150

D. Combination Fire and Smoke Damper.
   1. Furnish galvanized steel frame in gauges required by manufacturer's UL listing.
   2. Furnish with damper blades of 16 ga. Galvanized steel airfoil-shaped single-piece, Class II leakage rating.
   3. Furnish dampers with a UL fire resistance rating of 1-1/2 hour rated (or greater where required by the rated construction as indicated on the Drawings).
   4. Furnish with a quick detect heat actuated temperature release device set at 165°F with the following features:
      a. Close and lock damper during test, smoke detection, power failure, or fire conditions through actuator closure spring. At no time shall actuator disengage from damper blades.
      b. Allow damper to be automatically and remotely reset after test or power failure conditions. After exposure to high temperature or fire, inspect damper before reset to ensure proper operation.
      c. Controlled closing and locking of damper in 7 to 15 seconds to allow duct pressure to equalize. Instantaneous closure is not acceptable.
   5. Furnish damper that is UL rated for dual direction air flow.
   6. Furnish an externally-mounted 120V two-position fail-close actuator,,which is automatic remote resettable after testing, smoke detection, or power failure, and which fails closed. The actuator must be rated for energized hold open position periods of 6 months or more.

7. Furnish dampers with a maximum pressure drop of 0.12 inches w.g. at 2,000 feet per minute through 24 x 24 inch damper.
8. Acceptable manufacturers
   a. Greenheck FSD-33
   b. Nailor 1200
   c. Pottorff FSD-150
   d. Ruskin FSD-60.

2.6 FLUES AND FLUE CAPS

A. Furnish all boiler, water heater and other gas appliance flues (including connection to all such appliances) specified elsewhere. Construct flues, which pass through occupied or equipment room spaces, of black steel sheets not lighter than 18-gage, in accordance with the recommendations of SMACNA. Where flues pass through chases or attic spaces, furnish double wall type, Metalbestos, or approved equivalent.

B. Furnish flue caps of such design that wind action from any direction will create a vacuum in the flue.

C. Acceptable Manufacturers
   1. Breidert
   2. Metalbestos

2.7 FLEXIBLE CONNECTIONS

A. Where ducts connect to fans or air handling units, furnish "Ventglas" fabric. The fabric must be fire-resistant, waterproof and mildew resistant with a weight of 22 oz. per sq. yd. For outdoors applications, furnish Duall fan connector, Koroseal, black with UV inhibitors.

B. Acceptable Manufacturers
   1. Durodyne
   2. Duall
   3. Koroseal

2.8 ACCESS DOORS

A. Furnish heavy gauge galvanized steel access doors with two cam locks or piano hinge on one side and cam lock on the other. Construct doors which occur in insulated ducts with an insulation filler.

B. Acceptable Manufacturers
   1. Flexmaster
   2. Nailor

2.9 FLASHING

A. Furnish flashing not less than No. 26 gauge stainless steel or 16 oz. copper.

2.10 TEST HOLES

A. Furnish test holes with plug fittings in ducts and plenums necessary for using pitot tubes for taking air measurements to balance the air system.

B. Do not tap hole in the ductwork or plenums.

C. Furnish Ventfabrics, Inc. No. 699 instrument test holes.

PART 3 - EXECUTION

3.1 GENERAL

A. Erect all ducts in the general locations shown, but conform to all structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make all necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.

3.2 INSTALLATION

A. Construction Standards. Use construction methods which follow the requirements outlined above, as well as SMACNA Balancing and Adjusting publications, unless otherwise indicated in these Specifications or the Drawings.

B. Reinforcement. Reinforce ducts having one side equal to 25 in. or more in accordance with recommended construction practices of SMACNA.

C. Plenum Construction. Construct plenum chambers of not less than No. 20 U.S. gauge metal, reinforced with galvanized structural angles.

D. Cross Breaking or Beading. Cross break or bead sheet metal for rigidity, except ducts which are 12 in. or less in the longest dimension.

E. Wall Penetrations. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers. At all locations where ductwork passes through floors, install watertight sleeves projecting 3 in. above finished floor and flush with bottom of floor slab. Fabricate sleeves of ⅛ in. thick steel, galvanized after fabrication. Anchor into adjacent floor slab as required. Sleeves are required inside as well as outside chases. Support ducts where passing through floors with steel structural angles of adequate bearing surface, galvanized after fabrication, and resting on top of the sleeve.

F. Sealing. Seal the entire duct system.

G. Interior Painting. Paint interior of metal ductwork exposed to view through grilles, registers, and other openings. Do not install grilles, registers, or similar items until painting is complete.

3.3 LOW PRESSURE DUCTWORK

A. Branch splits. At each supply or exhaust duct tap serving two or more air outlets, install a shoetap (lo-loss) fitting or conical tap and volume damper (in either case), whether or not indicated on the Drawings, in accordance with SMACNA Duct Construction Manual.

B. Taps. At supply, return, and exhaust taps serving a single air outlet, install the same as for branch splits. On return ductwork, only install volume dampers where indicated on the drawings, or if a volume is scheduled in the air device callout on the drawing. For supply taps, refer to the detail on the drawings.

C. Volume Dampers. Install volume dampers in each return air, outside air and exhaust branch duct, in exhaust connections to hoods or equipment, in each zone at multizone unit discharge, and where otherwise indicated, in accordance with SMACNA Duct Manual.

D. Controls. For control devices concealed by ceilings, furring, or in other inaccessible locations, install extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified or otherwise indicated on the Drawings. For ducts which are not concealed, or ducts which are above lay-in ceiling but accessible, install heavy-duty, quadrant-type, adjustable regulators having wing nuts for locking in position. Saw-mark the ends of all operating rods for dampers and air control devices to indicate damper position.

E. Obstruction. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.

F. Remote Operated Dampers. Install remote operated dampers where indicated on the drawings or otherwise required for proper operation. Coordinate exact location of all such dampers and remote knobs with Architect prior to rough-in.

G. Low Pressure Insulated Flexible Duct.

1. Install in accordance with the guidelines of the Air Diffusion Council – Flexible Duct Performance & Installation Standards.
2. Install in lengths not exceeding 6 ft. Use the minimum length of flexible duct required for a workmanlike installation.
3. Follow manufacturer's recommendations for installing ducts to collars or ducts to ducts. For securing flex duct to collars or ducts, use either stainless steel clamps with worm gears

or nylon drawbands.

4. Seal flexible duct connections with 3M 900 mastic end tape or equivalent.
5. Support flexible duct independently of lights, ceiling and piping. Support air devices independently of flexible ducts.
6. Support flexible ducts at intervals as recommended by the manufacturer, but no more than 5 ft. on centers.
7. Connections of flexible duct to rigid duct or equipment is considered to be a support.
8. Maximum allowable sag of straight flexible duct runs between supports is ½" per foot.
9. Use a minimum of 1-1/2" wide metal bands to support flexible ducts. Do not support ducts using plastic braided straps.
10. Centerline radius of bends must be at least one times the duct diameter.
11. Avoid contact between flexible ducts and metal fixtures, pipes, and conduits.

H. Low Pressure Duct Supports.

1. Horizontal Ducts Up To 40 In. Support horizontal ducts up to and including 40 in. in their greater dimension by means of No. 18 U.S. gauge band iron hangers attached to the ducts by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on no more than 8 ft. centers. Use clamps to fasten hangers to reinforcing on sealed ducts.
2. Horizontal Ducts Larger Than 40 In. Support horizontal ducts larger than 40 in. in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on no more than 8 ft. centers according to the following:

Angle Length	Angle	Rod Diameter
4 ft.	1½" x 1½" x ⅛"	1/4"
6 ft.	1½" x 1½" x ⅛"	1/4"
8 ft.	2" x 2" x ⅛"	5/16"
10 ft.	3" x 3" x ⅛"	3/8"

3. Vertical Ducts. Support vertical ducts where they pass through the floor lines with 1½ in. x 1½ in. x ¼ in. angles for ducts up to 60 in. Above 60 in. increase the angles in strength and size on an individual basis, considering space requirements.

3.4 FABRIC AIR DISPERSION SYSTEM

A. Installation: Install suspension system in accordance with the requirements of the manufacturer. Furnish manufacturer's instructions with product.

B. Cleaning and Protection

1. Clean air handling unit and ductwork prior to the fabric duct system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.
2. Temporary Closure: Cover ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation with polyethylene film or other covering which will keep the system clean until installation is completed.
3. Should fabric duct become soiled during installation, remove and clean following the manufacturers standard terms of laundry, and reinstall.

3.5 DUCT SUPPORTS

A. Install hangers and supports in accordance with the latest edition of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible".

B. Where trapeze hangers or strap hangers that totally encircle a round duct are used, install rigid board insulation between the support and the hanger. Extend the rigid board a minimum of 4 in. on each side of the duct support. Refer to 23 07 00 for insulation requirements. Installing the duct on the trapeze hanger and insulating around the hanger is not acceptable.

3.6 FIRE AND SMOKE DAMPERS

A. Install fire and smoke dampers in accordance with all applicable code requirements.
B. Install fire and smoke dampers in accordance with all manufacturer's recommendations.
C. Install fire and smoke dampers in locations as indicated on the Drawings.
D. As part of the ductwork shop drawing procedure, review the Architectural Drawings to verify the locations and extent of all fire and/or smoke rated construction. Point out any discrepancies discovered between the Architectural and Mechanical Drawings as part of this review, prior to duct fabrication, and request clarification from the Architect/Engineer.
E. Install an access door at every fire and smoke damper. Locate the access door where it will be most accessible; where possible and accessible, locate in corridors, mechanical rooms, and other similar locations.

3.7 DUCT-MOUNTED SMOKE DETECTORS.

A. Install duct-mounted smoke detectors furnished under Division 28, and shown on the electrical drawings.

3.8 CONTROL DAMPERS.

A. Edit for correct controls section. Refer to Section 23 09 23 Facility Management System - BACnet. Install dampers as required by this section.

3.9 FLUES AND FLUE CAPS

A. Install all flues and flue caps required for gas-fired boilers, heaters, and other appliances in accordance with all applicable code requirements and in accordance with all manufacturer's recommendations. Refer to the Drawings for quantities and locations of applicable appliances.

3.10 FLEXIBLE CONNECTIONS

A. Where ducts connect to fans or air handling units, make flexible airtight connections. Install so as to maintain a minimum of ½ in. slack in the connections, and a minimum of 2½ in. distance between the edges of the ducts. Also allow a minimum of 1 in. slack for each inch of static pressure on the fan system. Securely fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where rectangular connections are made in outdoor locations, seal fabric to metal with mastic. For connections to belted vent sets outdoors, install Duall fan connector, Koroseal, and secure with stainless steel bands.

3.11 ACCESS DOORS

A. Install ductwork access doors in structural angle frames, arranged for convenient access.

3.12 FLASHING

A. Where ducts pass through roofs or exterior walls, install suitable flashing to prevent rain or air currents from entering the building.

3.13 HOLES AND OPENINGS

A. Either machine punch or drill all holes for damper rods and other necessary devices and make them no larger than necessary. Pin punching them is not acceptable.
B. Install sheet metal caps over openings that are to be left unconnected for any length of time.
C. In general, do not use sheet metal screws in the duct construction unless the head (not the point) of the screw is in the air stream.

3.14 DUCT LEAK TESTING

A. Allowable Leakage. Maximum allowable leakage is 5% of total flow.
B. Scope of testing. Test ductwork for leaks before concealing. Test sections of installed duct systems as randomly selected by Engineer. Test approximately10% of the entire duct system.

Perform additional testing beyond the initial 10% as part of the Work if any of the initial tests are not within the allowable leakage requirements. The extent of additional testing is at Engineer's discretion, depending on the failure rate and actual leakage as a percentage of total flow.

C. Equipment. Include equipment necessary for performing tests, including rotary blower, orifice section and U-tube gage board complete with cocks and rubber tubing.

D. Risers and Branch. Test duct riser or branch duct including flexible duct runouts in accordance with SMACNA manual.

E. Mains. Test mains after risers and branches are connected and all equipment set. Close runout connections and place fan in operation. Maintain pressure in mains at least 1 inch water gauge above design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are proven airtight.

END OF SECTION 23 31 00

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.1 SCOPE

A. This section includes the furnishing and installation of air distribution devices, including grilles, diffusers, registers, dampers, and similar equipment.

B. Related Sections

1. Section 23 05 00 Common Work Results for HVAC

1.2 SUBMITTALS

A. Submit product data for grilles, diffusers, registers, dampers, and similar equipment. Submit a table of sound data, indicating the NC level of each air device at the maximum scheduled airflow rate. Include sufficient data to substantiate that materials conform to the requirements of this section.

B. Submit product data and sound attenuation data for sound attenuators. Include sufficient data to substantiate that materials conform to the requirements of this section.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver air devices properly packaged in factory-fabricated containers.

B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handle carefully to avoid damaging air devices.

PART 2 PRODUCTS

2.1 FINISHES

A. Unless otherwise indicated, paint devices with factory standard white enamel finish.

2.2 DIFFUSERS

A. Louvered. Furnish louvered, fixed-pattern, multiple cone diffusers with removable center cone, frames and white factory finish.

1. Select faces and necks that are circular, rectangular or square, of the size and configuration indicated.
2. Construct diffusers and frames of aluminum or steel as indicated in the schedule.
3. Use a frame compatible with the type of ceiling in which the diffuser is installed.

B. Perforated. Furnish adjustable-pattern, aluminum or steel (as indicated in the schedule) diffusers and frames with white factory finish. Frame the diffuser face with a mitered and welded frame fitted with controllers of adjustable pattern.

C. Linear bar. Furnish in one-piece lengths up to 6 feet. Furnish diffuser lengths greater than 6 feet in multiple sections that are designed to joined together end-to-end with alignment strips or pins to form a continuous appearance. Furnish all alignment components.

1. Furnish diffuser core with extruded aluminum bars locked into a heavy extruded aluminum border. The deflection bars must be fixed and parallel to the long dimension. The core must have support bars located no more than 9 inches apart that are parallel to the short dimension.
2. Furnish floor models of the diffuser with heavy duty mounting frames (frames 5, 6 or 15) and removable cores for easy access. Furnish core support bars that are located no more than 6 inches apart and are parallel to the short dimension for added strength.
3. Furnish with white, clear anodized or aluminum finish as scheduled.

D. Dampers. Where indicated, furnish an opposed-blade damper easily adjustable through the outlet. Furnish operating rod extensions as required for damper adjustment.

2.3 GRILLES

A. Supply. Use double-deflection supply grilles made of aluminum or steel as indicated in the schedule.
   1. Furnish vertical face blades and horizontal rear blades. Furnish solid, extruded aluminum blades which are individually adjustable. Space at not more than ⅛ in. centers for rear blades and ½ in. centers for face blades and not less than ⅝ in. deep.
   2. Employ grille frames of extruded aluminum or steel as indicated in the schedule, with welded and mitered corners and mounting gaskets.

B. Return.
   1. For ceiling return, furnish perforated-face or louvered type, with white factory finish. Use construction and frame styles as specified for ceiling diffusers, but without pattern controllers. Use neck sizes as indicated on the Drawings.
   2. For wall return, furnish a fixed-blade, aluminum or steel grille as indicated in the schedule, essentially sightproof, having curved or angular break, inclined blades. Space the blades at ½ in. centers to achieve sightproof feature. Furnish hemmed or fully rounded leading edges. Furnish extruded aluminum grille frames with welded and mitered corners. Include mounting gaskets.

C. Door Grilles. Furnish sightproof door grilles with core of aluminum or steel construction as indicated in the schedule. Finish with prime coat suitable for field painting.

2.4 REGISTERS

A. Supply. Furnish double-deflection supply registers with , vertical face blades and horizontal rear blades. Use an integral, key-operated, opposed blade damper.
   1. Furnish solid, extruded aluminum or steel blades as indicated in the schedule which are individually adjustable. Space not more than ¾ in. centers for rear blades and ½ in. centers for face blades and not less than ⅝ in. deep.
   2. Furnish grille frames of extruded aluminum or steel as indicated in the schedule with welded and mitered corners and mounting gaskets.

B. Return and Exhaust. Furnish return and exhaust registers identical to return grilles except for the addition of an integral key-operated, opposed-blade damper.

2.5 ACCESSORIES

A. Mounting Frames. Furnish a companion, all-purpose mounting frame constructed like a grille frame for each grille or register not equipped with a removable core to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.
   1. Furnish frames with ½ in. thick sponge rubber gasket to prevent air leakage.
   2. Furnish a frame that neatly fits the grille. Mounting frames are not required for grilles or registers mounted directly on exposed ductwork.

2.6 ACCEPTABLE MANUFACTURERS

A. Air devices:
   1. Krueger
   2. Metalaire
   3. Nailor
   4. Price
   5. Titus

PART 3 EXECUTION

3.1 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26, Electrical, to ensure that intended functions of lighting and air systems are achieved.

3.2 INSPECTION

A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return air blank-off strips and flexible duct have been properly approved. Remove and reinstall any part of the installation found incorrect.

3.3 INSTALLATION

A. Diffusers. Mount louvered diffuser outlets tightly against the ceiling. Fasten outlets securely to ductwork with sheet metal screws. For diffusers, attach the frame assembly by a concealed hinge assembly to an outer frame compatible with the type of ceiling in which the diffuser is installed.

END OF SECTION 23 37 13

SECTION 23 74 18 - PACKAGED INDOOR ENERGY RECOVERY UNITS WITH DESICCANT WHEELS

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of components to rebuilt the existing single-zone, constant volume, 100% outside air unit with desiccant wheel, and electric heat for indoor application. The contractor will be responsible for a turnkey installation of new fans, enthalpy wheel, electric heating element, controls, relays, fuses and all other accessories for a complete and working system.

1.2 REFERENCE STANDARDS

A. ARI Standard 1060 for Air-to-Air Energy Recovery Ventilation Equipment
B. ARI Standard 410 (performance rating).
C. ARI Standard 270 (sound rating).
D. ASHRAE 62.
E. Labeled and Listed by ETL and by UL
F. Furnish units that comply with IECC 2015.

1.3 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00, Mechanical General Provisions.

1.4 SUBMITTALS

A. Submit manufacturer's technical product data for each component. Include sufficient data to substantiate that each unit conforms to the requirements of this section, and provides the performance indicated on the Drawings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver units properly packaged in factory-fabricated containers. Deliver to the site when required by the project schedule.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging units.

