FSDB#: ITB-15-034

INVITATION TO BID (ITB)

for

Heating Hot Water Primary System Replacement
(Boiler Replacement Phase 2)

Florida School for the Deaf & the Blind

Do More. Be More. Achieve More.

PURCHASING DEPARTMENT
FLORIDA SCHOOL FOR THE DEAF AND THE BLIND
207 N. SAN MARCO AVENUE
ST. AUGUSTINE, FL 32084
PHONE (904) 827-2294
FAX (904) 827-2357

WWW.FSDB.K12.FL.US

July 2015

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The Florida School for the Deaf and the Blind (FSDB) invites you to participate in a sealed bid solicitation for the specified services to result in a Contractual Agreement.

MANDATORY PRE-BID CONFERENCE:
Bidders wishing to submit a bid shall attend a **mandatory** pre-bid conference on the date and time indicated on the Timeline in the **Conference Room, Bldg. #27 Hogel Maintenance**, **The Florida School for the Deaf and the Blind, 207 North San Marco Ave. St. Augustine, FL. 32084.** Failure to attend will preclude Bidder from submitting a bid. Subcontractors are welcome to attend, but their attendance is not mandatory.

PLACE FOR RECEIVING BIDS:
Bids may be hand delivered or mailed and must be received **no later than indicated on the Timeline**. Bids will be received at The Florida School for the Deaf and the Blind, Building #28/Stores & Receiving, 207 North San Marco Ave. St. Augustine, FL. 32084. Bids arriving after the deadline will not be opened. *Time of arrival for bid deliveries shall be determined by the time of arrival at the FSDB Campus Police Security Check Point.*

Companies or individuals intentding to submit a response shall e-mail the Contract Administrator indicating their intent to submit a response and shall indicate their agreement that bid correspondence shall be conducted electronically by e-mail.

DATE, TIME, AND PLACE FOR BID OPENING:
Bids will be opened as indicated on the Timeline**,** in the **Conference Room, Building #27 Hogel Maintenance**, The Florida School for the Deaf and the Blind, 207 North San Marco Ave. St. Augustine, FL. 32084. Please arrive in ample time to allow for security clearance processing and conveyance through the FSDB campus. *Time of arrival for meeting attendance shall be determined by the time of arrival at the FSDB Campus Police Security Check Point.*

SEALED BIDS:
Bids shall be sealed in an envelope and marked as follows in the lower left corner:

SEALED BID
Attention: Charles Meyers, Contract Administrator
DO NOT OPEN PRIOR TO: August 10, 2015, at 2:00PM

CONTACT PERSON: Charles Meyers, 904-827-2294, meyersc@fsdb.k12.fl.us

DOCUMENTS:
Qualified bids will contain the following documents:

- Proof of MFMP Registration and W-9 Filing.
- Proposal Form – completed, signed and notarized.
- Receipt of Addendum Form – completed, signed and notarized.
- Identical Tie Bids Statement – completed, signed and notarized.
- Public Entity Crimes Sworn Statement – completed, signed and notarized.
- Affidavit of Compliance with Minority Business Participation Construction –completed, signed and notarized.
- Copy of Current Florida Occupational License

NO BID:
If a bid will not be submitted, return only the Proposal Form with "No Bid" noted in the space provided. Failure to do so will result in the company's name being removed from future invitations to bid.

SPECIAL ACCOMMODATIONS:
Any person with a qualified disability requiring special accommodations at the pre-bid conference and/or bid opening shall contact the Purchasing Director at (904) 827-2356 at least five (5) working days prior to the event. If you are hearing or speech impaired, please contact this office by using the Florida Relay Services which can be reached at 1-800-955-8771 (TDD).

Certified Minority Business Enterprises are encouraged to participate in the bidding process.

PROJECT TIMELINE:

	Activity	Date	Time
	Bid Package Promulgated	07/13/15	
	Advertisement Open	07/13/15	
	Advertisement Close	07/27/15	
	Question Submission Deadline	07/31/15	2:00 PM
	FSDB Staff Pre-Bid Workshop Meeting (Closed)	07/31/15	2:30 PM
	Answers Issued as Addendum @ Pre-Bid Meeting	08/04/15	
	Mandatory Pre-Bid Meeting (Public)	08/04/15	2:00 PM
	Question Submission Deadline	08/10/15	2:00 PM
	Answers Issued as Addendum	08/13/15	
	Bid Submission Deadline	08/20/15	1:45 PM
	Bid Opening & Review (Public)	08/20/15	2:00 PM
	Results Notification	08/21/15	
	Intent to Award Advertisement Open	08/21/15	
	Intent to Award Advertisement Close	08/26/15	
	Agreement Draft, Review, Execution	08/27/15	
	Contract term begins*	09/16/15	
	**Or date of execution, whichever is later*		

PROJECT DESCRIPTION:

Heating Hot Water Primary System Replacement

SCOPE OF WORK

The work to be completed under this contract generally includes, but is not limited to, the following:

Removal of existing boilers and installation of new FSDB supplied boilers all in accordance with the attached **Heating Hot Water Primary System Replacement** specifications and drawings.

GENERAL INSTRUCTIONS TO RESPONDENTS:

General Instructions. Potential respondents to the solicitation are encouraged to carefully review all the materials contained herein and prepare responses accordingly. **Companies or individuals intentding to submit a response shall e-mail the Contract Administrator indicating their intent to submit a response and shall indicate their agreement that bid correspondence shall be conducted electronically by e-mail.**

Terms and Conditions. All responses are subject to the terms of the following sections of this solicitation, which, in case of conflict, shall have the order of precedence listed:

- Technical Specifications/Scope of Work,
- Special Conditions and Instructions,
- Instructions to Respondents,
- General Conditions, and
- Introductory Materials.

FSDB objects to and shall not consider any additional terms or conditions submitted by a respondent, including any appearing in documents attached as part of a respondent's response. In submitting its response, a respondent agrees that any additional terms or conditions, whether submitted intentionally or inadvertently, shall have no force or effect. Failure to comply with terms and conditions, including those specifying information that must be submitted with a response, shall be grounds for rejecting a response.

Questions. Respondents shall address all questions regarding this solicitation to the Contract Administrator. Questions must be submitted by e-mail and must be **RECEIVED NO LATER THAN** the time and date reflected on the Timeline. Questions shall be answered in accordance with the Timeline by e-mail and shall be made available to all respondents and shall be published as an addendum with the final bid documents. Respondents shall not contact any other employee of FSDB or the State for information with respect to this solicitation. Each respondent is responsible for monitoring the initial advertising source and the FSDB website for new or changing information. FSDB shall not be bound by any verbal information or by any written information that is not contained within the solicitation documents or formally noticed and issued by FSDB's contracting personnel. Questions to the Contract Administrator or to any FSDB personnel shall not constitute formal protest of the specifications or of the solicitation.

Conflict of Interest. This solicitation is subject to Chapter 112 of the Florida Statutes (F.S.). Respondents shall disclose with their response the name of any officer, director, employee or other agent who is also an employee of the State. Respondents shall also disclose the name of any State employee who owns, directly or indirectly, an interest of five percent (5%) or more in the respondent or its affiliates.

Convicted Vendors. A person or affiliate placed on the convicted vendor list following a conviction for a public entity crime is prohibited from doing any of the following for a period of 36 months from the date of being placed on the convicted vendor list:

- submitting a bid on a contract to provide any goods or services to a public entity;
- submitting a bid on a contract with a public entity for the construction or repair of a public building or public work;
- submitting bids on leases of real property to a public entity;
- being awarded or performing work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity; and
- transacting business with any public entity in excess of the Category Two threshold amount ($25,000) provided in §287.017, F.S..