1.6 OPERATION & MAINTENANCE DATA

A. Submit in accordance with Division 01 and Section 23 05 00.

1.7 GUARANTEES AND WARRANTIES

A. Deliver to the Owner a five-year warranty on each compressor.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish units with sizes, arrangements, capacities and performance shall be as indicated on plans and schedules.
B. Furnish units that are factory preassembled, tested and shipped complete with all components necessary to maintain humidity and temperature control levels independent of load variations within design limits.

2.2 UNIT CASING AND FRAMES

A. The existing unit casing is to be reused.
B. Replace gasketing at demounting locations where unit will be disassembled for removal and installation of new components.

2.3 ACCESS DOORS

A. All components shall be easily accessible through hinged access doors for exhaust, supply, filter, and damper compartments.

B.

2.4 ENERGY RECOVERY WHEEL

A. Enthalpy type for both sensible and latent energy recovery
B. Designed to insure laminar flow.
C. Energy transfer ratings must be ARI Certified to Standard 1060
D. Desiccant, silica gel for maximum latent energy transfer.
E. Constructed of lightweight polymer media.
F. Mount polymer media in a stainless steel rotor for corrosion resistance.
G. Removable wheel segments.
H. Permanently bond Silica gel desiccant to wheel media.
I. Use high strength urethane material for energy recovery drive belt and factory install it in a pre-stretched state.

2.5 FANS

A. Centrifugal fans to be double width, double inlet, forward curved type.
B. Statically and dynamically balance blower wheels.
C. Grind and polish steel fan shafts that are mounted in permanently lubricated, sealed ball bearing pillow blocks.
D. Selected bearings for minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds.
E. Provide separate motors for exhaust and supply blowers.
F. Multi-tap PSC motor.
G. Mount fan and motor assemblies to unit base with neoprene isolators as standard.
H. Locate fans in draw-through position in reference to the energy recovery wheel.

2.6 MOTORS AND DRIVES

A. Motors that are energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures
B. Permanently lubricated motors
C. Integral overload protection on energy wheel motors.

2.7 FILTERS

A. 2-thick supply and exhaust air filters
B. Pleated fiberglass.
C. Merv 8
D. Tested to meet UL Class 2.
E. Die-formed, galvanized steel filter racks.

2.8 ELECTRICAL

A. Factory wire all internal electrical components for single point power connection.
B. Wire units with electric reheat for an independent power supply,.(where scheduled).
C. Electrical components that are UL Listed, Approved, or Classified where applicable and wired in compliance with the National Electrical Code.
D. Weatherproof, integral door interlocking disconnect switch
E. standard components in the control center
   1. Motor starters
   2. Control circuit fusing
   3. Control transformer for 24 VAC circuit
   4. Terminal strip.
F. Motor starters that consist of a contactor and Class 20 electronic adjustable overload protection.

2.9 COOLING COIL (where scheduled)
- A. Direct expansion that are factory tested and rated in accordance with ARI 410.
- B. Copper tubes with permanently expanded aluminum fins, 12 fpi or less.
- C. Equipped with distributors to receive expansion valves at the liquid connections.
- D. Stainless steel drain pan.
- E. Size with remote condensing unit.

2.10 ELECTRIC HEAT (where scheduled)
- A. UL listed and circuit fused per NEC.
- B. Heater for multi-step control
- C. Factory wired and installed.
- D. 24 volt control with class 2 transformer.
- E. Standard air flow switch to shut down heater if air ceases to flow across heater.

2.11 SEQUENCE OF OPERATION
- A. Refer to section 23 09 23 for control requirements.

2.12 ACCEPTABLE MANUFACTURERS
- A. Greenheck, or approved equivalent.

PART 3 - EXECUTION

3.1 COORDINATION
- A. Coordinate size and configuration of new roof curb to match existing roof curb.

3.2 INSTALLATION
- A. Install according to manufacturer's recommendations and as indicated on the Drawings.
- B. Coordinate exact location of each unit with Structural Engineer prior to release of structural shop drawings for fabrication. Make all ductwork or other modifications required as a result of having to shift the location of any units resulting from failure to comply with this provision.
- C. Coordinate installation of curb with roofing installer.
- D. Install a trapped condensate drain to nearest roof drain, gutter, or other suitable drain; do not discharge onto roof or ground.
- E. Coordinate with Controls contractor.

3.3 STARTUP AND TESTING
- A. Manufacturer’s representative shall instruct owner regarding its functions and sequence of operation and verify in writing that the unit has been installed in accordance with the manufacturers recommendations.
- B. Manufacturer’s service technician is to work with the controls contractor until digital and analog inputs and outputs are successfully mapped to the FMS. Verify proper operation of each unit in each mode of operation.
- C. Verify that each unit is properly charged and lubricated; adjust as required.

END OF SECTION 23 74 23

SECTION 23 74 23 - PACKAGED INDOOR ENERGY RECOVERY VENTILATORS WITH HEAT WHEELS

PART 1 GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of a single-package, single-zone, constant volume, 100% outside air unit with desiccant wheel, and electric heat for indoor application.

1.2 REFERENCE STANDARDS

A. ARI Standard 1060 for Air-to-Air Energy Recovery Ventilation Equipment
B. ARI Standard 410 (performance rating).
C. ARI Standard 270 (sound rating).
D. ASHRAE 62.
E. Labeled and Listed by ETL and by UL
F. Furnish units that comply with IECC 2015.

1.3 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00, Mechanical General Provisions.

1.4 SUBMITTALS

A. Submit manufacturer's technical product data for each unit. Include sufficient data to substantiate that each unit conforms to the requirements of this section, and provides the performance indicated on the Drawings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver units properly packaged in factory-fabricated containers. Deliver to the site when required by the project schedule.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging units.

1.6 OPERATION & MAINTENANCE DATA

A. Submit in accordance with Division 01 and Section 23 05 00.

1.7 GUARANTEES AND WARRANTIES

A. Deliver to the Owner a five-year warranty on each compressor.

PART 2 PRODUCTS

2.1 GENERAL

A. Furnish units with sizes, arrangements, capacities and performance shall be as indicated on plans and schedules.
B. Furnish units that are factory preassembled, tested and shipped complete with all components necessary to maintain humidity and temperature control levels independent of load variations within design limits.

2.2 UNIT CASING AND FRAMES

A. Internal frame type construction of galvanized steel.
B. G90 galvanized steel.
C. Double wall.
D. Overlapping, standing seam where top panels are joined.
E. Factory seal all metal-to-metal seams, so that no caulking is required at job site.

2.3 INSULATION
- A. 1-inch fiberglass that meets requirements of NFPA 90A and tested to meet UL 181 erosion requirements.
- B. Enclose insulation in double wall construction.

2.4 ACCESS DOORS
- A. All components shall be easily accessible through hinged access doors for exhaust, supply, filter, and damper compartments.
- B. Mount energy recovery wheels (smaller than 58 inches) in a slide-out track.

2.5 ENERGY RECOVERY WHEEL
- A. Enthalpy type for both sensible and latent energy recovery
- B. Designed to insure laminar flow.
- C. Energy transfer ratings must be ARI Certified to Standard 1060
- D. Desiccant, silica gel for maximum latent energy transfer.
- E. Constructed of lightweight polymer media.
- F. Mount polymer media in a stainless steel rotor for corrosion resistance.
- G. Removable wheel segments.
- H. Permanently bond Silica gel desiccant to wheel media.
- I. Use high strength urethane material for energy recovery drive belt and factory install it in a pre-stretched state.

2.6 FANS
- A. Centrifugal fans to be double width, double inlet, forward curved type.
- B. Statically and dynamically balance blower wheels.
- C. Grind and polish steel fan shafts that are mounted in permanently lubricated, sealed ball bearing pillow blocks.
- D. Selected bearings for minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds.
- E. Provide separate motors for exhaust and supply blowers.
- F. Multi-tap PSC motor.
- G. Mount fan and motor assemblies to unit base with neoprene isolators as standard.
- H. Locate fans in draw-through position in reference to the energy recovery wheel.

2.7 MOTORS AND DRIVES
- A. Motors that are energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures
- B. Permanently lubricated motors
- C. Integral overload protection on energy wheel motors.

2.8 FILTERS
- A. 2-thick supply and exhaust air filters
- B. Pleated fiberglass.
- C. Merv 8
- D. Tested to meet UL Class 2.
- E. Die-formed, galvanized steel filter racks.

2.9 ELECTRICAL
- A. Factory wire all internal electrical components for single point power connection.
- B. Wire units with electric reheat for an independent power supply,.(where scheduled).
- C. Electrical components that are UL Listed, Approved, or Classified where applicable and wired in compliance with the National Electrical Code.
- D. Weatherproof, integral door interlocking disconnect switch

E. standard components in the control center
   1. Motor starters
   2. Control circuit fusing
   3. Control transformer for 24 VAC circuit
   4. Terminal strip.
F. Motor starters that consist of a contactor and Class 20 electronic adjustable overload protection.

2.10 COOLING COIL (where scheduled)
A. Direct expansion that are factory tested and rated in accordance with ARI 410.
B. Copper tubes with permanently expanded aluminum fins, 12 fpi or less.
C. Equipped with distributors to receive expansion valves at the liquid connections.
D. Stainless steel drain pan.
E. Size with remote condensing unit.

2.11 ELECTRIC HEAT (where scheduled)
A. UL listed and circuit fused per NEC.
B. Heater for multi-step control
C. Factory wired and installed.
D. 24 volt control with class 2 transformer.
E. Standard air flow switch to shut down heater if air ceases to flow across heater.

2.12 SEQUENCE OF OPERATION
A. Refer to section 23 09 23 for control requirements.

2.13 ACCEPTABLE MANUFACTURERS
A. Greenheck, or approved equivalent.

PART 3 EXECUTION

3.1 COORDINATION
A. Coordinate size and configuration of new roof curb to match existing roof curb.

3.2 INSTALLATION
A. Install according to manufacturer's recommendations and as indicated on the Drawings.
B. Coordinate exact location of each unit with Structural Engineer prior to release of structural shop drawings for fabrication. Make all ductwork or other modifications required as a result of having to shift the location of any units resulting from failure to comply with this provision.
C. Coordinate installation of curb with roofing installer.
D. Install a trapped condensate drain to nearest roof drain, gutter, or other suitable drain; do not discharge onto roof or ground.
E. Coordinate with Controls contractor.

3.3 STARTUP AND TESTING
A. Manufacturer’s representative shall instruct owner regarding its functions and sequence of operation and verify in writing that the unit has been installed in accordance with the manufacturers recommendations.
B. Manufacturer’s service technician is to work with the controls contractor until digital and analog inputs and outputs are successfully mapped to the FMS. Verify proper operation of each unit in each mode of operation.
C. Verify that each unit is properly charged and lubricated; adjust as required.

END OF SECTION 23 81 23

SECTION 23 81 19 - SELF CONTAINED AIR CONDITIONERS

PART 1 - GENERAL

1.1 SCOPE
A. This section specifies the furnishing and installation of a single-package, single-zone, constant volume, electric air conditioning unit with gas heat for rooftop application.

1.2 REFERENCE STANDARDS
A. ARI Standard 210 or 360 (performance rating).
B. ARI Standard 270 (sound rating).
C. Design certified by AGA and CSA
D. Furnish units that comply with the 2015 International Energy Conservation Code.

1.3 APPLICABLE PROVISIONS
A. Refer to Section 23 05 00, Common Work Results for HVAC.

1.4 SUBMITTALS
A. Submit manufacturer's technical product data for each unit. Include sufficient data to substantiate that each unit conforms to the requirements of this section, and provides the performance indicated on the Drawings.

1.5 DELIVERY, STORAGE AND HANDLING
A. Deliver packaged air conditioning units properly packaged in factory-fabricated containers. Deliver to the site when required by the project schedule.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging units.

1.6 OPERATION & MAINTENANCE DATA
A. Submit in accordance with Division 1 and Section 23 05 00.

1.7 GUARANTEES AND WARRANTIES
A. Deliver to the Owner a five-year warranty on each compressor.
B. Deliver to the Owner a ten year limited warranty on each gas heat exchanger.

PART 2 - PRODUCTS

2.1 GENERAL
A. Furnish a unit specifically designed for outdoor installation; completely assembled on a rigid base for one-piece shipping and rigging; and suitable for mounting on either a roof curb furnished by the same manufacturer, a slab at grade, or a structural steel support located above the roof, as indicated on the Drawings.

2.2 PERFORMANCE CHARACTERISTICS
A. Furnish a unit with physical, capacity and electrical characteristics as indicated on the Drawings.

2.3 REFRIGERANT
A. Furnish units that use R-410 refrigerant.

2.4 COMPRESSOR
A. Furnish a thermally protected, hermetic compressor with service valves, vibration isolation, crankcase heaters, suction line freeze-stat, high pressure switch, low pressure switch, high discharge temperature switch, compressor motor protection, 5 minute short cycle timer, sight

glass and filter dryer. Furnish units over 6 tons nominal capacity with two compressors and independent refrigerant circuits.

2.5 EVAPORATOR AND CONDENSER COILS

A. Furnish direct expansion, draw-thru evaporator coil. Furnish a draw-thru condenser coil(s) with refrigeration system to accomplish at least 15°F sub-cooling at design conditions. Furnish copper tubes with mechanically bonded aluminum fins.

B. For units with exposed condenser coils, furnish coil guards to protect the coils from hail. Furnish guards with openings not less than 1 inch wide.

2.6 EVAPORATOR FANS

A. Furnish a belt-driven, forward-curved, centrifugal fan, with adjustable motor sheaves. Furnish 1100 rpm motors.

2.7 CONDENSER FANS

A. Furnish propeller-type fans with direct-drive motors. Furnish 1100 rpm motors with class B insulation, permanently lubricated, with sleeve-type bearings.

2.8 GAS HEAT EXCHANGERS

A. Furnish a natural gas-fired heat exchanger. Furnish a 20-gauge aluminized steel clam-shell or tubular type heat exchanger; intermittent spark ignition with proven pilot; single-stage firing on units of 6 tons nominal capacity or less, two-stage firing on units of 7½ tons nominal capacity or more, two equal and separate heat exchangers on units of 15 tons nominal capacity or more; a power venter motor with a centrifugal end switch; a high temperature limit thermostat with automatic reset; a redundant gas valve(s) with a pressure regulator(s); post-purge cycle to remove products of combustion at the end of each heating cycle; and electronic ignition control(s) with a flame sensor(s) to lock out the gas valve(s) in the event of ignition failure.

2.9 CASING, FILTERS AND DUCT CONNECTION

A. Furnish a cabinet constructed of 18 gauge galvanized or zinc-coated steel, primed and coated with a UL approved coating system, and suitable for outdoor installation, gasketed and insulated.

B. Furnish 1 in., 1 pound per cubic ft. density foil-faced fiberglass insulation on heat exchanger section, mat-faced in evaporator section.

C. Furnish duct connections on the bottom or side of each unit, as indicated on the Drawings.

D. Furnish removable panels to allow access to all internal parts requiring maintenance, service and adjustment.

E. Furnish electronic enthalpy automatic economizer, including outdoor and return air dampers that are interlocked and positioned by a fully-modulating, spring-return damper actuator. Furnish dampers whose leakage does not exceed 2% when fully closed and operating against 0.5 in. water gauge pressure. Furnish a unit-mounted potentiometer to adjust the outdoor and return air damper assembly to take in the scheduled minimum ventilation air quantity during normal operation. Furnish a mixed-air temperature control to prevent the supply air from dropping below 55°F during economizer operation. Furnish an integral electronic enthalpy control and logic module to change the unit from compressor to economizer operation. Furnish a rain hood with water eliminators, to match the exterior of the unit.

F. Furnish filter racks suitable for use with either 1 in. or 2 in. filters, without modification to the unit. Size filter rack to furnish an air velocity at maximum rated supply air quantity that does not exceed 500 fpm.

2.10 CONTROLS

A. Furnish 75 VA control transformer.

B. Furnish a DDC (BacNet) Control Interface.

C. Refer to section 23 09 23

2.11 ROOF CURB

A. Furnish a roof curb which is 24 in. high or 8 in. above finished roof, whichever is taller, of the same manufacture as the air-conditioning unit. The curb must support the unit in a level position regardless of roof slope and provide a watertight enclosure to protect ductwork on downflow units. Use a design complying with National Roofing Contractors Association requirements.

2.12 ACCEPTABLE MANUFACTURERS

A. Lennox, JCI or Approved.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install according to manufacturer's recommendations and as indicated on the Drawings.
B. Coordinate exact location of each unit with Structural Engineer prior to release of structural shop drawings for fabrication. Make all ductwork or other modifications required as a result of having to shift the location of any units resulting from failure to comply with this provision.
C. Coordinate installation of curb with roofing installer.
D. Install a trapped condensate drain to nearest roof drain, gutter, or other suitable drain; do not discharge onto roof or ground.

END OF SECTION 23 81 19

SECTION 23 81 23 - PACKAGED DX OUTSIDE AIR UNITS

PART 1 GENERAL

1.1 SCOPE
- A. Single-package
- B. Outside at grade application.
- C. Single-zone
- D. 100% outside air
- E. Gas heat
- F. Factory installed BacNet compatible controls to interface with Building DDC controls.

1.2 REFERENCE STANDARDS
- A. ARI Standard 210 or 360 (performance rating).
- B. ARI Standard 270 (sound rating).
- C. Design certified by AGA and CSA
- D. NFPA Compliance: Construct and install energy recovery units incorporating electrical equipment in accordance with NFPA 70 "National Electric code."
- E. Furnish units that comply with the 2012 International Energy Conservation Code or ASHRAE 90.1.

1.3 APPLICABLE PROVISIONS
- A. Refer to Section 23 05 00, Common Results for HVAC.
- B. Refer to Section 23 09 23, Direct-Digital BACnet Control System for HVAC.
- C. Refer to Division 28.
- D. Refer to AMCA Standard Test Code, Bulletin 210.

1.4 SUBMITTALS
- A. Technical product data.
- B. Submit manufacturer's requirements regarding control and electrical requirements that must be included by the controls vendor in order to satisfy the unit manufacturer that the equipment will operate as intended
- C. Sufficient data to substantiate conformance to the requirements of
  1. This section, and
  2. Performance indicated on Drawings.
- D. Shop Drawings
  1. Submit manufacturer’s assembly-type shop drawings indicating
     - a. Dimensions
     - b. Weight loadings
     - c. Required clearances
     - d. Methods of assembly of components.
  2. Submit in accordance with 01 33 00 and 23 05 00.