Discriminatory Vendors. An entity or affiliate placed on the discriminatory vendor list pursuant to §287.134 , F.S. may not:

- submit a bid on a contract to provide any goods or services to a public entity;
- submit a bid on a contract with a public entity for the construction or repair of a public building or public work;

- submit bids on leases of real property to a public entity;
- be awarded or perform work as a contractor, supplier, sub-contractor, or consultant under a contract with any public entity; or
- transact business with any public entity.

Respondent's Representation and Authorization. In submitting a response, each respondent understands, represents, and acknowledges the following (if the respondent cannot so certify to any of following, the respondent shall submit with its response a written explanation of why it cannot do so).

- The respondent is not currently under suspension or debarment by the State or any other governmental authority.
- To the best of the knowledge of the person signing the response, the respondent, its affiliates, subsidiaries, directors, officers, and employees are not currently under investigation by any governmental authority and have not in the last ten (10) years been convicted or found liable for any act prohibited by law in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract.
- Respondent currently has no delinquent obligations to the State, including a claim by the State for liquidated damages under any other contract.
- The submission is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive response.
- The prices and amounts have been arrived at independently and without consultation, communication, or agreement with any other respondent or potential respondent; neither the prices nor amounts, actual or approximate, have been disclosed to any respondent or potential respondent, and they will not be disclosed before the solicitation opening.
- The respondent has fully informed FSDB in writing of all convictions of the firm, its affiliates (as defined in §287.133(1)(a), F.S.), and all directors, officers, and employees of the firm and its affiliates for violation of state or federal antitrust laws with respect to a public contract for violation of any state or federal law involving fraud, bribery, collusion, conspiracy or material misrepresentation with respect to a public contract. This includes disclosure of the names of current employees who were convicted of contract crimes while in the employ of another company.
- Neither the respondent nor any person associated with it in the capacity of owner, partner, director, officer, principal, investigator, project director, manager, auditor, or position involving the administration of federal funds:
  - Has within the preceding three years been convicted of or had a civil judgment rendered against them or is presently indicted for or otherwise criminally or civilly charged for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a federal, state, or local government transaction or public contract; violation of federal or state antitrust statutes; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property; or
  - Has within a three-year period preceding this certification had one or more federal, state, or local government contracts terminated for cause or default.
- The product offered by the respondent will conform to the specifications without exception.
- The respondent has read and understands the Contract terms and conditions, and the submission is made in conformance with those terms and conditions.
- If an award is made to the respondent, the respondent agrees that it intends to be legally bound to the Contract that is formed with FSDB.
- The respondent has made a diligent inquiry of its employees and agents responsible for

preparing, approving, or submitting the response, and has been advised by each of them that he or she has not participated in any communication, consultation, discussion, agreement, collusion, act or other conduct inconsistent with any of the statements and representations made in the response.

- The respondent shall indemnify, defend, and hold harmless FSDB and its employees against any cost, damage, or expense which may be incurred or be caused by any error in the respondent's preparation of its bid.
- All information provided by, and representations made by, the respondent are material and important and will be relied upon by FSDB in awarding the Contract. Any misstatement shall be treated as fraudulent concealment from FSDB of the true facts relating to submission of the bid. A misrepresentation shall be punishable under law, including, but not limited to, Chapter 817, F.S..

Manufacturer's Name and Approved Equivalents. Unless otherwise specified, any manufacturers' names, trade names, brand names, information or catalog numbers listed in a specification are descriptive, not restrictive. With FSDB's prior approval, the Contractor may provide any product that meets or exceeds the applicable specifications. The Contractor shall demonstrate comparability, including appropriate catalog materials, literature, specifications, test data, etc. FSDB shall determine in its sole discretion whether a product is acceptable as an equivalent.

Performance Qualifications. FSDB reserves the right to investigate or inspect at any time whether the product, qualifications, or facilities offered by Respondent meet the Contract requirements. Respondent shall at all times during the Contract term remain responsive and responsible. In determining Respondent's responsibility as a vendor, the agency shall consider all information or evidence which is gathered or comes to the attention of the agency which demonstrates the Respondent's capability to fully satisfy the requirements of the solicitation and the contract.

Respondent must be prepared, if requested by FSDB, to present evidence of experience, ability, and financial standing, as well as a statement as to plant, machinery, and capacity of the respondent for the production, distribution, and servicing of the product bid. If FSDB determines that the conditions of the solicitation documents are not complied with, or that the product proposed to be furnished does not meet the specified requirements, or that the qualifications, financial standing, or facilities are not satisfactory, or that performance is untimely, FSDB may reject the response or terminate the Contract. Respondent may be disqualified from receiving awards if respondent, or anyone in respondent's employment, has previously failed to perform satisfactorily in connection with public bidding or contracts. This paragraph shall not mean or imply that it is obligatory upon FSDB to make an investigation either before or after award of the Contract, but should FSDB elect to do so, respondent is not relieved from fulfilling all Contract requirements.

Public Opening. Responses shall be opened on the date and at the location indicated on the Timeline. Respondents may attend, but are not required to attend. FSDB may choose not to announce prices or release other materials pursuant to §119.071(1)(b), F.S.. Any person requiring a special accommodation because of a disability should contact the Contract Administrator at least five (5) workdays prior to the solicitation opening. If you are hearing or speech impaired, please contact FSDB by using the Florida Relay Service at (800) 955-8771 (TDD).

Electronic Posting of Notice of Intended Award. Based on the evaluation, on the date indicated on the Timeline, FSDB shall electronically post a notice of intended award at http://www.myflorida.com/apps/vbs/vbs_www.main_menu. If the notice of award is delayed, in lieu of posting the notice of intended award FSDB shall post a notice of the delay and a revised date for posting the notice of intended award. Any person who is adversely affected by the decision shall file with FSDB a notice of protest within 72 hours after the electronic posting. FSDB shall not

provide tabulations or notices of award by telephone.

Firm Response. FSDB may make an award within sixty (60) days after the date of the opening, during which period responses shall remain firm and shall not be withdrawn. If award is not made within sixty (60) days, the response shall remain firm until either FSDB awards the Contract or FSDB receives from the respondent written notice that the response is withdrawn. Any response that expresses a shorter duration may, in FSDB's sole discretion, be accepted or rejected.

Clarifications/Revisions. Before award, FSDB reserves the right to seek clarifications or request any information deemed necessary for proper evaluation of submissions from all respondents deemed eligible for Contract award. Failure to provide requested information may result in rejection of the response.

Minor Irregularities/Right to Reject. FSDB reserves the right to accept or reject any and all bids, or separable portions thereof, and to waive any minor irregularity, technicality, or omission if FSDB determines that doing so will serve the State's best interests. FSDB may reject any response not submitted in the manner specified by the solicitation documents.

Contract Formation. FSDB shall issue a notice of award, if any, to successful respondent(s), however, no contract shall be formed between respondent and FSDB until FSDB signs the Contract. FSDB shall not be liable for any costs incurred by a respondent in preparing or producing its response or for any work performed before the Contract is effective.

Contract Overlap. Respondents shall identify any products covered by this solicitation that they are currently authorized to furnish under any state term contract. By entering into the Contract, a Contractor authorizes FSDB to eliminate duplication between agreements in the manner FSDB deems to be in its best interest.

Public Records. Article 1, section 24, Florida Constitution, guarantees every person access to all public records, and §119.011, F.S., provides a broad definition of a public record. As such, all responses to a competitive solicitation are public records unless exempt by law. Any respondent claiming that its response contains information that is exempt from the public records law shall clearly segregate and mark that information and provide the specific statutory citation for such exemption.

Protests. Any protest concerning this solicitation shall be made in accordance with §120.57(3) and §287.042(2), F.S. and Chapter 28-110 of the Florida Administrative Code (F.A.C.). Questions to the Contract Administrator shall not constitute formal notice of a protest. It is FSDB's intent to ensure that specifications are written to obtain the best value for the State and that specifications are written to ensure competitiveness, fairness, necessity, and reasonableness in the solicitation process.

§120.57(3)(b), F.S. and §28-110.003, Florida Admionistrative Code require that a notice of protest of the solicitation documents shall be made within seventy-two hours after the posting of the solicitation.

§120.57(3)(a), F.S. requires the following statement to be included in the solicitation: "Failure to file a protest within the time prescribed in §120.57(3), F.S., shall constitute a waiver of proceedings under Chapter 120, F.S."

§28-110.005, F.A.C. requires the following statement to be included in the solicitation: "Failure to file a protest within the time prescribed in §120.57(3), F.S., or failure to post the bond or other security required by law within the time allowed for filing a bond shall constitute a waiver of proceedings under Chapter

120, F.S..”

Limitation on Vendor Contact with Agency During Solicitation Period. Respondents to this solicitation or persons acting on their behalf may not contact, between the release of the solicitation and the end of the 72-hour period following the agency posting the notice of intended award, excluding Saturdays, Sundays, and state holidays, any employee or officer of the executive or legislative branch concerning any aspect of this solicitation, except in writing to the procurement officer or as provided in the solicitation documents. Violation of this provision may be grounds for rejecting a response.

PROPOSAL FORM

Florida School for the Deaf and the Blind
Purchasing Department
Charles Meyers, Contract Administrator
207 San Marco Avenue
St. Augustine, FL 32084

☐ Decline to Bid

Submitted by (Company Name):

_____

To Whom It May Concern:

The undersigned Contractor, hereinafter called "Bidder" proposes to furnish all materials and labor for The Florida School for the Deaf and the Blind facility project in St. Johns County.

Project Name: Boiler Replacement

In full accordance with the Scope of Work Specifications bidder submits the following bid price(s).

Existing Boiler Removal and Site Prep	$
Disposal/Salvage of Existing Boiler Equipment	$
Installation of New Boiler Equipment	$
Total Base Bid	$

In consideration of the Agreement by the "Owner," the Bidder has agreed and does hereby agree, (1) that the attached proposal shall remain in full force and effect for a period of thirty (30) days after the time of the opening of this proposal, and that the "Bidder" will not revoke nor cancel this proposal or withdraw from the competition within said thirty (30) day period, (2) that in the event the contract is awarded to this "Bidder, " he/she will within thirty (30) consecutive calendar days after it is submitted, enter into a written contract with the "Owner" in accordance with the accepted bid.

IN WITNESS WHEREOF, the Bidder has hereunto set his/her signature and affixed his/her seal this

_____day of _____, 20____. BY: _____
(name of authorized principal)

_____ _____
(Signature of principal in firm) (firm name and title) (Seal)

_____
(Type contractor's Florida Department of Business and Professional Regulations license number)

State of Florida
County of St. Johns

PERSONALLY APPEARED BEFORE ME, THE UNDERSIGNED AUTHORITY,

_____

who after being sworn by (name of individual signing) me, affixed his/her signature in the space provided above on this _____day of _____, 20___.

_____
(Notary Public)

My commission expires:

END OF PROPOSAL FORM DOCUMENT

RECEIPT OF ADDENDUM FORM

Acknowledgement is hereby made of receipt of the following Addenda issued during the bidding period:

ADDENDA NO._____ DATED_____

ADDENDA NO._____ DATED_____

ADDENDA NO._____ DATED_____

PRIOR TO BIDDING, **SITE VISITS WERE MADE BY MY FIRM** ON THE FOLLOWING DATE(S):

IN WITNESS WHEREOF, the Bidder has hereunto set his/her signature and affixed his/her seal this

_____day of _____, 20____. BY: _____
(name of authorized principal)

_____ _____
(Signature of principal in firm) (firm name and title) (Seal)

_____
(Type contractor's Florida Department of Business and Professional Regulations license number)

State of Florida
County of St. Johns

PERSONALLY APPEARED BEFORE ME, THE UNDERSIGNED AUTHORITY,

_____

who after being sworn by (name of individual signing) me, affixed his/her signature in the space provided above on this _____day of _____, 20___.

_____
(Notary Public)

My commission expires:

END OF DOCUMENT

IDENTICAL TIE BIDS STATEMENT

Whenever two or more bids which are equal with respect to price, quality and service are received by the Florida School for the Deaf and the Blind for the procurement of commodities or contractual services, a bid received from a business that certifies that it has implemented a drug-free workplace program shall be given preference in the award process. Established procedures for processing tie bids will be followed if none of the tied contractors have a drug-free workplace program. In order to have a drug-free workplace program, a business shall:

1. Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the actions that will be taken against employees for violations of such prohibition.

2. Inform employees about the dangers of drug abuse in the workplace, the business' policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation and employee assistance programs and the penalties that may be imposed upon employees for drug abuse violations.

3. Give each employee engaged in providing the commodities or contractual services that are under bid a copy of the statement specified subsection 1 (above).

4. In the statement specified in subsection 1., notify the employees that, as a condition of working on the commodities or contractual services that are under bid the employee will abide by the terms of the statement and will notify the employer of any conviction of or plea of guilty or nolo contendere to any violations of Chapter 893 or of any controlled substance law of the United States or any state for a violation occurring in the workplace no later than five (5) days after such conviction.

5. Impose a sanction on or require the satisfactory participation in a drug abuse assistance or rehabilitation program if such is available in the employee's community by any employee who is so convicted.

6. Make a good-faith effort to continue to maintain a drug-free workplace though implementation of this section.

As the person authorized to sign the statement, I certify that this firm complies fully with the above requirements.

IN WITNESS WHEREOF, the Bidder has hereunto set his/her signature and affixed his/her seal this _____day of _____, 20____. BY: _____ (name of authorized principal)

_____ _____

(Signature of principal in firm) (firm name and title) (Seal)

_____

(Type contractor's Florida Department of Business and Professional Regulations license number)

State of Florida
County of St. Johns

PERSONALLY APPEARED BEFORE ME, THE UNDERSIGNED AUTHORITY,

_____

who after being sworn by (name of individual signing) me, affixed his/her signature in the space provided above on this _____day of _____, 20___.

_____

(Notary Public)

My commission expires:

END OF DOCUMENT

SWORN STATEMENT PURSUANT TO §287.133(3)(a), F.S., ON PUBLIC ENTITY CRIMES

THIS FORM MUST BE SIGNED AND SWORN TO IN THE PRESENCE OF A NOTARY PUBLIC OR OTHER OFFICIAL AUTHORIZED TO ADMINISTER OATHS.

1. This sworn statement is submitted to The Florida School for the Deaf and the Blind by _____ (print individual's name and title) for _____ (print name of entity submitting sworn statement) whose business address is _____ and its Federal Employer Identification Number (FEIN) is _____ (If the entity has no FEIN, include the Social Security Number of the individual signing this statement: _____)

2. I understand that a "public entity crime" as defined in Paragraph 287.133(1) (g), F.S., means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or of the United States, including, but not limited to, and bid or contract for goods or services to be provided to any public entity or an agency or political subdivision of any other state or of the United States and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misrepresentation.

3. I understand that "convicted" or "conviction" as defined in Paragraph 287.133(1) (b), F.S. means a finding of guilt or a conviction of a public entity crime, with or without an adjudication of guilt, in any federal or state trial court of record relating to charges brought by indictment or information after July 1, 1989, as a result of a jury verdict, nonjury trial, or entry of a plea of guilty or nolo contendere.

4. I understand that an "affiliate" as defined in Paragraph 287.133(1) (a), F.S., means:

    1) A predecessor or successor of a person convicted of a public entity crime; or

    2) An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public entity crime. The term "affiliate" includes those officers, directors, executives, partners, shareholders, employees, members and agents whose are active in the management of an affiliate. The ownership by one person of shares constituting a controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm's length agreement, shall be a prima facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of public entity crime in Florida during the preceding 36 months shall be considered an affiliate.