1.5 DELIVERY, STORAGE AND HANDLING
- A. Properly packaged.
- B. Deliver to site when required by the project schedule.
- C. Store in a clean, dry space in original containers.
- D. Protect products from weather, damaging fumes, construction debris and traffic.
- E. Handle carefully to avoid damaging units.

1.6 OPERATION & MAINTENANCE DATA
- A. Submit in accordance with Division 1 and Section 23 05 00.

1.7 GUARANTEES AND WARRANTIES

A. One-year parts and labor warranty on entire unit.
B. Five-year parts only warranty on each compressor.
C. Five year parts only warranty on each electric heating element.
D. Five year parts only warranty on heat exchanger core.

PART 2 PRODUCTS

2.1 GENERAL
A. Makeup air unit that is
1. Completely assembled and factory tested.
B. Minimum parts and components:
1. Compressor(s)
2. Evaporator coil
3. Outside air inlet damper & return air damper
4. Total energy core
5. Outside air fan & motor
6. Exhaust air fan & motor
7. Condenser
8. Refrigeration valves
9. Hot gas reheat coil on circuit #1
10. Gas heating Section
11. Electrical controls.
C. Arrangements, and performance as indicated on drawings.

2.2 UNIT CASING
A. Panels
1. Foam injected double wall panels
2. Outer wall - 22 gauge galvanized sheet metal, painted steel rated for 1000 hours in accordance with ASTM B117 and ASTM D1654
3. Inner wall - 22 gauge galvanized sheet metal
4. Constructed where panels are thermal broken (no metal-to-metal contact between the interior and exterior sheet metal of each panel)
B. Base
1. Base rails constructed of 10 gage galvanized steel with 16 gage integral floor pan.
2. Base pan insulated with ½" closed-cell neoprene liner
3. 4" overhang over the top of a roof curb to prevent water infiltration
4. Floor seams shall have a raised rib joint
5. ½” raised rib around all floor penetrations
C. Roofs
1. Pitched roof
2. ½” roof overhang around the perimeter of the unit
D. Insulation: Internally insulate units with
1. 2 in. thick.
2. 2 lb./cu.ft. foam insulation, R value of 6 per inch
3. Insulation water absorption maximum 0.038 lb/ft per ASTM D 2842 and show "no growth" per ASTM G21 biocide testing
4. No insulation exposed to stream or under unit floor
5. Secure with steel angles
6. Insulate drain pans and floor areas on the underside.
E. Openings
1. Weather Hood with bird screen on outside air inlet and exhaust air outlet

2.3 ACCESS SECTIONS
A. Furnish access doors to the following components:

1. Fans and motors
2. Filters
3. Dampers and operators
4. Access plenums
5. Electrical control panels
6. Compressor compartments

2.4 ACCESS DOORS
A. 2 in. thick double wall door
B. 2 lb./cu.ft. foam insulation, R value of 6 per inch
C. Insulation water absorption maximum 0.038 lb/ft per ASTM D 2842 and show "no growth" per ASTM G21 biocide testing
D. Two quarter turn compression latches with adjustable catches
E. Full gasket perimeter

2.5 ACCESS PANELS
A. Lift out access panels either bolted
B. Secured with two or more cam lock fasteners
C. For locations where non-regular access is required.

2.6 DAMPERS
A. Parallel blade dampers with electric actuator
1. Factory installed and wired modulating spring-return actuators
2. Outside Air
B. Low leakage type with blade edge and side seals
1. 16 gage galvanized steel hat-channel frame
2. 16 gage galvanized steel blades strengthened by three longitudinal 1 inch deep “vee” grooves
3. Synthetic sleeve-type axle bearings
4. Blade seals shall be extruded vinyl permanently bonded to the appropriate blade edges
5. Flexible stainless steel compression-type jamb seals
6. Factory installed and wired modulating spring-return actuators
7. Damper leakage shall be no more than 3 cfm/sq.ft. at 1 in.wg static pressure damper leakage

2.7 CONTROL PANEL
A. Separate compartments for high and low voltage components.
B. Fully gasket panels
C. Hinged doors with quick release latches
D. Insulate interior cabinet surfaces in contact with the air stream with
1. Flexible fire-retardant material
2. Coated on the air side
3. Contains an EPA-registered immobilized anti-bacterial agent that resists bacteria and fungi growth by tests in accordance with ASTM standards G21 and G22.

2.8 FANS
A. Direct drive, single width, single inlet plenum fans for
1. Outside air
B. Variable speed drives.
1. Factory installed and wired for both fans on the inside of unit of accessible exhaust (return) air section
C. Variable speed drives.
D. Rate in accordance with AMCA Standard Test Code, Bulletin 210.
E. Air Flow monitoring station

1. Supply and return air fans.
2. Volumetric flow calculated by empirically derived formulas based on testing.
3. Non restrictive airflow probes.
4. Four (4) equidistantly spaced sensor orifices.
5. Pressure differential accuracy within +/- 3%.
6. Shall be standard offering from fan manufacturer.
7. Supplied with electronics package that includes
   a. Pressure transmitter
   b. LCD digital readout
   c. BACnet MSTP communications
8. Sure Aire, Ruskin AMS, or equivalent.

2.9 MOTORS
A. VFD rated
B. ODP type
C. EPACT compliant
D. Premium efficiency (PE)
E. Isolation
   1. Fan motors with rubber vibration isolators 1" deflection

2.10 FILTERS
A. Galvanized steel racks to provide for easy removal of filters
B. 2 inches thick, pleated disposable filters
C. Non-woven media held in place by wire support grid
D. Minimum MERV 13 efficiency per ASHRAE test standard 52-76.
E. Camfil Farr 30/30 or equivalent

2.11 COILS-DIRECT EXPANSION
A. Evaporator and condenser coils
   1. ARI rated
   2. 500 psi working pressure.
   3. Minimum of 4 rows deep.
   4. Refrigeration systems with more than one circuit shall have interlaced evaporator coils
   5. 16 gage galvanized steel casing
   6. 1/2" diameter, 0.016" thick seamless copper tubing
   7. 0.0060" thick aluminum coil fins

2.12 MODULATING HOT GAS REHEAT
A. ARI rated
B. 500 psi working pressure
C. Refrigeration systems with more than one circuit shall have interlaced evaporator coils
D. 16 gage galvanized steel casing
E. 1/2" diameter, 0.016" thick seamless copper tubing
F. 0.0060" thick aluminum coil fins
G. Factory-supplied modulating hot-gas reheat control valve

2.13 DRAIN PAN
A. 18 gage 201 stainless steel
B. Double-sloped to ensure condensate removal from unit
C. Extend 8” past the evaporator coil to ensure condensate retention

2.14 CONDENSER COILS
A. Full face coil guard to prevent hail damage
B. 16 gage galvanized steel casing

C. 3/8" diameter, 0.016" thick seamless copper tubing
D. 0.0060" thick aluminum coil fins

2.15 CONDENSER FANS
A. Direct drive fans
B. Inlet fan guard
C. 1140 RPM
D. Statically and dynamically balanced in accordance with AMCA Standard 204-05
E. Lead fan controlled by a factory-supplied variable frequency drive to modulate to maintain refrigerant pressure in the condensing section
F. Additional condensing fans enabled/disabled to maintain refrigerant pressure in the condensing section

2.16 COMPRESSORS
A. Digital Scroll Compressors
1. Reverse rotation protection
2. Oil level adjustment
3. Oil filter
4. Rotary dirt trap
5. Short cycling control
6. High and low pressure limits
7. Crankcase heaters
B. R-410A refrigerant
C. Isolated compartment separate from all other electrical components inside the unit
D. Rubber vibration isolators
E. Lead refrigeration circuit shall be capable of 10:1 turndown
F. Furnish units capable of operation down to 50F

2.17 INDIRECT GAS FURNACE
A. AGA-certified
B. Forced-draft
C. 4:1 turndown
D. Electronic modulating gas valve
E. Two-speed combustion fan
F. 409 stainless steel heat exchanger

2.18 ELECTRICAL
A. All electrical controls that are UL listed
B. Entire unit factory wired in accordance with National Electrical Code.
C. Fused main power disconnect
1. Mount in control panel
2. Engaged by an operating mechanism on the panel door.
D. Single point power connection
E. All conductors shall be copper.
F. GFI duplex receptacle with weather proof cover plate. All wiring 120 volts and higher shall be enclosed in liquid tight conduit.
G. Marine lights in each accessible section of the unit with switch on exterior of unit.
H. GFI and lights to be powered by division 26 contractor.

2.19 UNIT MOUNTED CONTROLS
A. Units shall include factory supplied, mounted, wired, and tested stand-alone microprocessor controls,
B. BacNet MSTP interface
C. Microprocessor controller

1. Interface with DDC controls for schedule
2. Mounted in a weather-proof enclosure and accessible without exposing the operator to high voltage wiring or having to turn off or circumvent the main disconnect
3. Include local liquid crystal display (LCD) for user interface.
4. Sensors factory supplied, mounted, and wired inside the unit
   a. Outdoor air humidity sensor
   b. Outdoor air temperature sensor
   c. Evaporator coil leaving air temperature sensor

D. Sequence of operation
1. Startup
   a. When given a start command from the BMS and when the outside air temperature is above 50 degrees, open the outside air damper. When end switch is proven, the unit shall enable the supply fan and exhaust fan. The unit will then enable the DX cooling coil. Unit shall maintain the supply air temperature of 55˚ F. When the outside air temperature is below 50˚ F, unit shall supply 65˚ F supply air temperature.
2. Occupied Mode
   a. Open Outside Air Damper
   b. Energize Supply Fan
   c. Run Cooling Control or Heating Control based on the outside air temperature
3. Supply Fan and Exhaust Fan
   a. Supply Fan and Exhaust Fan shall operate at constant speed
4. Cooling Control
   a. If outdoor air dew point is above 55F(adj)
   b. Enable stages of DX cooling coil to maintain a coil leaving air temperature of 55˚ F(adj)
   c. If outdoor air dew point is below 55F(adj)
   d. Disable cooling coil
5. Heating Control
   a. When outside air temperature is below 45F(adj)
   b. Cycle gas heating stages to maintain 65F(adj) supply air temperature
6. Unoccupied Mode
   a. Close Outside Air Damper
   b. Turn off Supply Fan
   c. Disable DX Cooling Coil
   d. Disable gas heat
7. Alarm Shutdown
   a. Shutdown unit via BMS
   b. General Fire Alarm
   c. Emergency Shutdown - via EPO switch
8. Alarms
   a. Fan CT open when fan is commanded on
   b. VFD Fault
9. 11. Graphic
   a. Control points listed in the equipment graphic

E. DDC Monitoring points
1. Supply Fan status
2. Compressor(s) status
3. Gas heat status
4. Leaving Air Temperature
5. Air flow
6. Set-point (adjustable)

2.20 ACCEPTABLE MANUFACTURERS

A. Valent
B. Aaon
C. Daikin
D. Other manufacturers may be acceptable thru the substitution request process.

PART 3 EXECUTION

3.1 INSTALLATION
A. Install according to manufacturer's recommendations and as indicated on the Drawings.
B. Coordinate exact location of each unit with Structural Engineer prior to release of structural shop drawings for fabrication. Make all ductwork or other modifications required as a result of having to shift the location of any units resulting from failure to comply with this provision.
C. Coordinate installation of curb with roofing installer.
D. Install a trapped condensate drain to nearest roof drain, gutter, or other suitable drain; do not discharge onto roof or ground.
E. Coordinate with unit controls contractor as required to provide
1. Necessary wiring diagrams, and
2. Sensor locations, and
3. Safeties necessary for proper operation and protection of system components.
4. Refer to Section 23 09 23 for control sequence

3.2 STARTUP AND TESTING
A. Manufacturer’s representative to
1. Provide startup supervision.
2. Instruct owner regarding unit functions.
3. Verify in writing that the unit has been installed in accordance with the manufacturers recommendations.
4. Verify that each unit is properly charged and lubricated; adjust as required.

END OF SECTION

SECTION 23 81 26 - AIR-COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of air-cooled condensing units complete with casing, compressor, outdoor coil, outdoor fan and controls required for a split system air conditioning system, with all needed accessories and appurtenances.

1.2 REFERENCE STANDARDS

A. Rate in accordance with ARI Standard 210/240 latest edition.
B. Furnish UL approved units.
C. Rate for sound in accordance with ARI Standard 270 latest edition.
D. Meet safety standards for grounding as required by U.L. and NEC.

1.3 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00 – Common Work Results for HVAC.
B. Refer to Section 23 23 00 – Refrigerant Piping.
C. Furnish units that comply with the 2015 International Energy Conservation Code.

1.4 SUBMITTALS

A. Submit manufacturer's technical product data for each condensing unit scheduled. Include data sufficient to confirm that the units submitted meet the scheduled performance and all specification requirements herein.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver to the site when required by the project schedule. Suitably store and handle the units on site as required to protect from damage or weathering.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging units.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance information on condensing units in accordance with General Provisions.

1.7 GUARANTEES AND WARRANTIES

A. Comply with the requirements of Section 23 05 00 – Common Work Results for HVAC.
B. Provide a 5-year compressor warranty for each compressor.

PART 2 - PRODUCTS

2.1 PERFORMANCE

A. Furnish units which meet or exceed the performance criteria scheduled on the drawings.

2.2 COMPRESSOR

A. Furnish a hermetic or semi-hermetic compressor with temperature-actuated crankcase heaters (except for scroll compressors), inherently protected motors, spring mounts and capacity modulation.

2.3 OUTDOOR COILS

A. Furnish copper tubes with mechanically bonded aluminum fins.
B. Design coils for at least 15°F subcooling at design conditions.

C. Factory test coil to ensure leakproof construction.
D. For units with exposed coils, furnish coil guards to protect the coils from hail. Furnish guards with openings not less than 1 inch wide.

2.4 FANS AND MOTORS
A. Furnish propeller-type direct drive fans and vertical discharge.
B. Protect fan with a heavy-gage wire guard.
C. Furnish motors which are inherently protected, permanently lubricated, and weatherproof.

2.5 CASING
A. Furnish a unit designed for outdoor mounting. Fabricate the casing of 18 gauge G90 galvanized steel which is zinc coated and powder coated.
B. Furnish removable access panels for easy access to all serviceable components.
C. Use screws that comply with ASTM B117 salt spray test at a minimum of 750 hours.

2.6 CONTROLS
A. Furnish safety and operating controls factory wired and mounted in a separate enclosure.
B. Include high pressure or high temperature switch and compressor motor overload devices.
C. For units indicated to be on a pumpout, furnish a low pressure cutout for field installation, if it not standard with the unit.
D. Furnish a time delay device to prevent short cycling.
E. For single phase units, furnish start controls to assist starting under load conditions or low voltage conditions.
F. Unless otherwise indicated, furnish 35°F low ambient controls.
G. Furnish 24V control transformer, a pressure relief device, and suction and discharge valves with service connections.
H. Include a thermometer well, a shrader fitting in the vapor and discharge lines, gage ports, a high-capacity filter-drier with internal check valve, and a strainer.
I. Where scheduled, furnish hot gas bypass solenoid valve(s) and controls.
J. Where scheduled, furnish modulating hot gas reheat.

2.7 ACCEPTABLE MANUFACTURERS
A. Lennox, JCI or Approved.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Mount units on 5½ inch foundation pads for units installed at grade or equipment rails for units installed on the roof and pipe as indicated on the Drawings.
B. Install in strict accordance with all applicable manufacturer's recommendations.
C. Size refrigerant piping in accordance with manufacturer’s recommendations, considering the particular line lengths and relative heights of each condensing unit and its applicable indoor unit.

3.2 TESTING
A. Upon completion of installation, test units in conjunction with fan coil units to ensure proper operation of all normal modes and all safeties.

END OF SECTION 23 81 26

SECTION 23 81 27 - DUCTLESS SPLIT SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies the furnishing and installation of fan-coil air units designed for ductless application, and air-cooled condensing units complete with casing, compressor, outdoor coil, outdoor fan and controls required for a split system air conditioning system.

1.2 REFERENCE STANDARDS

A. ARI Standard 210/240 latest edition.
B. ARI Standard 270 latest edition.
C. Safety standards for grounding as required by UL and NEC.
D. Furnish units that comply with the 2001 Supplement to the 2000 International Energy Conservation Code.
E. Refer to Section 23 05 00 - Mechanical General Provisions.

1.3 SUBMITTALS

A. Comply with the requirements of Section 23 05 00.
B. Submit manufacturer's technical product data for units and accessories. Include sufficient data to substantiate that equipment conform to the requirements of this section and meets the performance criteria scheduled on the Drawings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver units properly packaged in factory-fabricated boxes or crates.
B. Store in a clean, dry space in original containers. Protect units from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging units.

1.5 OPERATION AND MAINTENANCE DATA

A. Comply with the requirements of Section 23 05 00.

1.6 GUARANTEES AND WARRANTIES

A. Comply with the requirements of Section 23 05 00.
B. Provide a 5-year compressor warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE

A. Furnish units which meet the characteristics and capacities as scheduled on the Drawings.

2.2 EVAPORATOR

A. Wall-mounted.
    1. Furnish a ductless evaporator unit with wall-mounted housing and cover, which incorporates integral supply and return air grilles, filter, and condensate drain pan.
    2. Furnish relays and connections for companion condensing unit.
    3. Furnish digital controls including the following:
        a. Thermostat – post-purge fan control.
        b. Fan speed control with auto ramping.
        c. Straight cool or heat pump compatible, with dip-switch setting.
        d. Digital set point and room temperature display.
        e. Cycling or constant speed fan mode.
    4. Furnish hanger mounting kit.

5. Furnish 24 volt remote wall-mounted thermostat.
6. Furnish heat with auto-reset high temperature cutout and redundant high temperature fuse link.