5. I understand that a "person" as defined in Paragraph 287.133(1) (e), F.S., means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which bids or applies to bid on contracts for the provision of goods or services let by a public entity, or which otherwise transacts or applies to transact business with a public entity. The term "person" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity.

6. Based on information and belief, the statement which I have marked below is true in relation to the entity submitting this sworn statement. (Indicate which statement applies.)

_____ Neither the entity submitting this sworn statement, nor any of its officers, directors, executives, partners, shareholders, members, or agents who are active in the management of the entity, nor any affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

_____ The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, members, or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

_____ Either the entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, members, or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989. However, there has been a subsequent proceeding before a Hearing Officer of the State of Florida, Division of Administrative Hearings and the Final Order entered by the Hearing Officer determined that it was not in the public interest to place the entity submitting this sworn statement on the convicted vendor list. (Attach a copy of the final order.)

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR THE PUBLIC ENTITY IDENTIFIED IN PARAGRAPH 1 (ONE) ABOVE IS FOR THAT PUBLIC ENTITY ONLY AND, THAT THIS FORM IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT I AM REQUIRED TO INFORM THE PUBLIC ENTITY PRIOR TO ENTERING INTO A CONTRACT IN EXCESS OF THE THRESHOLD AMOUNT PROVIDED IN SECTION 287.017, F.S., FOR CATEGORY TWO OF ANY CHANGE IN THE INFORMATION CONTAINED IN THIS FORM.

IN WITNESS WHEREOF, the Bidder has hereunto set his/her signature and affixed his/her seal this

_____day of _____, 20____. BY: _____
(name of authorized principal)

_____ _____
(Signature of principal in firm) (firm name and title) (Seal)

_____
(Type contractor's Florida Department of Business and Professional Regulations license number)

State of Florida
County of St. Johns

PERSONALLY APPEARED BEFORE ME, THE UNDERSIGNED AUTHORITY,

_____

who after being sworn by (name of individual signing) me, affixed his/her signature in the space provided above on this _____day of _____, 20___.

_____
(Notary Public)

My commission expires:

END OF DOCUMENT

It is the policy of FSDB to aggressively promote the equality of opportunity in our procurement processes for commodities, services and construction. The purpose is to provide FSDB with quality goods and services at the lowest possible prices from contractors and providers who reflect the diversity of our School and our community. Accordingly, purchasing procedures for commodities and services provide for the solicitation of minority participation. Likewise, participation in construction contracts is encouraged and supported by:

1. the scheduling of pre-solicitation and pre-bid meetings for the purpose of informing minority business enterprises of contracting and subcontracting opportunities in minor and major construction.

2. providing interested minority business enterprises or minority persons with adequate information about the plans, specifications and requirements of construction contracts. Minority contractors and subcontractors should contact the Director of Purchasing to declare interest in this and future projects.

3. providing general contractors who submit construction bids with information regarding minority subcontractors who have declared their interest in the project through the School's Purchasing Office. The contractor may also solicit quotations from other minority subcontractors known to it. A statement signed by officer of company of the Contractor's efforts to solicit bids from School identified and other minority subcontractors shall be submitted with the contractor's proposal at the time of bidding.

END OF DOCUMENT

AFFIDAVIT OF COMPLIANCE WITH MINORITY BUSINESS PARTICIPATION

Comes now_____ as _____ of
(Type name of firm authority) (Type position of authority)

_____ and after being sworn, deposes and states under oath:
(Type name of firm)

1. I have read the policy of The Florida School for the Deaf and the Blind regarding the promotion of equal opportunity in the School's construction process.

2. In preparing and submitting the attached bid, we have contacted the following persons/firms in order to encourage their submission of a bid for a subcontract to do a part of the bid that would otherwise have been subcontracted out by us.

FIRM	CONTACT PERSON
_____	_____
_____	_____
_____	_____

3. Our Firm has also taken additional action to solicit and encourage minority business participation as follows:

_____

_____

FURTHER AFFIANT SAYETH NOT. IN WITNESS WHEREOF, the Bidder has hereunto set his/her signature and affixed his/her seal this

_____day of _____, 20____. BY: _____
(name of authorized principal)

_____ _____
(Signature of principal in firm) (firm name and title) (Seal)

_____
(Type contractor's Florida Department of Business and Professional Regulations license number)

State of Florida, County of St. Johns

PERSONALLY APPEARED BEFORE ME, THE UNDERSIGNED AUTHORITY,

_____

who after being sworn by (name of individual signing) me, affixed his/her signature in the space provided above on this _____day of _____, 20___.

_____
(Notary Public)

My commission expires:

END OF DOCUMENT

NOTICE TO CONTRACTORS

This form must be signed by the owner or corporate officer of the firm covered by this contract. This form will become a legal part of this contract.

1. All staff and employees of the contractor must contact Fieldprint prior to commencing any work on the campus. Instructions shall be provided to the successful respondent.

2. Fieldprint will initiate background checks on all contractors and their staffs. No one will be permitted access to the campus until completion of the background check and issuance of an FSDB Identification.

3. Once cleared each individual will be issued an FSDB identification badge. This identification must be displayed by the individual at all times. If any person working on campus fails to display the identification he will be escorted from the campus and not permitted to return.

4. All contractors are required to ensure that persons working under their contract have completed the required background check. This requirement applies to any sub-contractor working under general contract.

5. Failure of the contractor to ensure compliance with the previous requirements may lead to termination of this contract and the possibility of future work at FSDB.

_____
Name of Firm

By: _____
Authorized Signature

_____
(Print Name as Signed Above)

_____
Title

_____
Date

GC-1 DEFINITIONS

A. The contract documents consist of the following items, including all modifications thereof incorporated in the Documents before their execution. These form the contract: Qualification Process; Invitation to Bid; Proposal Form; Bid Documents; Agreement; General Conditions; Scope of Services; Certifications, Addenda, Attachments; Exhibits; and all other attachments hereto.

B. The Florida School for the Deaf and the Blind (OWNER) and the CONTRACTOR are those mentioned as such in the AGREEMENT.

C. CONTRACTOR: The person whose bid is accepted by the Florida School for the Deaf and the Blind and who enters into a formal contract with the Florida School for the Deaf and the Blind to do the work.

D. BIDDER OR OFFEROR: Any person who submits a bid upon the project described in the Invitation for Bids.

E. BID: The written offer of bidder (when submitted on the reproduced approved forms) to perform the contemplated work and furnish the necessary materials and labor in accordance with the provisions of the contract documents.

F. SCOPE of SERVICES: A part of the contract documents containing the written directions and requirements for completing the work per the contract. The Florida School for the Deaf and the Blind Construction Standards and Specifications, which are cited in the contract documents by reference, shall have the same force and effect as if fully set forth therein.

G. SUBCONTRACTOR: Those firms having a direct contract with CONTRACTOR, including one who furnishes material worked to a special design according to the plans or specifications of this work, but not including one who merely furnishes material.

H. PERSON: Any individual, partnership, society, association, joint stock company, corporation, estate, receiver, trustee, assignee, referee or capacity, whether appointed by a court or others and any combination of individuals.

I. PROJECT MANAGER: The Director of Facilities Management or authorized designee.

J. WORK OF CONTRACTOR OR SUBCONTRACTOR: Labor or materials or both, equipment, transportation, or other facilities necessary to complete the contract.

K. BID POSTING: The official posting and tabulation of all bids received and opened duly presented in response to the bid.

L. FLORIDA SCHOOL FOR THE DEAF AND THE BLIND'S SUPPLEMENTAL INSTRUCTION: Instructions issued by the Project Manager to make minor changes in the work not affecting cost or time, and consistent with the purpose of the work.

M. Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or to an office of the corporation for whom it is intended; or if delivered at or sent by main, to the business address shown in the bid or contract.

N. AFFIDAVIT: The instruction which is to be signed by CONTRACTOR and submitted to the Florida School for the Deaf and the Blind, upon completion of the work, showing that all bills, if any, from subcontractors and suppliers have been paid.