B. Ceiling-mounted.
1. Cabinet of 20 gauge galvanneal steel, powder coat finish, high impact polystyrene air discharge panel, removable perforated steel inlet grille, adjustable aluminum bidirectional louvered discharge grille, galvanized steel drain pan with anti-corrosion coating, aluminum discharge vanes, in matte finish white.
2. Fan and motor. Forward curved centrifugal type, directly mounted to the motor shafts and dynamically balanced. PSC type motor with internal overload protection. Airstream surfaces insulated with 1/2 in. foil-faced fiberglass.
3. Filter. Permanent electrostatic, washable, user accessible.
4. Coil. Seamless copper tubing, arranged in staggered configuration, with enhanced aluminum fins, tested to 460 psig. The tubes are mechanically expanded for secure bonding to fin shoulder.
5. Refrigerant Circuit. Expansion valve with flare type connections.
6. Controls. Digital controls including the following:
   a. Connections for remote 24 volt thermostat.
   b. Anti-short cycle timer, post-purge fan relay, and 30 amp electric relay.
7. Furnish installation isolator kit and hanger bolt cover kit.
8. Furnish 24 volt remote wall-mounted thermostat.

C. Furnish condensate pump, 4 ft. head.

D. For units indicated to be on a pumpout, furnish a low pressure cutout for field installation, if it not standard with the unit.

2.3 CONDENSING UNIT

A. Cabinet. Furnish a unit designed for outdoor mounting. Fabricate the casing of heavy gauge G60 galvanized steel which is zinc coated and finished with polyester powder coat. Furnish removable access panels. Furnish with integral fan and coil guards.

B. Compressor. Furnish a hermetic compressor with temperature-actuated crankcase heaters, inherently protected motors, and spring mounts.

C. Refrigeration circuit. Furnish precharged, with service valves.

D. Condenser coil. Seamless copper tubing with enhanced aluminum fins. Tubes mechanically expanded into fins.

E. For units with exposed coils, furnish coil guards to protect the coils from hail. Furnish guards with openings not less than 1 inch wide.

F. Condenser fan and motor. Propeller fan, direct connected to PSC motor with internal overload protection.

G. Controls. Factory installed controls including the following:
1. Compressor and fan motor contactor.
2. Capacitor.
3. Low voltage transformer and connections.
4. Low ambient control.

2.4 ACCEPTABLE MANUFACTURERS

A. Carrier, Enviromaster International (EMI), Friedrich, JCI, Mitsubishi, Trane.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount outdoor units on equipment rails; pipe as indicated on the Drawings, and in accordance with manufacturer's recommendations.

B. Mount outdoor units on 5½ inch foundation pads and pipe as indicated on the Drawings, and in

accordance with manufacturer's recommendations.

C. Mount indoor units clear of any racks, wiring, electrical equipment, etc. Install in accordance with manufacturer's recommendations.

D. For units on a pump out
   1. Install low pressure cutout in the suction line.
   2. Wire the low pressure cut out it to energize the condensing unit when the solenoid is open and de-energize the condensing unit when the solenoid is closed.
   3. Wire the temperature control to open the solenoid on a rise in temperature and close the solenoid when the temperature is satisfied.

3.2 TESTING

A. Upon completion of installation, test units to ensure proper operation of all normal modes and all safeties.

END OF SECTION 23 81 27

SECTION 23 85 35 - AIR COOLED HEAT PUMP OUTDOOR UNITS

PART 1 - GENERAL

1.1 SCOPE

A. This section specifies air-cooled heat pump condensing units complete with casing, compressor, outdoor coil, outdoor fan and controls, with all needed accessories and appurtenances required for a split system heat pump air conditioning system.

1.2 REFERENCE STANDARDS

A. Rate in accordance with ARI Standard 210/240 latest edition.
B. Furnish UL approved units.
C. Rate for sound in accordance with ARI Standard 270 latest edition.
D. Meet safety standards for grounding as required by U.L. and NEC.
E. Furnish units that comply with the 2015 International Energy Conservation Code.

1.3 APPLICABLE PROVISIONS

A. Refer to Section 23 05 00 – Common Work Results for HVAC.
B. Refer to Section 23 23 00 – Refrigerant Piping.
C. Refer to Section 23 85 36 – Heat Pump Fan Coil Units.

1.4 SUBMITTALS

A. Comply with the requirements of Section 23 05 00.
B. Submit manufacturer's technical product data for each outdoor unit scheduled. Include data sufficient to confirm that the units submitted meet the scheduled performance and all specification requirements herein.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver to the site when required by the project schedule. Suitably store and handle the units on site as required to protect from damage or weathering.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging units.

1.6 OPERATION AND MAINTENANCE DATA

A. Comply with the requirements of Section23 05 00.

1.7 GUARANTEES AND WARRANTIES

A. Comply with the requirements of Section 23 05 00.
B. Provide a 5-year compressor warranty for each compressor.

1.8 ACCEPTABLE MANUFACTURERS

A. Lennox, JCI or Approved.

PART 2 - PRODUCTS

2.1 COMPRESSOR

A. Furnish a compressor with temperature-actuated crankcase heaters, inherently protected motors, spring mounts and capacity modulation.

2.2 OUTDOOR COILS

A. Furnish copper tubes with mechanically bonded aluminum fins.
B. Factory test coil to ensure leakproof construction.
C. For units with exposed coils, furnish coil guards to protect the coils from hail. Furnish guards with

openings not less than 1 inch wide.

2.3 FANS AND MOTORS
- A. Furnish propeller-type direct drive fans and vertical discharge.
- B. Protect fan with a heavy-gage wire guard.
- C. Furnish motors which are inherently protected, permanently lubricated, and weatherproof.

2.4 CASING
- A. Furnish a unit designed for outdoor mounting. Fabricate the casing of heavy gage steel which is zinc coated and finished with enamel. Furnish removable access panels.

2.5 CONTROLS
- A. Furnish safety and operating controls factory wired and mounted in a separate enclosure.
- B. Include high and low pressure switches and compressor motor overload devices.
- C. Furnish factory-installed 4-way reversing valve operating on pressure differential between outdoor and indoor units.
- D. Furnish defrost control timer with adjustable time between defrosts, and sensing element to initiate and terminate defrost cycle.
- E. Furnish a time delay device to prevent short cycling.
- F. For single phase units, furnish start controls to assist starting under load conditions or low voltage conditions.
- G. Employ a control transformer, a pressure relief device and suction and discharge valves with service connections.
- H. Include a thermometer well, a shrader fitting in the vapor and discharge lines, gage ports, a high-capacity drier with internal check valve, and a strainer.
- I. Furnish an adjustable outdoor thermostat that prevents the electric resistance supplemental heat from operating as the second stage of heat above its setpoint.

PART 3 - EXECUTION

3.1 Mount units on 5-1/2 inch foundation pads for grade applications or portable equipment platforms for rooftop application, and pipe as shown on drawings and in accordance with manufacturer's recommendations.

3.2 Upon completion of installation, test units in conjunction with fan coil units to ensure proper operation of all normal modes and all safeties.

END OF SECTION 22 85 35

SECTION 23 85 36 - HEAT PUMP FAN COIL UNITS

PART 1 - GENERAL

1.1 SCOPE
A. This section specifies heat pump fan coil units for indoor installation, matched with heat pump outdoor units specified in another section.

1.2 REFERENCE STANDARDS
A. Rate coils and matching outdoor units in accordance with ARI Standard 210/240 latest edition.
B. Rate electric heater in accordance with DOE test procedures and FTC labeling regulations.
C. Meet UL and NEC standards for grounding units.
D. Furnish units that comply with the 2015 International Energy Conservation Code.

1.3 APPLICABLE PROVISIONS
A. Refer to Section 23 05 00 – Common Work Results for HVAC.
B. Refer to Section 23 23 00 – Refrigerant Piping.
C. Refer to Section 23 85 35 – Air Cooled Heat Pump Outdoor Units.

1.4 PERFORMANCE
A. Furnish units which meet or exceed the performance criteria scheduled on the drawings.

1.5 SUBMITTALS
A. Comply with the requirements of Section 23 05 00.
B. Submit manufacturer's technical product data for each unit. Include sufficient data to substantiate that each unit conforms to the requirements of this section, and provides the performance indicated on the Drawings.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver packaged fan coil properly packaged in factory-fabricated containers. Deliver to the site when required by the project schedule.
B. Store in a clean, dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
C. Handle carefully to avoid damaging units.

1.7 OPERATION AND MAINTENANCE DATA
A. Comply with the requirements of Section 23 05 00.

1.8 GUARANTEES AND WARRANTIES
A. Comply with the requirements of Section 23 05 00.

1.9 ACCEPTABLE MANUFACTURERS
A. Lennox, JCI or Approved.

PART 2 - PRODUCTS

2.1 CABINET
A. Furnish a unit suitable for vertical, floor-mounted installation as shown on the drawings.
B. Furnish units complete with coils, motors and drives.
C. Furnish minimum 18-gage steel insulated cabinets which are corrosion-resistant treated before final finish is added.
D. Furnish removable access panels to all parts requiring service.
E. Furnish electrical knockouts on both sides of unit.
F. Make provision for duct connections at each end of the fan coil unit.

2.2 COILS
- A. Furnish seamless copper tubes with aluminum fins.
- B. Factory test coil to ensure leakproof construction.

2.3 ELECTRIC HEAT
- A. Where scheduled, provide field installed electric heaters, mounted internal to the unit.
- B. Furnish nichrome bare heating elements exposed to the air stream.
- C. Furnish high temperature limit control with automatic reset.
- D. Furnish thermal cutoff safety fuses mounted external to the element faceplate for easy replacement.
- E. Furnish thermal sequencer relay to bring the elements on and off line, in sequence and in equal increments, with a time delay between each element. Sequencer also initiates and terminated blower operation.
- F. Furnish heater control relays.
- G. Furnish factory wired circuit breakers for overload and short circuit protection, manually reset.
- H. Factory mount controls in heavy gauge galvanized steel box, requiring only plug-in field connections.

2.4 FANS
- A. Furnish direct drive blower, statically and dynamically balanced as an assembly before it is mounted in the unit.

2.5 MOTORS
- A. Furnish motors of the permanent, split capacitor type wired for multiple speeds.
- B. Control the motors with easily accessible, multispeed switches located within the fan coil unit housing.
- C. Furnish built-in thermal overload and short circuit protection, accessible external to the cabinet, manually reset.

2.6 DRAIN PAN
- A. Furnish heavy-duty, rust-inhibited drain pans extending under coils, valves and pipe connection assembly within units, with primary and secondary drain connections.

2.7 CONTROLS
- A. Furnish 75 VA control transformer and terminal strip, factory installed in the unit control box.
- B. Refer to 23 05 93 for DDC Controls.

2.8 FILTER RACK
- A. Furnish a horizontal filter rack with hinged access door and magnetic latch.
- B. Filter rack shall be capable of housing 1" or 2" filters.

PART 3 - EXECUTION
- A. Install the unit and make refrigerant and control connections in accordance with the manufacturer's recommendations.
- B. Upon completion of system installation, test the unit for proper operation in all normal modes. Verify that all safeties function properly.

END OF SECTION 23 85 36

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes
  - 1. All work specified in Division 26
  - 2. Work specified in Divisions 27 and 28 when referenced to this Section
  - 3. Work required by Division 1 as it applies to the work of Division 26, and Divisions 27 and 28 when referenced to this Section
  - 4. Furnishing and installing
    - a. Labor, materials, equipment, tools and appurtenances for complete and functioning permanent electrical systems
    - b. A temporary construction lighting and power distribution system
  - 5. Installing
    - a. Electrical materials and equipment specified in other Divisions of the Specifications
    - b. Electrical materials and equipment furnished by Owner
    - c. Final connections to equipment installed by others as part of the contract
  - 6. Obtaining
    - a. Required permits
    - b. Permanent and temporary electrical utility service
  - 7. Paying for
    - a. Required permits
  - 8. Coordination
    - a. With existing site features
    - b. With existing building(s) features
    - c. With the work of other trades performing work on this contract
    - d. With sub-contractors performing work directly to this contractor
- B. Related Sections
  - 1. Division 2 for existing conditions and demolition
  - 2. All Sections of Division 26
  - 3. Some Sections of Divisions 27 and 28
  - 4. All Sections specifying equipment that requires 120 volt or higher electrical connections

1.2 REFERENCES
- A. Comply with the edition of the standards in effect at time of bidding unless otherwise noted
  - 1. All standards referenced in Division 26
  - 2. All standards referenced in Divisions 27 and 28 when referenced to this Section

1.3 SUBMITTALS
- A. Comply with the requirements of Division 1
  - 1. Submit information in .pdf format
    - a. With a cover sheet for each Section of the specifications having the following information
      - i. Project name
      - ii. Architect’s name
      - iii. Consultant’s name
      - iv. Contractor’s name
      - v. Sub-contractor or supplier’s name
      - vi. Index of materials included in submittal
    - b. With a separate file name for each Section of the specifications followed by a number identifying submission number; example: 26 05 00-01.pdf for original submittal and 26 05 00-02.pdf for first resubmittal
- B. Product data

a. Clearly indicate proposed products where more than one product or model number is shown on data sheet
b. Clearly indicate where products of different manufacturers are proposed for the same purpose

C. Test Reports
1. Submit within two weeks of successful completion of testing
2. Include copies with Closeout Submittals

D. Contract Closeout Submittals
1. Operation and Maintenance Data
2. Warranties
3. Project Record Documents
4. Test Reports

E. Resubmittals
1. Resubmit only those items that were identified in submittal reply as needing correction or additional information
2. Data that has been revised and or added to the original submission shall be clearly marked on the submittal

F. Scope of review
1. Review is only for
a. General conformance with the design concept of the Project
b. General compliance with the Contract Documents
2. The Contractor is responsible for
a. Confirming and correlating equipment dimensions at the Site
b. Information that pertains to fabrication processes or construction techniques
c. Coordination of the Work of all Trades
3. Review and acceptance of submittals does not relieve the Contractor, any Subcontractor and/or Material Supplier of responsibility for
a. Deviation from the requirements of the Contract Documents
b. Errors or omissions in submittals
c. Failure to coordinate with Work required by other trades

1.4 QUALITY ASSURANCE

A. Comply with the edition of applicable codes in effect at time of bidding, adopted by the Authority Having Jurisdiction, including but not limited to
1. Code of the City of Austin (COA)
2. International Energy Conservation Code (IECC)
3. International Fire Code (IFC)
4. International Building Code (IBC)
5. Life Safety Code (LSC)
6. National Electrical Code (NEC)
7. National Electrical Safety Code (NESC)
8. Occupational Safety and Health Act (OSHA)
9. Texas Accessibility Standards (TAS)

1.5 DELIVERY, HANDLING AND STORAGE

A. Schedule delivery of materials and equipment to the project site
1. Only if there are proper facilities for their storage
2. When they are ready for imminent installation

B. Take steps necessary to prevent damage to materials and equipment during handling

C. Store materials and equipment in proper facilities to protect them from the weather, contaminants, foreign objects and theft
1. Materials suitable for installation outdoors or below grade may be stored outdoors
2. Apply a suitable form of heat to the equipment in the space during extended durations of humidity levels above 70% to protect equipment from corrosion or insulation moisture

absorption

1.6 INTERRELATIONSHIP OF DOCUMENTS
- A. Where the provisions stated below are in conflict with the General Conditions or Supplementary General Conditions of the Contract, the General Conditions or Supplementary General Conditions take precedence
- B. The Drawings and Specifications are complimentary to each other; items indicated on the Drawings but not specifically mentioned in the Specifications and/or items mentioned in the Specifications but not indicated on the Drawings shall be furnished and installed as if they were located in both documents
- C. Documents
  1. Specifications establish the nature, quality and expected performance of materials
  2. Drawings establish the locations, quantities and spatial relationships of the materials
  3. In case of conflicts within the documents, the precedence of documents is as follows:
     - a. Specifications take precedence over Drawings
     - b. Dimensioned drawings take precedence over scaled drawings
     - c. Large scaled drawings take precedence over small scaled drawings

1.7 DRAWINGS
- A. The drawings are diagrammatic in character
- B. The drawings generally indicate the approximate location of devices and equipment
  1. Details and/or dimensions may indicate exact location of devices and equipment
  2. Where exact location of devices and equipment is not dimensioned, location must be determined in the field in coordination with other trades performing work on the project
  3. Exact locations of lighting fixtures are indicated on the Architectural reflected ceiling plans and building elevations
  4. Coordinate equipment rough-in and installation with submittals and shop drawings

1.8 CONTRACTOR QUALIFICATIONS
- A. Be a specialist in this field having the personal experience, training, skill and organization to construct complete and working systems
- B. Have on site supervisory personnel with experience in constructing no less than three projects with similar requirements to ensure the work will be performed in accordance with the contract documents
- C. Have competent workmen trained in the best practices of the trade to execute the work in a thorough, neat and workmanlike manner

PART 2 - PRODUCTS

2.1 SUBSTITUTION PROCEDURES
- A. Comply with the requirements of Division 1

2.2 CONSTRUCTION MATERIALS
- A. Shall be new, unless otherwise indicated on the drawings
- B. Shall conform to the requirements of the standards organizations regulating those products
- C. Shall be listed or labeled by Underwriters Laboratories where applicable
- D. Shall be manufacturer's standard product with specified standard options
- E. Shall have performed satisfactorily on similar projects for a period of no less than two years
- F. All adhesives, sealants, paints, coatings applied within the weatherproofed interior of the building shall comply with applicable VOC thresholds of SCAQMD 1113 and 1168.

2.3 CAPACITIES AND SPACE LIMITATIONS
- A. Capacities indicated in the documents are required minimums and may exceed minimums set by codes and standards

B. Where circuiting required for proposed equipment in any Section of the Specifications exceeds the designed circuiting, the designed circuiting shall be adjusted to accommodate the proposed equipment at no cost to the Owner
C. Proposed equipment which does not fit in the space allocated and satisfy required clearances and/or maintenance access will be replaced, at no cost to the Owner, with equipment that meets the spatial limitations of the project

PART 3 - EXECUTION

3.1 TEMPORARY CONSTRUCTION POWER
A. Construct a temporary construction lighting and power distribution system that conforms to
1. NEC - Article 590 Temporary Installations
2. NECA 200 - Temporary Electrical Power at Construction Sites
3. OSHA - 29 CFR 1926.56 Illumination, Table D-3 Illumination Intensities in Foot-Candles
B. The proposed construction site currently has provisions for temporary construction power
1. Make arrangements with the Owner to connect to the existing electrical distribution system where there is an adequate source of temporary construction power
2. Coordinate with the General Contractor regarding who pays cost for power consumed by the temporary construction power system
C. Remove the temporary construction power system when no longer required

3.2 OUTAGES
A. Outages of existing services required for the project shall be scheduled in advance of the work
1. Make request, in writing, to the Owner a minimum of 14 days before the desired time for an outage
2. Deliver to the Owner a detailed schedule of activities during the proposed outage including estimated duration of each activity
3. Coordinate with utility company if utility company personnel are required to execute shutdown
B. Schedule outages for after Owner's normal business hours, weekends or holidays
1. Include premium time costs for outages in base bid
C. Life safety systems
1. Shall be maintained in full working condition during occupied hours if facility is to remain open during construction phase
2. Including but not limited to
a. Emergency lighting
b. Fire alarm
c. Standby generators
d. Building communications

3.3 INSTALLATION
A. Prior to beginning work
1. Carefully review the Contract Documents
a. Notify the Architect/Engineer of discrepancies and obtain clarification before proceeding with the work
2. Coordinate the work with that of other trades performing work on the project
a. Schedule work sequence to coordinate with other trades performing work on the project
b. Verify locations where other trades require permanent power connections
c. Verify electrical requirements for equipment specified in other Divisions of the Specifications
B. In interior finished spaces, conceal electrical work in walls, chases, floors, crawl spaces and ceiling cavities, unless otherwise noted
C. Exposed interior work is permitted

1. Where exposure is necessary in order to function properly
2. Where physical size precludes concealment
3. Where shown or allowed by the specifications

D. Set equipment level and plumb
E. Equipment attached to the interior of exterior walls shall be spaced a minimum of 3/4" from walls using corrosion resistant materials and anchors

3.4 MANUFACTURERS' INSTRUCTIONS
A. Follow manufacturers' written instructions regarding assembly, installation, adjustment and start-up procedures
B. Notify the Architect/Engineer of any conflicts between the Contract Documents and the manufacturer's instructions, and obtain clarification before proceeding with the work

3.5 EXISTING FACILITIES
A. Protect existing facilities and equipment from ongoing construction activities
B. Repair and/or replace existing facilities and equipment damaged by construction activities
C. Secure permission from Owner before entering existing facilities
D. Schedule construction activities far enough in advance with the Owner so that work can be scheduled when it is beneficial to both parties
E. Notify Owner of any required roof penetrations

3.6 DEMOLITION
A. Remove electrical materials and equipment from areas designated on the architectural and electrical drawings to be demolished
B. Relocate existing electrical work as required to accommodate the work of other trades
C. Extent of demolition is indicated on the drawings
D. Field verify source of power for items to be removed before starting demolition operations
E. Where partial removal of an existing circuit is required, maintain the remaining portion of the existing circuit in an operable condition
F. Remove conductors from items to be removed back to the last outlet to remain in service or to the panelboard serving them
G. Remove raceways from items to be removed back to the last outlet to remain in service or to the panelboard serving them, except that portion of the raceway
1. Concealed in walls not scheduled for demolition
2. Concealed above non-accessible ceilings not scheduled for demolition
3. Embedded in concrete floors, walls or roofs not scheduled for demolition

H. Empty raceways that are allowed to remain in place shall be
1. Cut off flush with the remaining building surface
2. Capped or plugged with a manufactured device

I. Meet with Owner prior to starting demolition operations to determine if any demolished items are to be salvaged
1. Deliver salvaged items to a location designated by the Owner
2. Properly dispose of items not designated for salvage

3.7 COORDINATION WITH OTHER DIVISIONS
A. Refer to the requirements of other Divisions and include in Division 26 any work outlined therein

3.8 CUTTING AND PATCHING
A. Prior to any cutting operations required for penetration of floors, walls or roofs
1. To the extent possible, investigate hidden conditions in the area to be cut
2. Coordinate the proposed size and method of making openings in non-load bearing walls with the Architect
3. Coordinate the proposed size and method of making openings in load bearing walls, floors and roofs with the Structural Engineer

a. If required by the Structural Engineer, X-ray the proposed area of the opening

B. Reinforce openings as directed by the Architect and/or the Structural Engineer

C. Cover openings exposed to the weather to prevent intrusion of water

D. Restore surfaces damaged by cutting operations to match existing adjacent surfaces

3.9 CONDITIONS AT SUBSTANTIAL COMPLETION

A. When the work is substantially complete, the contractor will inspect the work to ensure the following

1. Lighting fixtures are operating; lamps, lenses and reflectors are cleaned of foreign materials, including fingerprints and smudges
2. Lighting controls are functioning as designed and/or specified
3. Device plates and exposed switch and receptacle parts are cleaned of foreign materials
4. Enclosure interiors are vacuum cleaned and exterior surfaces are cleaned of foreign materials
5. Enclosure surface finishes, if damaged, are restored to original condition or to the satisfaction of the Architect
6. Panelboard circuit directories reflect the as-built information
7. Required identification nameplates are in place and properly attached to the equipment
8. Manufacturer's equipment nameplates are plainly visible
9. Special systems are functioning properly

END OF SECTION 26 05 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES - COPPER

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes
  - 1. 600-Volt insulated copper conductors
    - a. Phase, neutral and grounding
    - b. Used for feeders or branch circuits
  - 2. Splicing and terminating fittings
- B. Related Sections
  - 1. Section 26 05 00 Common Work Results for Electrical
  - 2. Section 26 05 26 Grounding and Bonding for Electrical Systems
  - 3. Section 26 05 53 Identification for Electrical Systems
  - 4. Section 26 08 00 Commissioning of Electrical Systems

1.2 REFERENCES
- A. ICEA S-95-658 (NEMA WC 70) - Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy
- B. NECA 1 - Standard Practice of Good Workmanship in Electrical Construction

1.3 SUBMITTALS
- A. Product Data
  - 1. None required
- B. Shop Drawings
  - 1. None required
- C. Test Reports
  - 1. Per Section 26 08 00
- D. Contract Closeout Submittals
  - 1. None required

1.4 QUALITY ASSURANCE
- A. Regulatory Requirements
  - 1. UL 83 - Thermoplastic-Insulated Wires and Cables
  - 2. UL 486A-486B - Wire Connectors
  - 3. UL 486C - Splicing Wire Connectors

1.5 DELIVERY, STORAGE AND HANDLING
- A. Packing and Shipping
  - 1. Deliver insulated conductors and fittings in suitable containers or packing material
- B. Acceptance at Site
  - 1. Inspect conductors for damage to insulation system
  - 2. Inspect fittings for damage
- C. Storage and Protection
  - 1. Store in a clean dry environment
  - 2. Store spools a minimum of 1-1/2" above floor
  - 3. Large reels may be stored outdoors if insulation is suitable for wet locations and ends of cable are wrapped to prevent moisture absorption

1.6 WARRANTY
- A. Include per Division 1

PART 2 - PRODUCTS

2.1 MANUFACTURERS
- A. All whose insulated conductors are manufactured in the USA

2.2 MANUFACTURED UNITS
- A. Conductors
  - 1. Conform to ICEA S-95-658 and UL 83
  - 2. 600-Volt insulated copper
- B. Splicing and/or tap fittings
  - 1. Conductors of any size
    - a. Insulated blocks or connectors
      - i. Mechanical lug type
  - 2. Conductors 8 AWG and smaller
    - a. Pressure type with insulating cap
      - i. Spring type
      - ii. Crimp type
  - 3. Conductors 6 AWG and larger
    - a. Compression butt type rated 75°C with
      - i. Cold-shrink insulating sleeve
      - ii. Heat-shrink insulating sleeve
  - 4. Not permitted
    - a. Split-bolt type for insulated conductors
- C. Terminating fittings
  - 1. Mechanical lug type rated 75°C
  - 2. Compression lug type rated 75°C

2.3 COMPONENTS
- A. Conductor
  - 1. Soft-drawn annealed copper with conductivity of not less than 98% at 20°C
    - a. Minimum size 12 AWG
    - b. Solid conductor for 10 AWG and smaller
    - c. Stranded conductor for 8 AWG and larger
- B. Insulation
  - 1. Type THHN/THWN flame-retardant, moisture- and heat-resistant thermoplastic
    - a. 75°C rating for dry and wet locations
    - b. 90°C rating for dry and damp locations
  - 2. Color
    - a. Factory-colored for 10 AWG and smaller
    - b. Black for 8 AWG and larger
  - 3. Marked per NEC Article 310
- C. Nylon outer jacket

PART 3 - EXECUTION

3.1 INSTALLATION
- A. Conductors
  - 1. Install per manufacturer's instructions
  - 2. Install per NECA 1, as limited below
  - 3. Install a dedicated neutral conductor for each single phase circuit
  - 4. Install in a single raceway, with no more than
    - a. Three conductors of different phases
    - b. Switchlegs associated with paragraph 3.1A.4.a when not exceeding 6 current carrying conductors
    - c. A single neutral for poly-phase circuits
    - d. A dedicated neutral conductor for each single phase circuit

e. A single equipment grounding conductor
f. A dedicated isolated grounding conductor for each IG circuit
5. More than 3 phase conductors shall be permitted in a single raceway under any of the following conditions:
a. Conduit nipples do not exceed 24" in length
b. Derated per NEC Table 310-15 (B)
i. Neutral conductor shall be considered a current carrying conductor
6. Install colored tape per Section 26 05 53
7. Neatly bundle in enclosures
8. Do not bend to less than eight times conductor overall outside diameter
9. Use wire-pulling compound where necessary
a. Use UL listed compound approved by conductor manufacturer
10. Use 10 AWG branch circuit conductors for 20A branch circuits if
a. 120-volt circuit length from panelboard to first outlet exceeds 100 feet
b. 277-volt circuit length from panelboard to first outlet exceeds 200 feet

B. Connections
1. Tighten per manufacturer's published torque values
a. In the absence of manufacturer's published information tighten per UL 486A-486B or 486C as appropriate
2. Splices and/or taps
a. Blocks or connectors
i. Install blocks in an appropriately sized enclosure
ii. Support connectors independently of conductors
b. Compression butt type
i. Insulate with cold-shrink sleeve if installed above ground
ii. Insulate with heat-shrink sleeve if installed underground
c. Pressure type
i. Twist conductors together before inserting into connector
3. Terminations
a. Use screws or lugs supplied with equipment
b. Compression lug type for dry-type transformers

C. Inspection and Testing
1. Per Section 26 08 00

3.2 ADJUSTING
A. Adjust ampacity of conductors for the installation conditions described in NEC Article 310.15

3.3 CLEANING
A. Remove wire-pulling compound from exposed conductors

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes
  - 1. Grounding and bonding
    - a. Conductors
    - b. Fittings
    - c. Equipment
- B. Related Sections
  - 1. Section 26 05 00 Common Work Results for Electrical
  - 2. Section 26 05 19 Low-Voltage Electrical Power Conductors and Cables - Copper
  - 3. Section 26 08 00 Commissioning of Electrical Systems

1.2 REFERENCES
- A. IEEE Std 142 - IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems
- B. NECA 1 - Standard Practice of Good Workmanship in Electrical Construction
- C. NECA 331 - Standard for Building and Service Entrance Grounding and Bonding

1.3 SUBMITTALS
- A. Product Data
  - 1. None required
- B. Shop Drawings
  - 1. None required
- C. Test Reports
  - 1. Per Section 26 08 00
- D. Contract Closeout Submittals
  - 1. None required

1.4 QUALITY ASSURANCE
- A. Regulatory Requirements
  - 1. UL 467 - Grounding and Bonding Equipment
  - 2. UL 486A-486B - Wire Connectors

1.5 DELIVERY, STORAGE AND HANDLING
- A. Packing and Shipping
  - 1. Deliver conductors, fittings and equipment in suitable containers or packing material
- B. Acceptance at Site
  - 1. Inspect conductors, fittings and equipment for damage to insulation system and products
- C. Storage and Protection
  - 1. Store in a clean dry environment
  - 2. Store products a minimum of 1-1/2" above floor
  - 3. Large reels may be stored outdoors if bare or insulation is suitable for wet locations and ends of cable are wrapped to prevent moisture absorption

1.6 WARRANTY
- A. Include per Division 1

PART 2 - PRODUCTS

2.1 MANUFACTURERS
- A. All meeting the UL requirements for the specified product

2.2 MANUFACTURED UNITS
- A. Conductors
  - 1. Bare copper
  - 2. Insulated copper per Section 26 05 19
- B. Grounding Bushings
  - 1. Conform to UL 467
  - 2. Insulated
  - 3. Malleable-iron or steel
  - 4. With external ground lug
- C. Connectors
  - 1. Above grade
    - a. Conform to UL 486A
    - b. Copper compression type
    - c. Copper mechanical type
  - 2. Below grade
    - a. Copper compression type
    - b. Exothermic welded type
- D. Ground Bars
  - 1. 20" long x 4" high x 1/4" thick copper bar with pre-punched holes
  - 2. Thermoset polyester insulators
  - 3. Stainless steel mounting brackets
- E. Ground Rods
  - 1. Conform to UL 467
  - 2. Copper-clad steel
  - 3. 5/8" diameter X 8'-0" long

PART 3 - EXECUTION

3.1 INSTALLATION
- A. Install bare conductors
  - 1. In the grounding electrode system
  - 2. As bonding jumpers
  - 3. In metal conduit where subject to physical damage
    - a. Bond conduit at both ends per NEC Article 250
- B. Install insulated conductors
  - 1. As equipment grounding conductors with feeders and branch circuits
  - 2. To bond receptacles to device boxes
    - a. Not required if receptacle yoke is listed for grounding purposes
- C. Install grounding bushings on
  - 1. Metallic raceways terminating in the service entrance equipment enclosure
  - 2. Metallic raceways 1-1/2" and larger terminating in enclosures having a ground bus
  - 3. Metallic raceways protecting grounding electrode conductor

3.2 BONDING JUMPERS
- A. Install bonding jumpers
  - 1. To maintain the continuity of the metal raceway system
  - 2. For separately derived systems

3.3 ADJUSTING (Not Used)

3.4 CLEANING (Not Used)

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes
  - 1. Metal framing, fittings and accessories
  - 2. Supports
- B. Related Sections
  - 1. Section 26 05 00 Common Work Results for Electrical

1.2 REFERENCES
- A. AISI SG02-1- North American Specification for the Design of Cold-Formed Steel Structural Members
- B. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- C. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- D. ASTM A684 - Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled
- E. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- F. ASTM A1018 - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- G. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
- H. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
- I. ASTM F1136 - Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners
- J. MFMA-4 - Metal Framing Standards Publication
- K. MFMA-103 - Guidelines for the Use of Metal Framing
- L. NECA 1 - Standard Practice of Good Workmanship in Electrical Construction

1.3 SUBMITTALS
- A. Product Data
  - 1. None required
- B. Shop Drawings
  - 1. None Required
- C. Test Reports
  - 1. None required
- D. Contract Closeout Submittals
  - 1. None Required

1.4 QUALITY ASSURANCE
- A. UL 2239 - Hardware for the Support of Conduit, Tubing and Cable

1.5 DELIVERY, STORAGE AND HANDLING
- A. Packing and Shipping
  - 1. Deliver materials in suitable containers or packing material
- B. Acceptance at Site
  - 1. Inspect materials for damage to product and finishes
- C. Storage and Protection
  - 1. Store in a clean dry environment

2. Store products a minimum of 1-1/2" above floor
3. Metal framing may be stored outdoors if kept a minimum of 4" above grade

1.6 WARRANTY
A. Include per Division 1

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Beam Clamps
1. Cooper - B-Line
2. Erico - Caddy
3. Hilti
B. Concrete anchors
1. Concrete Fasteners
2. Hilti
3. Red Head
C. Metal framing, fittings and accessories
1. Cooper - B-Line
2. Thomas & Betts Corp - Kindorf & Superstrut
3. Unistrut
4. Any member manufacturer of MFMA
D. Supports
1. Conform to UL 2239
2. Indoor, protected from the weather and directly exposed to the weather
a. Cooper - B-Line
b. Erico - Caddy
c. Or approved equivalent
3. Roof
a. Cooper - B-Line
b. Erico - Caddy
c. Miro Industries, Inc
d. Portable Pipe Hangers

2.2 MANUFACTURED UNITS
A. Concrete anchors
1. Hot dipped galvanized steel construction
2. For fastening to concrete slabs and tilt-wall panels, brick, and concrete block
3. Hammer drive expansion type
4. Expansion type
5. Threaded type
6. Sized for applied load
B. Beam Clamps
1. Malleable iron
2. Zinc plated
3. Threaded screw to hold clamp in place
4. Sized for applied load
C. Metal framing, fittings and accessories
1. Conform to AISI SG02-1 and MFMA-4
2. Channel conforming to ASTM A1011, Grade 33
a. 12-gauge, nominally 1-1/2" wide by 1-1/2" deep
b. 14-gauge, nominally 1-1/2" wide by 3/4" deep
3. Fittings conforming to ASTM A1018, Grade 33
4. Channel finish conforming to ASTM A123 (hot-dip galvanized) or ASTM B633

(electroplated)
5. Fittings finish conforming to ASTM A123, ASTM B633 or ASTM F1136

D. Supports
1. Indoor
a. Spring steel conforming to ASTM A684 for raceways
b. Steel conforming to ASTM A653 for boxes
c. Manufacturer's standard finish
d. 12-gauge galvanized soft temper wire
2. Protected from the weather
a. Spring steel conforming to ASTM A684
b. Electro galvanized finish conforming to ASTM B633
3. Directly exposed to the weather
a. Steel conforming to ASTM A653 for boxes
b. Mechanically galvanized finish conforming to ASTM B695
4. Roof
a. Non-metallic UV resistant base
b. Hot-dip galvanized channel