O. It shall be understood that the works "Contract" and "Agreement" are synonymous in the contract documents.

P. DAY: Each day shown on the calendar.

Q. AND: Means "or" and the work "or" means "and" wherever the contents of the contract or its purpose so requires.

R. HE: Where the masculine singular form of the pronoun is used in these contract documents, it shall be construed to mean masculine, feminine or neuter, singular or plural, wherever the context so requires.

GC-2 BACKGROUND CHECKS

In accordance with § 1012.467, F.S., CONTRACTOR'S employees, subcontractors and staff who have obtained from any Florida school district and are wearing a valid uniform statewide contractor's identification badge will be permitted access to the Florida School for the Deaf and the Blind's campus.

Unless exempt by law, the CONTRACTOR agrees that, pursuant to § 1012.465 and § 1012.467, F.S., any of the CONTRACTOR's employees, subcontractors and staff, including temporary or day laborers, not possessing and wearing a valid uniform statewide contractor's identification badge shall submit to Level 2 background screening, defined in § 1012.32, F.S., obtain, and wear a uniform statewide contractor's identification badge before being allowed access to the campus.

The CONTRACTOR also agrees that, while on the campus, the CONTRACTOR's employees, subcontractors and staff shall at all times wear, so as to be visible, their uniform, statewide contractor's identification badges and be subject to all of the Florida School for the Deaf and the Blind's rules and regulations that govern the behavior of its full-time employees, including all traffic rules and regulations and the prohibition of tobacco usage.

The CONTRACTOR agrees that any breach of said rules and regulations may result in immediate cancellation of this CONTRACT.

The requirements of this GENERAL CONDITION in no way obligates CONTRACTOR if CONTRACTOR requires no access to the aforementioned campus or facilities and does not attempt to access the campus or facilities.

GC-3 BIDDERS AND SUBCONTRACTOR'S LICENSURE AND REGISTRATION REQUIREMENTS.

Each bidder and each subcontractor whose field or area is governed by Chapter 399, 455, 489 or 633, F.S. for licensure must hold a valid current license as required by the Statute. If the bidder is a corporation, he must also be properly registered with the State of Florida, Department of State, Division of Corporation.

GC-4 REJECTION OF BIDS

The Owner reserves the right to reject any and all bids under any of the circumstances prescribed in Rule 60D-5.0071, F.A.C., and to negotiate the contract in accordance with Rules 60D-5.008 and 60D-5.0091, F.A.C., if the low qualified bid exceeds the project construction budget.

GC-5 NOTICE AND PROTEST PROCEDURES

On contracts within Levels, 2, 3, 4 and 5, the notice of a decision or intended decision on contract award or bid rejection shall be given by posting the bid tabulation at the location where the bids were opened or by certified United States mail, return receipt requested to each bidder.

Protest

1. Any person who is affected adversely by the Owner's decision or intended decision shall file with the Owner a notice of protest in writing within 72 hours, excluding Saturday, Sunday and State legal holidays, after receipt of the bidding documents if the protest is directed toward the bidding documents or after the notice of the Owner's decision or intended decision on contract award or bid rejection if the protest is directed toward contract award or bid rejection.

2. Thereafter a formal written protest by petition in compliance with § 120.53 and 120.57, F.S., and Rule 60D-5.010, F.A.C., must be filed with the Owner within ten (10) days after the d ate the notice of protest was filed.

3. Failure to file a timely notice of protest or failure to file a timely formal written protest petition shall constitute a waiver of protest proceedings. Any protest filed prior to posting of the bid tabulation or receipt of the notice of the agency decision or intended decision will be considered abandoned unless renewed within the time provided for protests.

4. The Agency and the Commission on Minority Economic and Business Development is hereby granted standing to protest, pursuant to s. 287.0945, in a timely manner, any contract award in competitive bidding for contractual services and construction contracts that fail to include minority business enterprise participation, if any responding bidder has demonstrated the ability to achieve any level of participation, or any contract award for commodities where, a reasonable and economical opportunity to reserve a contract statewide or district level, for minority participation was not executed or, and agency failed to adopt applicable preference for minority participation. Any low bidder with no participation may be presumed not in "good faith". All bidders will be notified of the minority participation goal by addendum.

Owner Action

1. Upon receipt of a notice of protest that has been timely filed, the Owner shall delay the contract award process until the subject of the protest is resolved by mutual agreement between the parties or by final Owner action, unless the Owner sets forth in writing particular facts and circumstances which require the continuation of the bid solicitation process or the contract award process without delay to avoid an immediate and serious danger to public health, safety, or welfare; provided, however, that if the petition is not files within the time stated above, the contract award process may continue as if the notice of protest had not been filed.

2. Upon receipt of the formal written protest petition which has been timely field, the Owner shall attempt to resolve the protest by mutual agreement between the parties within 7 days, excluding Saturday, Sunday and legal State holidays.

3. If the protest is not resolved by mutual agreement within said seven (7) days, and if no disputed issue of material fact is involved, the Owner may designate a Hearing Officer who shall conduct an informal proceeding pursuant to § 120.57, F.S., and Rule 60D-5.010, F.A.C.. The qualifications of such designated Hearing Officer shall be: 1. A member in good standing of the Florida Bar; or 2. A person knowledgeable by virtue of practical experience of the procedures relating to soliciting and evaluating bids for state contracts. Notice of informal proceedings shall be given no less than three days prior to the proceeding. The Proceedings may be held before the Owner.

4. If there is a disputed issue of material fact, the protest shall be referred to the Division of Administrative Hearings of Department of Administration, State of Florida, for proceedings under Section 120.57(1).

GC-6 DETERMINATION OF SUCCESSFUL BIDDER

1. All projects except where competitive bidding is waived under the provisions of Rule 60D-5.008, F.A.C., will be publicly bid in accordance with the provisions herein. Award of contract will be made to the responsive bidder, determined to be qualified in accordance with the provisions herein and meeting the requirements of the bidding documents, that submits the lowest valid bid for the work. The lowest bid will be determined as follows:

2. The lowest bids will be the bids from the responsive bidders that have submitted the lowest prices for the base bid or the base bid plus the additive alternates or less the deductive alternates chosen by the Agency to be included in or excluded from the proposed contract, taken in numerical order listed in the bid documents.

3. On projects whose bidding documents provide for evaluation of the bids based performance criteria, the lowest bid will be the bid by the firm whose bid products are determined to yield the lowest total cost in accordance with the criteria set forth in the bidding documents.

4. The Florida School for the Deaf and the Blind reserves the right to award contracts to multiple firms.

GC-7 CORRELATION AND INTENT OF DOCUMENTS

Contract documents are complementary, and what is called for by any one shall be binding as if called by all. The intent of the documents is to include all labor and materials, equipment, transportation and incidental necessary for the proper and complete execution of the work. Materials or work described in words, which so applied, have a well-known technical or trade meaning shall be held to refer to such recognized standards.

GC-8 DETAILED INSTRUCTIONS AND ADDENDA

The Project Manager will furnish, prior to bid, additional written instructions necessary for the proper execution of the work. All instructions will be consistent with the contract documents, true developments thereof and reasonably inferable therefrom. Any additional instructions which alter the contract time or cost will be issued as addenda.

GC-9 NOTICE TO PROCEED TO MOBILIZE ON SITE AND TO PROCEED WITH CONSTRUCTION; TIME OF COMPLETION AND LIQUIDATED DAMAGES

The contract will be issued to the Contractor after it is signed. The Contractor shall not pay for or secure any permits except as provided herein.

Local building permits are not required, however, special permits such as Water Management District, Dept. of Environmental Regulation, D.O.T., etc., may be necessary before construction can start. If additional time is required, the Contractor will request approval of a time extension for good cause for the purpose of obtaining any permit required prior to commencing construction on the site.

Upon securing the State Building Permit, the Contractor shall notify the Architect-Engineer and the Owner. The Notice to Proceed to mobilize on site and to proceed with construction will then be issued by the Owner.

The Owner is entitled to completion of the project within the time fixed above or within such further time, if any, as may be allowed in accordance with the provisions of the contract. In the event of termination of the contract by the Owner prior to completion the Contractor shall be liable to the Owner for the expenses for additional managerial and administrative services.

1. For each day he is in arrears in his work at the time of said termination as determined by the Project Director, and

2. For each day of thirty (30) additional calendar days hereby stipulated and agreed to be the time it will require the Owner to effect another contract for completion of the project and for resumption of work thereon. Provided, however, that the sum of 1 and 2 above shall not exceed the number of days beyond the original agreed completion date, or any extension thereof as herein provided, reasonably required for completion of the project.

It is further agreed that the Owner may deduct from the balance retained by the Owner, under the provisions above, the additional managerial and administrative and any other expenses of Owner, as the case may be, or such portions thereof as the said retained balance will cover.

GC-10 CONTRACTOR'S UNDERSTANDING

CONTRACTOR has satisfied himself concerning the nature and location of the work and the general and local conditions, and particularly, but without limitations, with respect to the following: those affecting transportation, disposal, handling and storage of materials, equipment and facilities needed preliminary to and during performance of the contract; and all other matters which can in any way affect performance of the contract, or the cost associated with such performance.

The failure of CONTRACTOR to acquaint himself with the aforementioned applicable conditions will not relieve him from the responsibility for properly estimating either the difficulties, the time required, or the costs of

successfully performing the contract. No verbal agreement or conversation with any officer, agency or employee of the Florida School for the Deaf and the Blind, either before or after the execution of the contract, shall affect or modify any of its terms.

GC-11 OWNERSHIP OF CONTRACT DOCUMENTS
All specifications, other contract documents and copies thereof furnished by the Florida School for the Deaf and the Blind are the property of the Florida School for the Deaf and the Blind. They are not to be used on other work and, with the exception of the signed contract set, are to be returned to the Florida School for the Deaf and the Blind, at the request of the Florida School for the Deaf and the Blind.

GC-12 CONTRACTOR's MATERIALS, APPLIANCE & EMPLOYEES
Unless otherwise stipulated, CONTRACTOR shall provide and pay for all materials, labor, water, tools, equipment, light power, transportation and other facilities necessary for the execution and completion of the work.

Both workmanship and materials shall be of good quality. CONTRACTOR shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

CONTRACTOR shall at all times enforce strict discipline and good order among his employees and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him.

GC-13 CIVIL RIGHTS
Pursuant to Chapter 760, Fla. Statute CONTRACTOR shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin, age, handicap or marital status.

GC-14 CONFLICTING EMPLOYMENT
CONTRACTOR agrees that at the time of execution of this contract he has no retainer or employment agreement, oral or written, with any third party relating to any matters which adversely affect any interest or position of the Florida School for the Deaf and the Blind. CONTRACTOR shall not accept during the terms of this contract any retainer or employment from a third party whose interest appear to be conflicting or inconsistent with those of the Florida School for the Deaf and the Blind.

Notwithstanding the foregoing paragraph, CONTRACTOR may accept retainers from or be employed by third parties whose interest appear conflicting or inconsistent with those of the Florida School for the Deaf and the Blind, if, after full written disclosure of the facts to the Florida School for the Deaf and the Blind. The Florida School for the Deaf and the Blind determines that the apparent conflict shall not interfere with the performance of the work by CONTRACTOR.

GC-15 PROTECTION AND RESTORATION OF WORK & PROPERTY
CONTRACTOR shall continuously maintain adequate protection of all his work from damage and shall protect public and privately owned property, structures, utilities, and work of any kind against damage or interruptions of service, which may result from the operations of CONTRACTOR. CONTRACTOR shall repair and restore any such damage, injury, or loss, at his expense, except such as may be directly due to errors in the contract documents or caused by the agents or employees of the Florida School for the Deaf and the Blind, as required by public authority or local conditions.

GC-16 INSPECTION OF WORK
Representatives of the Florida School for the Deaf and the Blind may visit and inspect the work at any time during his progress, and CONTRACTOR shall provide safe facilities for the inspection.

GC-17 SUPERVISION
CONTRACTOR shall provide sufficient and qualified supervisory and administrative personnel so that the work is properly performed. CONTRACTOR's supervisory personnel shall be subject to the Florida School for the Deaf and Blind approval.

GC-18 CHANGES IN THE WORK NOT AFFECTING COST OR TIME
The Project Manager shall have authority to make minor changes in the work, not affecting cost, not affecting time, and not inconsistent with the purpose of the work. CONTRACTOR shall not perform extra work or make changes without issuance of written supplemental instructions from the Project Manager. All supplement instructions shall be incorporated into the contract.

GC-19 CONTRACT AMENDMENTS
The Florida School for the Deaf and the Blind, without invalidating the contract, may order extra work or make changes by altering, adding to, or deducting from the work or cost and adjusting the contract accordingly. All such work shall be executed under the conditions of the original contract except that any associated claim for extension of time will be adjusted at the time of ordering the change. Changes affecting the work or cost shall be made only pursuant to a written contract amendment. No amendment to the contract shall be binding unless it is in writing.

The value of any work or cost affected by contract amendment will be determined in one or more of the following ways:

By estimate and acceptance in a lump sum. By unit prices named in the contract or subsequently agreed upon. By costs and percentage or by cost and a fixed fee.

If none of the above methods is agreed upon, CONTRACTOR shall proceed with the work and shall keep and present in such form as the Project Manager may direct a correct amount of the net cost of labor and materials, together with vouchers. The Project Manager will certify the amount, including reasonable allowances for overhead and profit, due CONTRACTOR. Pending final determination of value, payments on account of contract amendments will be made on the Project Manager's estimate.

GC-20 EMERGENCY CHANGES
In the event that an emergency endangering life or property requires immediate action, the Florida School for the Deaf and the Blind may give CONTRACTOR an oral order, direction or instruction to proceed with a change. Any oral order, direction or instruction will be confirmed in writing to CONTRACTOR within one working day. CONTRACTOR will, within forty-eight hours after commencement of the emergency change, provide the Florida School for the Deaf and the Blind with a written bid on the effect of the change. If CONTRACTOR fails to timely notify the Florida School for the Deaf and the Blind of effects on the schedule of compensation caused by the emergency change, CONTRACTOR shall be deemed to have waived any right to claim an extension of time or increase in compensation as a result of the emergency change.

GC-21 CHANGES IN THE WORK, DELAYS, EXTENSIONS OF TIME AND CLAIMS
During the course of the Contractor's performance of the work necessary to complete the subject Project, certain events may occur which have the effect of changing the conditions under which the work is to be performed as specified and described in the Bidding Documents, and/or the nature and extent of the work As specified and described in the Bidding Documents. The occurrence of such events may cause the Contractor to incur greater or less cost and expense to perform the work required to complete the subject Project than planned to be incurred in the Contractor's successful bid, in which event the Contractor or the Owner shall respectively be entitled to either an increase or decrease in the Contract Sum, whichever is the Case, to the extent such greater or less cost and expense results, and in which event the party entitled to the Benefit of any such adjustment to the Contract Sum shall, within twenty-one (21) calendar days from the First occurrence of such event(s), present written demand therefore on the other party through the Owner. Should the Contractor and Owner be unable to settle and dispose of such demand within thirty- (30) calendar Days from the date any such claim is presented, upon terms and conditions mutually agreeable to the Contractor, then such demand shall be referred to the Owner for determination, which determination shall Be final and binding upon the Contractor, unless appealed in accordance with applicable provisions of the Contract Documents, and if the Owner, upon considering any such demand, determines that the Contract Sum should be increased or decreased, the Owner's determination of the amount of any such increase or Decrease in the Contract Sum shall be governed and controlled by strict adherence to the following described Guidelines and limitations, and neither the Contractor or the Owner shall be entitled to receive any monetary Consideration beyond that which is authorized herein below.