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install supports per NECA 1 and manufacturer's instructions
1. Use supports that are appropriate for the material to be supported and the surface to which they are attached
B. Concrete anchors
1. For indoor use only
2. Use anchors that are appropriate for the material to be supported and the surface to which they are attached
a. As permitted under Divisions 3 and 4
3. Size for applied load and spacing
a. Minimum safety factor of three times actual load to be supported
4. Use only for application specifically approved by manufacturer
C. Beam Clamps
1. Use for securing supports to structural steel
2. Secure to top chord of bar joists
3. Minimum safety factor of 3 times actual load to be supported
D. Install metal framing, fittings and accessories per NECA 1 and MFMA-103
1. Use metal framing as follows
a. 1-1/2" by 1-1/2" channels
i. For supporting wall and floor mounted equipment
ii. For trapeze hangars
b. 1-1/2" by 3/4" channels
i. For attaching equipment, multiple raceways or cables to walls
ii. As spacers
c. Hot-dip galvanized channel
i. In crawl spaces
ii. Where exposed directly to the weather
d. Electroplated channel
i. In interior spaces
ii. In exterior spaces where protected from the weather
2. Support or attach metal framing using one of the following
a. A minimum of two 1/4" diameter all-thread rods for lengths up to 12" with up to two layers of raceways
b. A minimum of two 3/8" diameter all-thread rods for lengths over 12" and up to 24"

with up to two layers of raceways
c. A minimum of two 1/2" diameter all-thread rods for lengths over 24" and up to 48" with up to two layers of raceways
d. A minimum of two
i. Toggle bolts for stud or hollow masonry walls
ii. Expansion anchors for solid masonry or concrete walls or surfaces
iii. Sheet metal screws for metal studs or roof decking
iv. Wood screws for wood construction
e. Trim threaded rods used for supports to within 1" of bottom of channel

E. Wire Supports
1. Permitted for support of interior light fixtures as described in Section 26 51 00
2. Permitted for support of MC cable as described in Section 26 05 19.12
3. Shall be painted yellow to identify as part of electrical system
a. UL listed electrical drop wire securing clips may be used in lieu of paint
4. Shall be secured at both ends

3.2 ADJUSTING (Not Used)

3.3 CLEANING
A. Remove construction debris from hangers and supports
B. Touch up field cut ends of channel and rods with a minimum 90% low VOC zinc coating

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes
  - 1. Above ground raceways and fittings
- B. Related Sections
  - 1. Section 26 05 00 Common Work Results for Electrical

1.2 REFERENCES
- A. ANSI C80.1 - Electrical Rigid Steel Conduit (ERSC)
- B. ANSI C80.3 - Steel Electrical Metallic Tubing (EMT)
- C. ANSI C80.5 - Electrical Rigid Aluminum Conduit (ERAC)
- D. ANSI C80.6 - Electrical Intermediate Metal Conduit (EIMC)
- E. NECA 1 - Standard Practice of Good Workmanship in Electrical Construction
- F. NECA 101 - Installing Steel Conduits (Rigid, IMC, EMT)
- G. NECA 102 - Installing Aluminum Rigid Metal Conduit
- H. NECA 111 - Installing Nonmetallic Raceways (RNC, ENT, LFNC)
- I. NEMA FB 2.10 - Selection and Installation Guidelines for Fittings for Use with Non-flexible Electrical Metal Conduit or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit and Electrical Metallic Tubing)
- J. NEMA FB 2.20 - Selection and Installation Guidelines for Fittings for Use with Flexible Electrical Conduit and Cable
- K. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

1.3 SUBMITTALS
- A. Product Data
  - 1. None required
- B. Shop Drawings
  - 1. None required
- C. Test Reports
  - 1. None required
- D. Contract Closeout Submittals
  - 1. None required

1.4 QUALITY ASSURANCE
- A. Regulatory Requirements
  - 1. UL 1 - Standard for Flexible Metal Conduit
  - 2. UL 5 - Standard for Surface Metal Raceways and Fittings
  - 3. UL 5A - Nonmetallic Surface Raceways and Fittings
  - 4. UL 6 - Electrical Rigid Metal Conduit - Steel
  - 5. UL 6A - Electrical Rigid Metal Conduit - Aluminum, Red Brass and Stainless Steel
  - 6. UL 360 - Standard for Liquid-Tight Flexible Steel Conduit
  - 7. UL 514B - Conduit, Tubing, and Cable Fittings
  - 8. UL 651 - Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
  - 9. UL 797 - Electrical Metallic Tubing - Steel
  - 10. UL 870 - Standard for Wireways, Auxiliary Gutters and Associated Fittings
  - 11. UL 1242 - Standard for Electrical Intermediate Metal Conduit - Steel

1.5 DELIVERY, STORAGE AND HANDLING
- A. Packing and Shipping
  - 1. Deliver raceways and fittings in suitable containers or packing material
- B. Acceptance at Site

1. Inspect raceways and fittings for damage to product and finishes

C. Storage and Protection
1. Store in a clean dry environment
2. Store products a minimum of 1-1/2" above floor
3. Raceways may be stored outdoors if kept a minimum of 4" above grade
4. Protect from dust, dirt and foreign objects
5. Protect threaded ends of raceways

1.6 WARRANTY
A. Include per Division 1

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Raceways and Fittings
1. No restrictions
B. Wireways
1. No restrictions
C. Surface raceways
1. Panduit
2. Wiremold
3. Or approved equivalent

2.2 MANUFACTURED UNITS
A. Rigid Metal Conduit and Fittings - Steel (RSC)
1. Conform to ANSI C80.1, NEMA FB 2.10, UL 6 and UL 514B
2. Hot-dip galvanized after fabrication, including threads
3. Threaded malleable iron fittings, either cadmium plated or hot-dip galvanized
B. Rigid Metal Conduit and Fittings - Aluminum (RAC)
1. Conform to ANSI C80.5, NEMA FB 2.10, UL 6A and UL 514B
2. Aluminum alloy 6063-T1
3. Threaded aluminum fittings
C. Intermediate Metal Conduit and Fittings (IMC)
1. Conform to ANSI C80.6, NEMA FB 2.10 and UL 1242
2. Hot galvanized after fabrication, including threads
3. Threaded malleable iron fittings either cadmium plated or hot-dip galvanized
D. Electrical Metallic Tubing (EMT)
1. Conform to ANSI C80.3, NEMA FB 2.10, UL 514B and UL 797
2. Hot galvanized after fabrication
3. Interior coated with a silicone epoxy-ester lubricant
4. Steel compression fittings
E. Flexible Metal Conduit (FMC)
1. Conform to NEMA FB 2.20 and UL 1
2. Spirally-wound continuously-interlocked zinc coated steel strip
3. Double clamp steel or malleable iron fittings either cadmium plated or hot-dip galvanized
a. One-screw fittings for smaller than 1-1/2"
b. Two-screw fittings for 1-1/2" and larger
F. Rigid Nonmetallic Conduit - (RNC)
1. Conform to NEMA TC 2, NEMA TC 3 and UL 651
2. UV stabilized schedule 40 or 80 polyvinyl chloride (PVC)
3. Solvent-weld socket-type fittings
4. Non-metallic spacers for parallel raceway installations
5. Manufactured units for bends 45 degrees and greater
G. Liquidtight Flexible Metal Conduit (LFMC)

1. Conform to NEMA FB 2.20 and UL 360
2. Spirally-wound continuously-interlocked zinc coated steel strip
3. UV stabilized polyvinyl chloride (PVC) outer jacket bonded to the raceway
4. Compression type malleable iron fittings, with insulated throat, either cadmium plated or hot-dip galvanized

H. Wireways and Fittings
1. Conform to NEMA 250 and UL 870
2. Lay-in style with screw cover
   a. Minimum 16-gauge, sheet steel for 6" x 6" and smaller
   b. Minimum 14-gauge, sheet steel for larger than 6" x 6"
3. Finish: not less than two coats of enamel over a rust-inhibiting prime coat, or galvanized

I. Surface Metal Raceways and Fittings
1. Conform to UL 5
2. Minimum 18-gauge sheet steel consisting of a base and cover
3. 7.5 square inch, minimum, cross section
4. Capable of being divided into two compartments
5. Finish: not less than two coats of enamel over a rust-inhibiting prime coat

J. Surface Nonmetallic Raceways and Fittings
1. Conform to UL 5A
2. Minimum 0.095" thick, polyvinyl chloride (PVC) consisting of a base and cover or covers
3. Minimum 7.4 square inch cross section
4. Capable of being divided into two or three compartments
5. Finish: manufacturer’s standard

K. Sleeves and Penetration Seals
1. Sleeves
   a. Galvanized sheet metal
   b. EMT
   c. Galvanized steel
2. Seals
   a. Mastic sealant
   b. Fire stopping sealant as specified under Division 7
   c. All adhesives, sealants, paints, coatings applied within the weatherproofed interior of the building comply with applicable VOC thresholds of SCAQMD 1113 and 1168.

PART 3 - EXECUTION

3.1 GENERAL

A. Install raceways
1. In accordance with manufacturer's written instructions
2. Per NECA 1, as limited below
3. Securely fastened or supported from building structure or metal framing
4. As a complete electrically-continuous system including boxes
5. Parallel and perpendicular to building lines
6. Concealed in finished spaces
7. With a chrome-plated escutcheon plate at floor, wall or ceiling penetrations where passing through a finished space
8. With a nylon pulling line, in spare raceways and in raceways furnished for use by other trades
9. With a coupling and plug set flush with finished floor for connection to future equipment
10. With plastic insulated bushings at ends of special systems raceways
11. With insulated bushings on raceways containing conductors 4 AWG or larger
12. With insulated grounding bushings per Section 26 05 26
13. With expansion-deflection fittings where crossing building expansion joints or to compensate for expansion

14. With 12" minimum clearance between conduit and roof surface

B. Field joints and bends
1. Joints
a. Cut square
b. Ream smooth
c. Paint threads with a minimum 90% low VOC zinc coating
2. Bends
a. Make using equipment designed specifically for the material being bent
b. Shall be free of dents and flattening
c. Raceway bodies 1" and smaller may be used in lieu of field bends
d. For RNC bends 45 degrees and greater, use manufactured unit

C. Terminate threaded raceways
1. In enclosures without threaded openings or hubs
a. In interior spaces
i. With an external and internal locknut and an insulating bushing
b. In exterior spaces
i. On sides and bottom of enclosure with an external and internal locknut and an insulating bushing
ii. On tops of enclosures with an external hub or sealing locknut, an internal locknut and an insulated bushing

3.2 RACEWAYS

A. Install Rigid Metal Conduit and Fittings - Steel (RSC)
1. Per NEC Article 344 and NECA 10, as limited below
2. Use for feeders and branch circuits
a. 1/2" minimum trade size
b. Where concealed
c. Where penetrating slabs on grade
d. Where exposed directly to the weather
e. Where exposed and less than 60" above finished floor
f. In crawl spaces

B. Install Rigid Metal Conduit and Fittings - Aluminum (RAC)
1. Per NEC Article 344 and NECA 102, as limited below
2. For feeders
a. 2" minimum trade size
b. Where concealed
c. Where exposed directly to the weather
d. Where exposed and less than 60" above finished floor
e. In crawl spaces

C. Install Intermediate Metal Conduit and Fittings (IMC)
1. Per NEC Article 342 and NECA 101, as limited below
2. For feeders
a. 2" minimum trade size
b. Where concealed
c. Where exposed directly to the weather
d. Where exposed and less than 60" above finished floor
e. In crawl spaces

D. Install Electrical Metallic Tubing (EMT)
1. Per NEC Article 358 and NECA 101 as limited below
2. For feeders and branch circuits
a. 1/2" minimum trade size
b. Where concealed
c. Where exposed and 60" above finished floor in interior spaces

E. Install Flexible Metal Conduit (FMC)

1. Per NEC Article 348, as limited below
    a. For taps to interior luminaires, not exceeding 72" in length
        i. 3/8" trade size
    b. For connections to interior equipment subject to movement or vibration
        i. 1/2" minimum trade size
        ii. In lengths not exceeding 60"
    c. Where installed in existing wall cavities
        i. 1/2" minimum trade size

F. Install Liquidtight Flexible Metal Conduit (LFMC)
1. Per NEC Article 350, as limited below
    a. For connections to exterior equipment
        i. 1/2" minimum trade size
        ii. In lengths not exceeding 60"
    b. For connection to pump motors 1/6 horsepower and larger
        i. 1/2" minimum trade size
        ii. In lengths not exceeding 60"

G. Install Metal Wireways
1. Per NEC Article 376, as limited below
    a. 4" by 4" minimum size
    b. In interior spaces, conforming to NEMA 1 requirements
    c. In exterior spaces, conforming to NEMA 3R requirements

H. Install Surface Metal Raceways and Fittings
1. Per NEC Article 386

I. Install Surface Nonmetallic Raceways and Fittings
1. Per NEC Article 388

3.3 SLEEVES AND PENETRATION SEALS
A. Where raceways pass through walls or through floors not on fill, sleeves shall be used and shall
1. Have appropriate sealing material installed in the void space between the raceway and sleeve and around the outside of the sleeve to maintain rating of wall or floor
2. Have mastic seal where passing through exterior walls
3. Have an approved fire stopping sealant to maintain integrity of wall fire resistance rating
4. Have seals when entering or exiting classified (hazardous) areas or cool/cold storage facilities
5. Extend 1-½" above floor slab and be cemented in a watertight manner

B. Where raceways pass through the roof, the penetration shall comply with the requirements of Division 7
1. Penetrations through existing roofs shall be in accordance with Owner's requirements and shall be performed in a manner that maintains roof warranty

3.4 ADJUSTING
A. Touch up field-cut threads of RSC and IMC with a minimum 90% low VOC zinc coating
B. Touch up damaged surfaces of galvanized steel enclosures with a minimum 90% low VOC zinc coating
C. Touch up damaged surfaces of painted steel enclosures to match existing finish

3.5 CLEANING
A. Remove wire-pulling compound from raceway exterior

END OF SECTION 26 05 33

SECTION 26 05 33.11 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes
  - 1. Boxes
- B. Related Sections
  - 1. Section 26 05 00 Common Work Results for Electrical
  - 2. Section 26 05 53 Identification for Electrical Systems

1.2 REFERENCES
- A. NECA 1 - Standard Practice of Good Workmanship in Electrical Construction
- B. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
- C. NEMA OS 3 - Selection and Installation Guidelines for Electrical Outlet Boxes

1.3 SUBMITTALS
- A. Product Data
  - 1. Floor boxes
- B. Shop Drawings
  - 1. None required
- C. Test Reports
  - 1. None required
- D. Contract Closeout Submittals
  - 1. None required

1.4 QUALITY ASSURANCE
- A. Regulatory Requirements
  - 1. UL 50 - Standard for Enclosures for Electrical Equipment
  - 2. UL 514A - Metallic Outlet Boxes
  - 3. UL 514D - Cover Plates for Flush-Mounted Wiring Devices

1.5 DELIVERY, STORAGE AND HANDLING
- A. Packing and Shipping
  - 1. Deliver boxes in suitable containers or packing material
- B. Acceptance at Site
  - 1. Inspect boxes for damage to product and finishes
- C. Storage and Protection
  - 1. Store in a clean dry environment
  - 2. Store products a minimum of 1-1/2" above floor
  - 3. Protect from dust, dirt and foreign objects

1.6 WARRANTY
- A. Include per Division 1

PART 2 - PRODUCTS

2.1 MANUFACTURERS
- A. Boxes - Recessed and surface mounted
  - 1. No Restrictions
- B. Boxes - Recessed in existing facilities
  - 1. Old Work Boxes
    - a. Steel City
    - b. Or equvalent

2. "F-frame" support
   a. Erico DSI2A
   b. Steel City 820D

C. Boxes - Floor, small capacity
1. Hubbell "B" series
2. Wiremold "Omnibox" 880 series
3. Or approved equivalent

D. Boxes - Floor, large capacity
1. Hubbell "HBLCFB" series
2. Wiremold "RFB" series
3. Or approved equivalent

E. Boxes - Junction, pull and splice
1. No restrictions

2.2 MANUFACTURED UNITS

A. General
1. Conform to NEMA OS 1, NEMA OS 3, UL50, UL514A and UL514D, as limited in paragraph 2.2 below

B. Boxes - Recessed
1. 4" square galvanized steel boxes, minimum 1-1/2" deep
2. 4" octagonal galvanized steel boxes, minimum 1-1/2" deep
3. 3-3/4" high rectangular galvanized steel boxes, 3-1/2" deep
4. With galvanized steel raised cover for the device(s) to be installed

C. Boxes - Recessed in existing facilities
1. As described above
2. Suitable for use with "F-frame" support

D. Boxes - Surface mounted
1. 4" octagonal galvanized steel boxes, minimum 1-1/2" deep
2. 4" high die cast boxes, minimum 1-1/2" deep
3. With galvanized steel raised cover for the device(s) to be installed

E. Boxes - Junction, pull and splice
1. 4" square galvanized steel boxes, minimum 1-1/2" deep
2. Minimum 14-gauge galvanized or painted sheet steel, for boxes 100 cubic inches or smaller
3. Minimum 16-gauge galvanized or painted sheet steel, for boxes larger than 100 cubic inches
4. Screw on sheet steel cover; metal gauge and finish to match box

F. Boxes - Floor
1. General
   a. Cast aluminum flange and cover, with carpet inserts where installed in carpeted floor
   b. Aluminum or brass flanges and covers for the device(s) to be installed
   c. With the type of cover compatible with floor system specified by the Architect
   d. Color as selected by the Architect/Engineer
   e. With accessories required for complete installation
   f. Comply with scrub water exclusion test requirements
2. Small capacity
   a. Rectangular cast iron or stamped steel
   b. One-, two- or three-gang, minimum 2-3/8" deep
3. Large capacity
   a. Rectangular cast iron or stamped steel
   b. Four-compartment, multi-service, minimum 3-7/16" deep

PART 3 - EXECUTION

3.1 GENERAL

A. Install boxes
   1. In accordance with manufacturer's written instructions
   2. Per NEC Article 314
   3. Per NECA 1, as limited below
   4. So they are accessible
   5. So they coordinate with casework and millwork
   6. So they are not back-to-back
   7. With the face of the box within 1/4" of the wall's surface
   8. With tops of adjacent boxes aligned
   9. So they are supported by a minimum of two wall studs
   10. So they are supported independently of the ceiling suspension grid
   11. With identification per Section 26 05 53

3.2 BOXES
A. Install 4" square galvanized steel boxes
   1. For interior wiring devices
   2. For interior junction boxes
   3. With device ring and cover
   4. Using "F-frame" supports in existing areas
B. Install 4" octagonal galvanized steel boxes
   1. For interior junction boxes
   2. For direct connection to surface mounted luminaires
   3. With appropriate fixture mounting accessories
C. Install 3-3/4" high rectangular galvanized steel boxes
   1. In face brick construction
D. Install 4" high die-cast boxes
   1. For exposed exterior device boxes
E. Install junction, pull and splice boxes
   1. With covers small enough so that they can be handled by one person
   2. Of the size and shape to facilitate pulling of conductors
   3. In straight runs of raceway, on approximately 100' centers
   4. Having appropriate NEMA classification for the environment in which they are installed
F. Install floor boxes
   1. With the number of compartments for the devices indicated
   2. Flush with finished floor and with the appropriate type of flange for the floor surface
   3. With the type of cover and color as selected by the Architect/Engineer
   4. With the bottom and sides fully encased in 1" thick concrete where installed in slab-on-grade construction
   5. Coordinated with Division 27
   6. Of heavy duty construction in areas where floor is subject to heavy loads or where indicated on drawings

3.3 ADJUSTING
A. Relocate boxes that do not coordinate with casework and millwork
B. Verify location of floor boxes with Owner
C. Adjust tops of floor boxes so they are flush with finished floor surface

3.4 CLEANING
A. Clean top of floor box
B. Clean construction debris from boxes

END OF SECTION 26 05 33.11

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes
  1. Colored tape
  2. Self-adhesive markers
  3. Warning signs
  4. Plastic nameplates
  5. Paint
- B. Related Sections
  1. Division 9 Painting
  2. Section 26 05 00 Common Work Results for Electrical
  3. Section 26 05 19.xx Electrical Power Conductors and Cables
  4. Section 26 05 33.11 Boxes for Electrical Systems
  5. Section 26 24 16 Panelboards
  6. Section 26 28 16.10 Enclosed Switches

1.2 REFERENCES (Not Used)

1.3 SUBMITTALS
- A. Product Data
  1. None required
- B. Shop Drawings
  1. None required
- C. Test Reports
  1. None required
- D. Contract Closeout Submittals
  1. None required

1.4 QUALITY ASSURANCE
- A. UL 510 - Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape

1.5 DELIVERY, STORAGE AND HANDLING
- A. Packing and Shipping
  1. Deliver identification materials in suitable containers or packing material
- B. Acceptance at Site
  1. Inspect identification materials for damage to product and finishes
- C. Storage and Protection
  1. Store in a clean dry environment
  2. Store products a minimum of 1-1/2" above floor

1.6 WARRANTY
- A. Include per Division 1

PART 2 - PRODUCTS

2.1 MANUFACTURERS
- A. Colored Tape
  1. Plymouth Premium 37
  2. Scotch (3M) No. 35
  3. Or approved equivalent
- B. Self-adhesive markers

1. Panduit PCL-100 series
2. Or approved equivalent

C. Warning signs
1. Panduit No. PPS0710D73
2. Or approved equivalent

D. Plastic nameplates
1. No restrictions

2.2 MANUFACTURED UNITS

A. Colored tape
1. Conform to UL 510
2. 7-mil thick by 3/4" wide vinyl adhesive tape

B. Self-adhesive markers
1. Vinyl cloth self-adhesive markers with 1" high lettering

C. Warning signs
1. 7" high by 10" wide vinyl self-adhesive “DANGER--HIGH VOLTAGE–KEEP OUT” signs

D. Plastic nameplates
1. Tri-color plastic laminate
a. Normal service: black-white-black laminate (white letters)
b. Emergency service: red-white-red laminate (white letters)
2. With beveled edges

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install
1. In accordance with manufacturer's written instructions
2. Per NEC and OSHA
3. After field applied finishes are completed

B. Colored tape
1. On conductors 8 AWG and larger
2. At terminations and in junction, pull or splice boxes
3. Half-lapped for a total exposed length of 2"
4. So as not to cover factory markings on insulation
5. Colored in accordance with the table below

Phase	480Y/277	208Y/120	240Δ/120	240Δ	120/240
A or L1	Brown	Red	Red	Red	Red
B or L2	Yellow	Black	Orange	Black	Black
C or L3	Purple	Blue	Black	Blue	- - -
Neutral	Gray	White	White	- - -	White
Switch Leg	Same as phase color	Same as phase color	Same as phase color	Same as phase color	Same as phase color
Travelers	Same as phase color	Same as phase color	Same as phase color	Same as phase color	Same as phase color
Ground	Green	Green	Green	Green	Green
Isolated Ground	- - -	Green with yellow tracer	Green with yellow tracer	- - -	Green with yellow tracer

C. Where multiple neutrals are installed in one conduit as permitted in 26 05 19, paragraph 3.1A.4,

each neutral shall be marked in the originating panelboard and each J-box to identify its corresponding circuit

D. Self-adhesive markers
   1. On junction, pull or splice boxes dimensionally 12" x 12" or larger
E. Warning signs
   1. On doors entering or exiting electrical rooms
F. Plastic nameplates
   1. Engraved in accordance with the table below
   2. Attached with a minimum of two self-tapping stainless steel screws

Equipment	Information and Text Size	Example
Lighting Control Devices	Load served - 1/4" Served from - 1/8"	PARKING LOT LIGHTS Served from Circuit HA-1,3,5
Transformers	Designation - 1/4" Served from - 1/8"	TRANSFORMER TLA Served from Switchboard 1 Circuit 1
Switchboards	Designation - 1/4" Ampere and Voltage ratings - 1/8" Served from - 1/8"	SWITCHBOARD 1 2000A 480Y/277V Served from Utility Transformer
Switchboard Circuits	Load served - 1/4" kVA rating - 1/8"	TRANSFORMER TLA 75 kVA
Panelboards	Designation - 1/4" Ampere and Voltage ratings - 1/8" Served from - 1/8"	PANELBOARD LA 225A 208Y/120V Served from Transformer TLA
Enclosed Circuit Breakers & Switches	Load served - 1/4" Served from - 1/8"	ELEVATOR NO. 1 Served from Circuit HA-7,9,11
Motor Controllers	Load served - 1/4" Served from - 1/8"	AHU-1 Served from Circuit HA-13,15,17

G. Miscellaneous
   1. Electrical junction, pull or splice boxes dimensionally smaller than 12" x 12"
      a. Mark the outside of the cover with the circuit number(s) contained in the box with a black marking pen
   2. Device plates
      a. Engrave with equipment name if equipment controlled is not within sight of device
      b. Label with panel and circuit number, e.g. CKT LA1A-1, using black-on-clear self-adhesive label tape
      c. Where receptacle is protected by GFCI breaker, install GFCI label and circuit number on device plate, using black-on-clear self-adhesive label tape
   3. Paint, per Division 9, junction, pull or splice boxes
      a. Red for fire alarm
      b. Yellow for 480Y/277V circuits
   4. Identify wire supports used for electrical systems by either
      a. Yellow paint
      b. Yellow UL listed electrical drop wire clips

3.2 ADJUSTING
   A. Adjust locations of the means of identification so they are readily visible

3.3 CLEANING
   A. Clean the means of identification

END OF SECTION 26 05 53

SECTION 26 28 13 - LOW-VOLTAGE FUSES

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes
  - 1. Fuses rated 600 Volts and below
  - 2. Fuses rated 6000 Amperes and below
- B. Related Work
  - 1. Section 26 05 00 Common Work Results for Electrical

1.2 REFERENCES
- A. NEMA FU 1 - Low Voltage Cartridge Fuses

1.3 SUBMITTALS
- A. Product Data
  - 1. For each class of fuse
- B. Shop Drawings
  - 1. None required
- C. Test Reports
  - 1. None required
- D. Contract Closeout Submittals
  - 1. Operations and Maintenance
    - a. Include data per Division 1
    - b. Record of each fuse size and type installed for each piece of equipment

1.4 QUALITY ASSURANCE
- A. Regulatory Requirements
  - 1. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements
  - 2. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses
  - 3. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses
  - 4. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses
  - 5. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses
  - 6. UL 248-14 - Low-Voltage Fuses - Part 14: Supplemental Fuses
- B. Independent certification of interrupting ratings

1.5 DELIVERY, STORAGE AND HANDLING
- A. Packing and Shipping
  - 1. Deliver fuses in suitable containers or packing material
- B. Acceptance at Site
  - 1. Inspect fuses for damage to product and finishes
- C. Storage and Protection
  - 1. Store in a clean dry environment
  - 2. Store products a minimum of 1-1/2" above floor

1.6 WARRANTY
- A. Include per Division 1

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Fuse Class/Type	Bussman	Mersen	Littelfuse
CC / Time Delay	FNQ-R	ATQR	KLDR
CC / Fast Acting	KTK-R	ATM-R	KLK-R
J / Time Delay Dual Element	LPJ	AJT	JTD
L / Time Delay	KPR-C	A4BQ	KLPC
RK1 / 250V	LPN-RK	A2D	LLNRK
RK1 / 600V	LPS-RK	A6D	LLSRK
RK5 / 250V	FRN-R	TR	FLNR
RK5 / 600V	FRS-R	TRS-R	FLSR
Supplemental	GLR	GLR	LGR

2.2 MANUFACTURED UNITS

A. Class CC Fuses
   1. Conform to NEMA FU-1 and UL 284-4
   2. 30 amps and smaller
   3. 200,000 amps RMS symmetrical interrupting rating
   4. Rejection type
   5. Time-delay

B. Class CC Fuses
   1. Conform to NEMA FU-1 and UL 284-4
   2. 30 amps and smaller
   3. 200,000 amps RMS symmetrical interrupting rating
   4. Rejection type
   5. Fast acting

C. Class J Fuses
   1. Conform to NEMA FU-1 and UL 284-8
   2. 600 amps and smaller
   3. 200,000 amps RMS symmetrical interrupting rating
   4. Time-delay, dual-element
   5. Fast-acting

D. Class L Fuses
   1. Conform to NEMA FU-1 and UL 284-10
   2. 601 amps and larger
   3. 300,000 amps RMS symmetrical interrupting rating
   4. Rejection type
   5. Time-delay

E. Class R Fuses
   1. Conform to NEMA FU-1 and UL 284-12
   2. 600 amps and smaller
   3. 300,000 amps RMS symmetrical interrupting rating for Class RK1 and 200,000 amps RMS symmetrical interrupting rating for Class RK5
   4. Rejection type
   5. Time-delay, dual-element

F. Supplemental Fuses
   1. Conform to NEMA FU-1 and UL 284-14
   2. 15 amps and smaller
   3. 10,000 amps RMS symmetrical interrupting rating

4. Non-rejection type
5. Fast acting

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install
1. In accordance with manufacturer's written instructions
2. So fuse rating label is upright and facing forward
3. A minimum of 3 fuses or 10%, whichever is greater, spare fuses of each size and type in a suitable container or cabinet
4. Spare fuse container or cabinet in the main electrical room unless otherwise indicated on the drawings

B. Types According to Use
1. Use Class CC Rejection type fuses for control power transformers and control circuits
2. Use Class CC Fast Action fuses for ballasts for HID lighting fixtures
3. Use Class J fuses for elevator service
4. Use Class L for circuits requiring protection greater than 600 Amperes
5. Use Class RK1 for circuits supplying panelboards, resistance heating and elsewhere as noted on the drawings
6. Use Class RK5 for circuits supplying motors, transformers and elsewhere as noted on the drawings
7. Use supplemental fuses for ballasts for fluorescent lighting fixtures

END OF SECTION 26 28 13

SECTION 26 28 16.10 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY
- A. Section Includes
  - 1. Enclosed switches
- B. Related Sections
  - 1. Section 26 05 00 Common Work Results for Electrical
  - 2. Section 26 05 53 Identification for Electrical Systems
  - 3. Section 26 28 13 Low-Voltage Fuses

1.2 REFERENCES
- A. NECA 1 - Good Workmanship in Electrical Construction
- B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- C. NEMA 250 - Enclosures for Electrical Equipment (1000V Maximum)

1.3 SUBMITTALS
- A. Product Data
  - 1. For each type and rating of switch
- B. Shop Drawings
  - 1. None required
- C. Test Reports
  - 1. None required
- D. Contract Closeout Submittals
  - 1. Operations and Maintenance
    - a. Include data per Division 1

1.4 QUALITY ASSURANCE
- A. Regulatory Requirements
  - 1. UL 98 - Enclosed and Dead-Front Switches
  - 2. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
  - 3. UL 512 - Fuseholders

1.5 DELIVERY, STORAGE AND HANDLING
- A. Packing and Shipping
  - 1. Deliver switches in suitable containers or packing material
- B. Acceptance at Site
  - 1. Inspect switches for damage to product and finishes
- C. Storage and Protection
  - 1. Store in a clean dry environment
  - 2. Store products a minimum of 1-1/2" above floor
  - 3. Protect from dust, dirt and foreign objects

1.6 WARRANTY
- A. Include per Division 1

PART 2 - PRODUCTS

2.1 MANUFACTURERS
- A. Eaton
- B. General Electric

C. Siemens Energy & Automation
D. Square D

2.2 MANUFACTURED UNITS
A. Conform to NEMA KS 1 (Type HD), NEMA 250, UL 98, UL 489 and UL 512
B. Voltage and configuration
1. 480V maximum
2. 2-pole, 3-pole, 4-pole and 6-pole
3. Fusible and non-fusible
4. Single-throw and double-throw
5. Heavy duty
6. Lockable handle
7. Door interlock
C. Amperage
1. 30 to 1200 amps
D. Enclosure
1. Interior: NEMA 1 surface-mounted
2. Interior: NEMA 3R surface-mounted stainless steel when used in kitchens
3. Exterior: NEMA 3R surface-mounted
E. Accessories
1. Fully-rated neutral block bonded to enclosure as indicated on the drawings
2. Incoming line terminal shield
3. Fuses per Section 26 28 13 as indicated on the drawings

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install and connect
1. In accordance with manufacturer's written instructions
2. Per NECA 1
3. With top of switch 60" above finished floor or 6" above finished floor if switch is taller than 55"
4. With nameplate per Section 26 05 53

3.2 ADJUSTING
A. Plumb enclosures
B. Set breakers per coordination study/report

3.3 CLEANING
A. Clean exterior and touch up paint if necessary
B. Vacuum interior of enclosure

END OF SECTION 26 28 16.10

SECTION 28 31 00 – FIRE ALARM SYSTEM

1 SCOPE

1.1 This section specifies the addition of new devices to the existing Gamewell FCI 7100 series fire alarm control panel system at Eanes ISD Bridgepoint Elementary school. The contractor shall furnish and install all equipment, expansion cards, cabling, programming, etc. for new devices that communicate with the existing 7100 FACP located in the main admin area corridor. The system shall be complete and fully operational, electrically supervised automatic addressable system.

1.2 The contractor shall consult all other divisions of these specifications; determine the extent of impact on the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.3 The contractor shall include in his bid the cost of all other trades required to install the new devices. Include electrical, HVAC, etc., contractors as required.

1.4 This is a performance specification and the contractor shall provide equipment, devices, peripherals, conduit, wire, outlet boxes and appurtenances required for a complete, compliant and operable system.

1.5 It is the intent of the contract drawings and specifications that the fire alarm contractor provides an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the contractor to provide all material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned herein or not.

1.6 Items required but not limited to (not all items included in the paragraph are necessarily in the project scope):

1.6.1 New addressable duct-mounted smoke detector and low-voltage shut down relay for new HVAC ductwork from OAU-1.

1.6.1.1 Located downstream of the air filters and ahead of any branch connections.

1.6.1.2 Located within the building

2 REFERENCE CODES AND STANDARDS, LATEST EDITIONS

2.1 ADA – American with Disabilities Act (Public Law 101-336).
2.2 FM – Factory Mutual.
2.3 IBC – International Building Code.
2.4 IFC – International Fire Code.
2.5 NFPA 70 – National Electrical Code.
2.6 NFPA 72 – National Fire Alarm Code.
2.7 NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems.
2.8 NFPA 101 – Code for Safety to Life from Fire in Buildings and Structures.
2.9 TAS – Texas Accessibility Standards of the Architectural Barriers Act, Article 9102, Texas Civil Statutes.
2.10 Texas Insurance Code Article 5.43-2.
2.11 UL 38 – Standard for Manual Signaling Boxes for Fire Alarm Systems.
2.12 UL 217 – Standard for Smoke Alarms.
2.13 UL 228 – Standard for Door Closers-Holders, With or Without Integral Smoke Detectors
2.14 UL 268 – Smoke Detectors for Fire Alarm Systems.
2.15 UL 268A – Standard for Smoke Detectors for Duct Application.
2.16 UL 346 – Standard for Waterflow Indicators for Fire Protective Signaling Systems.
2.17 UL 464 – Standard for Audible Signal Appliances

2.18 UL 521 – Standard for Heat Detectors for Fire Protective Signaling Systems.
2.19 UL 864 – Standard for Control Units and Accessories for Fire Alarm Systems.
2.20 UL 1424 – Standard for Cables for Power-Limited Fire-Alarm Circuits.
2.21 UL 1480 – Standard for Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
2.22 UL 1481 – Standard for Power Supplies for Fire-Protective Signaling Systems.
2.23 UL 1638 – Standard for Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling.
2.24 UL 1711 – Standard for Amplifiers for Fire Protective Signaling Systems.
2.25 UL 1971 – Standard for Signaling Devices for the Hearing Impaired.
2.26 UL 2053 – Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.
2.27 UL 2572 – Standard for Mass Notification Systems.

3 APPLICABLE PROVISIONS

3.1 These specifications are accompanied by drawings of the building and details of the installation indicating locations of some devices. The drawings and specifications are complementary to each other and what is required by one shall be binding as if required by both.

3.2 If the contractor deems any departure from the drawings necessary, details of such departure and reasons therefore shall be submitted to the Owner's representative for approval.

3.3 Should the drawings disagree in themselves, or with the specifications, the better quality of work and materials shall be estimated and, unless otherwise directed by the Owner's representative in writing shall be performed or furnished.

3.4 The contractor under the appropriate section of work shall install items specifically mentioned in the specifications but not shown on the drawings and/or items shown on the drawings but not specifically mentioned in the specifications as if they were both specified and shown.

4 SUBMITTALS

4.1 Submit to and receive approval from the Authority Having Jurisdiction.

4.2 Submit to and receive approval from the Owner’s representative, three copies of the following information:
4.2.1 Manufacturer's technical product data on all components and miscellaneous materials. Include module space requirements on the motherboard and/or in the cabinet and data substantiating that the equipment will comply with the requirements.
4.2.2 A written system description detailing all modules and/or components of the system; with particular emphasis on conformity to this specification.
4.2.3 Written system sequence of operation detailing all operational aspects of the system.
4.2.4 CAD generated riser, point-to-point wiring diagrams and floor plans, at the same scale as the contract documents, showing the location of all new devices, control panels, power supplies, interconnecting wiring, zoning and proposed addressing with nomenclature read-out to be used at the control panel.
4.2.5 A copy of installer's current State license.