All adjustments to the Contract Sum resulting from a change in the work shall be determined by the measure of actual or estimated as the case may be, out-of-pocket costs and expenses incurred or spared by the contractor for labor, materials, equipment rental, plus overhead and profit thereon, for

performing the changed work.

1. Labor costs shall be inclusive of all direct job site cost for estimation, laying out, mechanics' wages and laborers' wages, together with all payroll taxes, payroll assessments, and insurance premiums paid for such labor.

2. All material costs, equipment costs and equipment rental costs shall be trade discount rates, plus State Sales Tax.

3. Overhead and profit shall be inclusive of all project management, project administration, superintendence, project coordination, project scheduling and other administrative support functions and services, whether performed on the job site or off the job site and general support equipment. Overhead and profit shall be determined as follows:

    a. Overhead and profit shall be calculated at the rate of 15% of the Contractor's labor, material, equipment and equipment rental costs, incurred or spared as measured under the preceding paragraphs for changes in the work performed by the officers, employees or subsidiaries of the Contractor.

    b. Overhead and profit shall be calculated at the rate of 7-1/2 percent of the Contractor's sub-contractors' actual labor, material, equipment and equipment rental costs, incurred or spared, as measured under the preceding paragraphs, plus 15% of all such costs, as overhead and profit to the Contractor's subcontractors, for all changes in the work performed by the officers, employees or subsidiaries of the Contractor's sub-contractors.

GC-22 DEDUCTIONS/NON-PAYMENT FOR CONTRACTOR INEFFICIENCIES

If the Project Manager decides it is not in the Florida School for the Deaf and Blind's best interest for CONTRACTOR to correct incomplete or damaged work caused by CONTRACTOR inefficiencies, the Florida School for the Deaf and the Blind will make an equitable deduction for the work from the contract price. Further, CONTRACTOR shall not be compensated for delays in the work caused by CONTRACTOR inefficiencies, correction or rework made necessary by errors, omissions or failure to properly perform the work.

GC-23 CORRECTION OF WORK BEFORE FINAL PAYMENTS

CONTRACTOR shall promptly make corrections to work returned by the Florida School for the Deaf and the Blind's Project Manager as failing to conform to the contract, without expense to the Florida School for the Deaf and the Blind.

GC-24 THE FLORIDA SCHOOL FOR THE DEAF AND BLIND'S RIGHT TO DO WORK

If CONTRACTOR should neglect to perform the work properly or fail to perform any provision of this contract, the Florida School for the Deaf and the Blind, after three days written notice to CONTRACTOR, may without prejudice to any other remedy he may have, make good such deficiencies at CONTRACTOR's expense.

Upon receipt of notice of termination CONTRACTOR waives all claims for damages, including, but not limited to, loss of anticipated profits, idle equipment, labor and facilities, and claims of Subcontractors and Vendors.

GC-25 THE FLORIDA SCHOOL FOR THE DEAF AND BLIND'S RIGHT TO SUSPEND WORK & TERMINATE CONTRACT

The Florida School for the Deaf and the Blind may, at any time, suspend all or part of the work, or any part of it by giving five (5) days' notice to CONTRACTOR in writing. The work shall be resumed by CONTRACTOR within ten (10) days after the date fixed in a written notice to resume from the Florida School for the Deaf and the Blind to CONTRACTOR. The Florida School for the Deaf and the Blind will reimburse CONTRACTOR for expense incurred as a result of the suspension unless it was ordered by the Project Manager to enforce the contract or ordered for any violation of the contract.

The following actions by CONTRACTOR shall give the Florida School for the Deaf and the Blind the right to terminate the contract within seven (7) days after CONTRACTOR's receipt of written notice and take possession of the premises and of all materials, tools and appliances on it and finish the work by whatever method the Florida School for the Deaf and the Blind may deem expedient. In such case, CONTRACTOR will not be entitled to receive any further payment until the work is finished. If the unpaid balance of the contract price exceeds the expense of finishing the work, including compensation for additional managerial and administrative services, the excess will be paid to CONTRACTOR. If the expense exceeds the unpaid balance, CONTRACTOR shall pay the difference to the Florida School for the Deaf and the Blind. The expense incurred by the Florida School for the Deaf and the Blind and the damage incurred through CONTRACTOR's default will be certified by the Project Manager.

CONTRACTOR actions resulting in contract termination are as follows:

1. CONTRACTOR fails to carry forward and complete the work;

2. CONTRACTOR fails to comply with applicable laws, regulations or ordinances;

3. CONTRACTOR fails to commence correction of defective work promptly after notification of the defect, or fails to continuously and vigorously pursue correction of the defect until the work is completed to the full satisfaction of the contract requirements;

4. CONTRACTOR makes a general assignment for the benefit of his creditors.

5. CONTRACTOR has a receiver appointed because of insolvency;

6. CONTRACTOR files bankruptcy or has a petition for involuntary bankruptcy filed against it; or CONTRACTOR fails to make prompt payment, when properly due, to his subcontractors, vendors or others for materials or labor used in the work.

Notwithstanding the above, the Florida School for the Deaf and the Blind reserves the right to terminate this contract or any work issued under it anytime, with or without cause upon 30 days written notice to CONTRACTOR. Upon receiving notice of termination, CONTRACTOR shall discontinue the work on the date and to the extent specified in the notice, and shall place no further orders for materials, equipment, services or facilities except as needed to continue any portion of the work which was not terminated. CONTRACTOR shall also make every reasonable effort to cancel, upon terms satisfactory to the Florida School for the Deaf and the Blind, all orders or subcontracts related to the terminated work. In the event of termination CONTRACTOR shall be compensated for any work performed prior to termination.

Upon receipt of notice of termination CONTRACTOR waives all claims for damages, including, but not limited to, loss of anticipated profits, idle equipment, labor and facilities, and claims of Subcontractors and Vendors.

GC-26 THE FLORIDA SCHOOL FOR THE DEAF AND THE BLIND's RIGHT TO STOP WORK

The Florida School for the Deaf and the Blind reserves the right to issue a Stop Work Order to CONTRACTOR in the event CONTRACTOR fails to comply properly or if negligent in the performance of any provision of this contract. The Stop Work Order will include instructions that all performance under this contract shall immediately cease and desist and that no further billable costs are to be incurred. The Stop Work Order shall continue in full force and effect until rescinded in writing by the Florida School for the Deaf and the Blind.

GC-27 CONTRACTOR's RIGHT TO STOP WORK & TERMINATE CONTRACT

If the work should be stopped under an order of any court, or other public authority for a period of three months, through no act or fault of CONTRACTOR or of anyone employed by it, or if the Project Manager should fail to issue any estimate for payment within seven (7) days after is due, of if the Florida School for the Deaf and the Blind fails to pay CONTRACTOR within thirty (30) days of its maturity and presentation, any sum certified by the Project Manager then CONTRACTOR may, upon seven (7) days written notice to the Florida School for the Deaf and the Blind and the Project Manager, stop work or terminate this contract and recover from the Florida School for the Deaf and the Blind payment for all work executed

and any loss sustained upon any plant or materials and reasonable profit and damages.

GC-28 REMOVAL OF EQUIPMENT

In the case of termination of this contract before completion, from any cause whatsoever, CONTRACTOR, if notified to do so by the Florida School for the Deaf and the Blind shall promptly remove any part or all of his equipment and supplies from any property interest of the Florida School for the Deaf and the Blind, failing which, the Florida School for the Deaf and the Blind will have the right to remove such equipment and supplies at the expense of CONTRACTOR.