4.3 Submit to and receive approval from the Special Systems section of the RRISD Maintenance Department, three copies of the following information:
4.3.1 CAD generated riser and point-to-point wiring diagrams and floor plans, at the same scale as the contract documents, showing the location of all control panels, annunciators, devices, power supplies, amplifiers, interconnecting wiring, zoning and proposed addressing with nomenclature read-out to be used at the control panel.

5 QUALITY ASSURANCE

5.1 All components of the Fire Alarm System shall be listed and labeled as products of a single fire alarm system manufacturer under the appropriate category by the Underwriter's Laboratories, Inc., utilizing standard products and pieces.

5.2 The systems shall be engineered by a factory trained, authorized representative and licensed installer.

6 CONTRACTOR QUALIFICATIONS

6.1 The contractor shall be an authorized representative of the manufacturer of the fire alarm system installed.

6.2 The contractor shall maintain a 24-hour service department and guarantee service within 8 hours, 7 days a week, 365 days a year.

6.3 The contractor shall be licensed by the State Fire Marshal to install, modify and service fire alarm systems.

6.4 Service technicians shall be licensed by the state and be factory trained in the maintenance and troubleshooting of the equipment supplied.

6.5 Field supervisor shall be licensed by the State Fire Marshal to supervise the installation of the fire alarm system.

6.6 Field technicians must have a minimum of 4 years of experience.

6.7 All other personnel shall be directly supervised on a one on one basis.

7 OPERATION AND MAINTENANCE DATA (CLOSE OUT DOCUMENTS)

7.1 Furnish one updated floor plan identifying cabinets, remote amplifiers and power supplies, initiating devices and indicating devices with their appropriate addresses.
7.1.1 Mount in a glass frame adjacent to the control panel.

7.2 Furnish the original and two copies of certificate of installation.

7.3 The original is shall be left at the control panel.

7.4 Furnish two electronic and three paper copies of “As-Built” drawings at the same scale as the contract documents with riser, point-to-point wiring diagrams and floor plans showing the location of all control panels, annunciators, devices, power supplies, amplifiers, interconnecting wiring, zoning and addressing with nomenclature read-out used at the control panel.

7.5 Furnish three printed copies of evidence of a functional system. In the event the system does not have memory capabilities, a performance test shall be performed to satisfy maintenance fire alarm personnel.

7.6 Furnish three copies, for each component:
7.6.1 Equipment operations manuals.
7.6.2 Equipment maintenance and testing manuals.
7.6.3 Equipment data and parts lists.

7.7 Furnish three signed letters of guarantee, which specifies the substantial completion date and the guarantee period.

8 SYSTEM DESCRIPTION

8.1 The contractor shall furnish and install all equipment, expansion cards, cabling, programming, etc. for new devices that communicate with the existing 7100 FACP located in the main admin area corridor. The system shall be complete and fully operational, electrically supervised automatic addressable.

8.2 The system shall shut down any additional fans and air-handling units, as required or shown on drawings.

8.3 The system shall be capable of automatic testing of detector calibration and sensitivity.

8.4 The system shall be capable of performing drift compensation.

9 SYSTEM OPERATION

9.1 The system alarm operation subsequent to activation of any alarm initiating device shall continue to function as presently programmed.

10 PRODUCTS (Not all products listed necessarily used in the project, not all components to be used necessarily listed)

10.1 Duct Mounted Detectors
- 10.1.1 Ionization smoke detector with sampling tubes and housing.
- 10.1.2 Comply with NFPA 90A.
- 10.1.3 Comply with UL Standard 268A

10.2 Alarm Indication / Test Switches
- 10.2.1 Include an alarm indicator/test switch for each duct detector.

10.3 Shut-down Relays
- 10.3.1 Shutdown relays shall be double pole, double throw; minimum rating is 1HP at 120/240 volts, 5Amp contacts, 24volt DC coil.

11 ACCEPTABLE MANUFACTURERS

11.1 Control Panel/Communicators:
- 11.1.1 Existing Gamewell FCI 7100

INSTALLATION

12 GENERAL

12.1 The existing system, if applicable, shall be operational until the upgrade is certified by the Authority Having Jurisdiction and accepted by the Special Systems section of the Maintenance department.

12.2 Install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations.

12.3 All conduit entries into fire alarm equipment enclosures shall be protected by a plastic bushing on the connector inside the enclosure. There shall also be a connector with a plastic bushing on

the end of the conduit that is not connected to the enclosure. All conduits entering a fire alarm equipment enclosure shall be supported as per the requirements of NFPA 70.

12.4 Sleeve and seal all penetrations of fire rated walls or ceilings.

12.5 Provide junction boxes, with supports, for all devices.

12.6 Cabling, regardless of elevation, shall be enclosed in a raceway unless within wall or above an accessible, suspended ceiling.

12.7 Duct-mounted Smoke Detectors

12.7.1 Duct mounted smoke detectors shall be provided by Division 28 and installed by mechanical contractor. Controls contractor shall install interlock wiring between duct detector and unit. Controls contractor shall make all terminations at the unit. Division 28 shall make all terminations at the duct mounted smoke detector.

12.7.2 Duct detectors shall be powered from the fire alarm system only. They shall not be powered from the HVAC control system or the Building Automation System.

12.7.3 Power to the duct detectors shall not be dependent upon the HVAC control voltage or the building automation system.

12.7.4 All duct smoke detectors shall be installed inside the building.

12.7.4.1 Where it is not possible to install a duct smoke detector inside the building, all duct smoke detectors mounted outside the building shall be installed within a NEMA 4 enclosure.

12.8 All surface mounted devices (flow and tamper supervisory devices, elevator control and supervisory modules, etc.) shall be installed in galvanized metal boxes not smaller than 4" x 4” x 2 1/8”. Minimum box depth is 2 1/8”.

12.9 Abandoned duct-mounted detectors shall be removed and have air handler wiring removed. Affected equipment shall be brought back to its original, functional state. Cover all duct openings resulting from detector removal.

12.10 Installation of the wiring for the fire alarm system is part of the work of this section, but is not specifically detailed on drawings. Determine exact number of wires for each type of device installed. Determine the size of the wire to prevent excessive voltage drop which might render the fire alarm devices inoperable.

12.11 The installation of all wiring, cable, and equipment shall be in accordance with the National Electrical Code, and specifically with Articles 760, 770, and 800, where applicable. In addition to meeting the requirements of the NEC and NFPA 72, the following conditions shall be required:

12.11.1 All cables serving outbuildings shall have lightning/surge protection where leaving and entering each building.

12.11.2 All cables shall be run parallel to the building lines.

12.11.2.1 No cables can be run diagonally across any corridor or room.

12.11.3 All cables shall be supported and strapped at intervals not to exceed 8 ft.

12.11.4 All cables shall be supported within 3 ft of all boxes.

12.11.4.1 Cables fished down walls shall be supported within 3 ft of the point of entry of the wall space.

12.11.4.2 Where a quantity of cables is run together, they may be bundled using cable ties.

12.11.4.2.1. Only cables from a specific system may be bundled together.

12.11.4.2.2. Such bundling of cables shall not be allowed as a means of support. The 8-ft support spacing remains in effect.

12.11.4.2.3. Only cable ties shall be permitted to bundle cables.

12.11.4.2.3.1. Tape will not be permitted.

12.11.4.3 All cables shall be fastened to building structural elements with D-rings, J-hooks or other similar cable supporting devices. <u>This includes cables run thru red iron or bar joists.</u>

12.11.4.3.1. Ducts are not an allowable means of support.
12.11.4.3.2. Cables shall not be fastened to or come into contact with threaded rod.
12.11.4.3.3. Cables shall not be supported by strut racks installed to support ductwork or any other mechanical or electrical system components.
12.11.4.3.4. Cables shall not be supported by lay-in ceiling grid wires.
12.11.4.3.5. Cables shall not lie on lay-in ceiling tiles.
12.11.4.4 No cable shall pass beneath any duct work, with the following exception:
12.11.4.4.1. Where a device is located beneath ductwork, only that portion of cable that serves the device may pass under the ductwork.
12.11.4.5 All cable entries into ceiling-mounted boxes shall be secured with a clamping connector.
12.11.4.6 All cables installed underground in conduit or other raceways shall be rated for direct burial.

12.12 Cables, boxes, cabinets, and fittings shall be attached to structural components by straps, hangers, or similar fittings designed and installed so as not to damage the cable.

12.13 Cables, raceways, and equipment installed behind panels designed to allow access, including suspended ceiling panels, shall be arranged and secured so as to allow the removal of panels and access to the equipment.

12.14 Power-limited fire alarm circuit cables and conductors shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuits.

12.15 Install circuits so that a fault in one circuit shall not prevent the subsequent alarm operation of another circuit.

12.16 Enclose cabling in raceways in all areas unless within wall or above an accessible, suspended ceiling.
12.16.1.1 Use Wiremold in interior finished spaces.

12.17 Install new, copper wiring using plenum rated cables, un-spliced from point to point, designed for the intended use.

12.18 Minimum #14 AWG conductor for notification and building control circuits.

12.19 Minimum #16 AWG conductor for initiation circuits.

12.20 T-Taping of supervised conductors will not be permitted on any conductor.

12.21 Color code cable jackets according to circuit types;
12.21.1 Yellow for NAC (Notification Appliance Circuit) cables.
12.21.2 Red for all other fire alarm system cables.

12.22 All power connections shall comply with the latest edition of the NEC and executed by a licensed electrical contractor.

12.23 Power connections shall not feed-thru other equipment.

12.24 Provide new circuit breakers, conduit and wiring for all equipment installed.

13 LABELING

13.1 Circuits shall be identified at terminal and junction locations.

13.2 Paint all fire alarm junction boxes and covers red.

13.3 Identify zone and device number on all detectors.

13.4 Identify panel and circuit label within the cabinet (s) served.

13.5 Labels shall be bold black letters/numbers not less than ¼" in height on a white background. The label shall have an adhesive backing and be legible when standing on the floor.

13.6 Fire alarm equipment

13.6.1 All fire alarm equipment shall be labeled to indicate the circuit and device. "Equipment" shall include all power supplies, all control relays, all monitoring relays, all parts of the emergency communication system, etc.

13.6.2 All fire alarm equipment that is connected to the building electrical system shall have a label on the outside of the equipment enclosure that indicates the branch circuit to which the equipment is connected.

13.7 Smoke detectors bases shall be labeled to indicate the device and circuit.

13.8 Duct detectors remote test/indicator switches shall be labeled to indicate the device and circuit, as well as the HVAC equipment it is serving.

14 TESTING

14.1 Furnish all instruments, labor and materials required for the tests and a qualified technician to conduct the tests.

14.2 Evidence of a functional system shall be provided in a printed document, legible and understandable to a person knowledgeably employed by the school district. In the event the system does not meet the required capabilities, the system shall be subjected to operational tests. Any deficiencies found shall be corrected and the system shall be retested prior to final acceptance. Tests shall be in accordance with procedures established within the National Fire Alarm Code.

15 DEMONSTRATION AND OWNER TRAINING

15.1 The completed fire alarm system shall be demonstrated in the presence of the Owner. The essential functions of the system shall be demonstrated. The Owner's designated personnel shall be trained in all aspects of operation and maintenance of the system.

16 CERTIFICATION

16.1 Upon completion of the testing, the manufacturer or his representative shall issue to the Owner a letter of certification that he has tested and adjusted the system, that all components are properly installed and free of defects, and that the system is in compliance with these Specifications and all applicable codes. In addition, the installation sticker and the certification certificate provided by the State Fire Marshal shall be completed with copies distributed and posted as required.

17 REQUIRED TEST and INSPECTIONS

17.1 Inspections shall conform to the requirements of the National Fire Alarm Code, NFPA 72, Chapter 7.

17.2 Conduct the following test and inspections:

17.2.1 Initial testing required under Paragraph 14.

17.2.2 One additional test, at no expense to the Owner, shall be made just prior to the expiration of the guarantee period to ensure satisfactory operation of the system.

18 GUARANTEE

18.1 The system shall be guaranteed to be free from all defects in material and workmanship for a period of one year from the date of substantial completion. Equipment or components showing inherent defects of a mechanical or electrical nature shall be replaced promptly at no expense to the Owner.

END OF SECTION 28 31 00

EANES INDEPENDENT SCHOOL DISTRICT

Sylvie Pouget
Purchasing Coordinator

601 Camp Craft Rd Austin, TX 78746 • 512 732-9036 • spouget@eanesisd.net • www.eanesisd.net

Please include the following forms in your proposal.
If you are awarded a contract, you will be filing the HB 1295 form with the TEC.

SUSPENSION OR DEBARMENT CERTIFICATE

Non-Federal entities are prohibited from contracting with or making sub-awards under covered transactions to parties that are suspended or debarred or whose principals are suspended or debarred. Covered transactions include procurement for goods or services equal to or in excess of $100,000.00 contractors receiving individual awards for $100,000.00 or more and all sub-recipients must certify that the organization and its principals are not suspended or debarred.

By submitting this offer and signing this certificate, the bidder:

1. Certifies that the owner/operator has not been convicted of a felony except as indicated on separate attachment to this offer, in accordance with Section 44.034 of the Texas Education Code, and

2. Certifies that no suspension or disbarment is in place, which would preclude receiving a federally funded contract under the Federal OMB, A-102, Common Rule (___.36)

Vendor Name: _____

Address: _____ City: _____ Zip Code: _____

Telephone: ( ) _____ Fax Number: ( ) _____

E-mail Address: _____

Authorized Company Official Signature: _____

Please Print Company Officials Name: _____

Title of Official: _____

Date: _____

CERTIFICATE OF RESIDENCY

The State of Texas has passed a law concerning non-resident contractors. This law can be found in Texas Government Code under Chapter 2252, Subchapter A. http://www.capitol.state.tx.us/statutes/docs/GV/content/htm/gv.010.00.002252.00.htm. This law makes it necessary for Eanes ISD to determine the residency of its bidders. In part, this law reads as follows:

Section: 2252.001

(1) 'Non-resident bidder' refers to a person who is not a resident.

(2) 'Resident bidder' refers to a person whose principal place of business is in this state, including a contractor whose ultimate parent company or majority owner has its principal place of business in this state.

Section: 2252.002

A governmental entity may not award a governmental contract to a nonresident bidder unless the nonresident underbids the lowest proposal submitted by a responsible resident bidder by an amount that is not less than the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in the state in which the nonresident's principal place of business is located."

I certify that

_____

(Name of Company Bidding)

is, under Section: 2252.001 (3) and (4), a

_____ Resident Bidder _____ Non-resident Bidder

My or Our principal place of business under Section: 2252.001 (3) and (4), is in the city of

_____ in the state of _____.

_____

Signature of Authorized Company Representative

_____

Print Name

_____ _____

Title Date

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. *See* Section 176.006(a-1), Local Government Code.

A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.

OFFICE USE ONLY

Date Received

1 **Name of vendor who has a business relationship with local governmental entity.**

2 ☐ **Check this box if you are filing an update to a previously filed questionnaire.** (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 **Name of local government officer about whom the information is being disclosed.**

Name of Officer

4 **Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.**

A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?

☐ Yes ☐ No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

5 **Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.**

6 ☐ Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).

7

Signature of vendor doing business with the governmental entity

Date

CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Governmetn Code may be found at http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

(A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;

(B) a transaction conducted at a price and subject to terms available to the public; or

(C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

***

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds $2,500 during the 12-month period preceding the date that the officer becomes aware that

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than $100 in the 12-month period preceding the date the officer becomes aware that:

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

(1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);

(2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or

(3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

(1) the date that the vendor:

(A) begins discussions or negotiations to enter into a contract with the local governmental entity; or

(B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

(2) the date the vendor becomes aware:

(A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);

(B) that the vendor has given one or more gifts described by Subsection (a); or

(C) of a family relationship with a local government officer.

Eanes Independent School District
601 Camp Craft Road, Austin Texas 78746

FELONY CONVICTION NOTICE

Senate Bill 1 passed by the State of Texas Legislators, Section 44.034, Notification of Criminal History, Subsection (a) states "a person or business entity that enters into a contract with a school district must give advance notice to the district if the person or owners or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the felony"

Subsection (b) states "a school district may terminate a contract with a person or business entity if the District determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The district must compensate the person or business entity for services performed before the termination of the contract". This disclosure is not required of a publicly-held corporation (option A).

I, the undersigned agent for the firm named below, certify that the information concerning notification of felony conviction had been reviewed by me and the following information furnished is true to the best of my knowledge (select one answer).

Vendor's Name: _____

Authorized Company Officer's Name: (please print) _____

Title: _____

A. My firm is a publicly-held corporation; therefore, this reporting requirement is not applicable.

Signature of Company Officer: _____

B. My firm is not owned nor operated by anyone who has been convicted of a felony.

Signature of Company Officer: _____

C. My firm is owned or operated by the following individual(s) who has/have been convicted of a felony (list names and titles):

_____

_____

Details of Conviction: _____

_____

ALL VISITORS TO ANY EANES ISD BUILDING WILL BE REQUIRED TO PRESENT A PICTURE ID AND BE ENTERED INTO THE VISITOR MANAGEMENT SYSTEM IN ORDER TO RECEIVE A VISITOR'S PASS. NO VISITOR WILL BE ALLOWED ENTRY WITHOUT A VISITOR'S PASS.

Signature of Company Officer: _____

CERTIFICATE OF INTERESTED PARTIES

FORM 1295

OFFICE USE ONLY

Complete Nos. 1 - 4 and 6 if there are interested parties.
Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.

1 Name of business entity filing form, and the city, state and country of the business entity's place of business.

2 Name of governmental entity or state agency that is a party to the contract for which the form is being filed.

3 Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the services, goods, or other property to be provided under the contract.

4

Name of Interested Party	City, State, Country (place of business)	Nature of Interest (check applicable)	
		Controlling	Intermediary

5 Check only if there is NO Interested Party. ☐

6 AFFIDAVIT

I swear, or affirm, under penalty of perjury, that the above disclosure is true and correct.

_____
Signature of authorized agent of contracting business entity

AFFIX NOTARY STAMP / SEAL ABOVE

Sworn to and subscribed before me, by the said _____, this the _____ day of _____, 20 _____ , to certify which, witness my hand and seal of office.

_____
Signature of officer administering oath | Printed name of officer administering oath | Title of officer administering oath

ADD ADDITIONAL PAGES AS NECESSARY