GC-29 PAYMENTS WITHHELD

The Florida School for the Deaf and the Blind may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any certificate of payment to such an extent as may be necessary to protect the Florida School for the Deaf and the Blind from loss on account of:

1. Defective work not remedied.

2. Claims filed or reasonable evidence indicating probable filing of claims.

Failure of CONTRACTOR to make payments properly to the subcontractors or for materials or labor. The Project Manager's opinion that the contract cannot be completed for the remaining or unpaid funds. Failure to maintain adequate progress. Damage to another CONTRACTOR. When the above grounds are removed, payment will be made for amounts withheld.

GC-30 CONTRACTOR'S INSURANCE

The Contractor shall not commence any work in connection with this Agreement until he has obtained all of the following types of insurance and such insurance has been approved by the Owner, nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance required of the subcontractor has been so obtained and approved. All insurance policies shall be with insurers qualified and doing business in Florida through an authorized licensed Florida Resident Agent.

Worker's Compensation Insurance

The Contractor shall take out and maintain during the life of this Agreement, Worker's Compensation Insurance for all of his employees connected with the work of this project and, in case any work is sublet, the Contractor shall require the subcontractor similarly to provide Worker's Compensation Insurance for all of the latter's employees unless such employees are covered by the protection afforded by the Contractor. Such insurance shall comply fully with the Florida Worker's compensation law. In case any class of employees engaged in hazardous work under this contract at the site of the project is not protected under the Workers Compensation statute, the Contractor shall provide, and cause each subcontractor to provide, adequate insurance, satisfactory to the Owner, for the protection of his employees not otherwise protected.

Contractor's Public Liability and Property Damage Insurance

The Contractor shall take out and maintain during the life of this Agreement COMPREHENSIVE GENERAL LIABILITY AND COMPREHENSIVE AUTOMOBILE LIABILITY INSURANCE as shall protect him from claims for damage for personal injury, including accidental death, as well as claims for property damages which may arise from operating under this Agreement whether such operations are by himself or by anyone directly or indirectly employed by him, and the amount of such insurance shall be the minimum limits as follows:

1. CONTRACTOR'S COMPREHENSIVE GENERAL LIABILITY COVERAGES, BODILY INJURY & PROPERTY DAMAGE: $1,000,000.00 Each Occurrence, Combined Single Limit

2. AUTOMOBILE LIABILITY COVERAGES, BODILY INJURY & PROPERTY DAMAGE: $1,000,000.00 Each Occurrence, Combined Single Limit Insuring clause for both BODILY INJURY AND PROPERTY DAMAGE shall be amended to provide coverage on an OCCURRENCE BASIS.

Subcontractor's Public Liability and Property Damage Insurance

The Contractor shall require each of his subcontractors to procure and maintain during the life of this subcontract, insurance of the type specified above or insure the activities of his subcontractors in his policy, as specified above.

"XCU" (Explosion, Collapse, Underground Damage)

The Contractor's Liability Policy shall provide "XCU" coverage for those classifications in which they are applicable.

Broad Form Property Damage Coverage, Products and Completed Operations Coverage's

The Contractor's Liability Policy shall include Broad Form Property Damage Coverage, Products and Completed Operations Coverage's.

Contractual Liability-Work Contracts

The Contractor's Liability Policy shall include Contractual Liability Coverage designed to protect the Contractor for contractual liabilities assumed by the Contractor in the performance of this Contract.

Indemnification Rider

To the fullest extent permitted by law, the Contractor's Liability Policy shall indemnify and hold harmless the Owner from and against claims, damages, loses and expenses, including but not limited to reasonable attorney's fees arising out of or resulting from performance of the work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including loss of use resulting therefrom, to the extent caused in whole or in part by negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to the Owner.

Builder's Risk Coverage

The Owner reserves the right to require the Contractor to provide Builder's Risk Coverage on a project by project basis.

Asbestos-Abatement Contractors Liability Insurance Pollution Endorsement

The asbestos-abatement Contractor shall procure a pollution endorsement to his public liability insurance, against claim or claims expenses arising from the abatement project, as required by § 469 , F.S.. The coverage by the endorsement may be of the Claims- Made type.

Loss Deductible Clause

The State of Florida shall be exempt from, and in no way be liable for any sums of money which may represent a deductible in any insurance policy. The payment of such deductible shall be the sole responsibility of the General Contractor and/or subcontractor providing such insurance.

Certificate of Insurance

The Owner shall be furnished proof of coverage of the above required insurance. Said proof shall be submitted on a form approved by the Department of Insurance. Said certificate of insurance forms shall be completed, signed by the authorized licensed Florida Resident Agent and returned to the office of the Owner. These certificates shall be dated and show:

1. The name of the insured contractor, the specific job by name and job number, the name of the insurer, the number of the policy, its effective date, and its termination date.

2. Statement that the Insured will mail notice to the Owner and a copy to the Architect-Engineer at least thirty (30) calendar days prior to any material changes in provisions or cancellation of the policy.

GC-31 LIENS

Neither the final payment nor any part of the retained percentage shall become due until CONTRACTOR delivers to the Florida School for the Deaf and the Blind, if requested, a complete release of all liens arising out of this contract, and an affidavit stating the release and receipts include all the labor and managerial costs for which a lien could be filed but CONTRACTOR may, if any subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the Florida School for the Deaf and the Blind, to indemnify the Florida School for the Deaf and the Blind against any lien. If any lien remains unsatisfied after all payments are made, CONTRACTOR shall refund to the Florida School for the Deaf and the Blind all monies that the latter may be compelled to pay in discharging such a lien, including all costs and a reasonable attorney's fee.

GC-32 ASSIGNMENT
CONTRACTOR shall not assign the contract or sublet it as a whole or in part without the written consent of the Florida School for the Deaf and the Blind nor shall CONTRACTOR assign any moneys due or to become due to him hereunder, without prior written consent of the Florida School for the Deaf and the Blind.

GC-33 RIGHTS OF VARIOUS INTERESTS
Wherever work being done by the Florida School for the Deaf and the Blind forces or by the other contractors is contiguous to work covered by this contract, the respective rights of the various interests involved will be established by the Project Manager, to secure the completion of the various portions of the work in general harmony.

GC-34 SEPARATE CONTRACTS
The Florida School for the Deaf and the Blind reserves the right to let other contracts in connection with this work. CONTRACTOR shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly conduct and coordinate his work with theirs.

If any part of CONTRACTOR's work depends, for proper execution or results upon the work of any other contractor, CONTRACTOR shall inspect and promptly report to the Project Manager any defects in such work that render it unsuitable for such proper execution and results. His failure so to inspect and report shall constitute an acceptance of the contractor's work as fit and proper for the reception of his work, except as to defects which may develop in the other contractor's work after the execution of the work.
To insure the proper execution of his subsequent work, CONTRACTOR shall measure work already in place of completed and shall at once report to the Project Manager any discrepancy between the executed work and the Drawings.

GC-35 SUBCONTRACTS
CONTRACTOR shall, as soon as practicable after signing the contract, notify the Project Manager in writing of the names of subcontractors proposed for the work and shall not employ subcontractor's, unless they are approved by the Project Manager. CONTRACTOR agrees that he is as fully responsible to the Florida School for the Deaf and the Blind for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by them.

Nothing contained in the contract documents shall create any contractual relation between any subcontractors and the Florida School for the Deaf and the Blind.

CONTRACTOR shall prepare invitations for bids, or requests for proposal when applicable, for all procurements of long lead items, materials and services, and for Subcontractor contracts. Such invitations for bids shall be prepared in accordance with the following guidelines:

1. Contracts over $1,000 but not exceeding $10,000 may be entered into by the CONTRACTOR with the firm which submits the lowest written quotation. The CONTRACTOR shall obtain a minimum of two (2) written quotations. The successful quotation shall be confirmed by written contract or purchase order to the low bid firm defining the scope and quality of work to be provided to the owner.

2. Contracts exceeding $10,000 but not exceeding $200,000 may be entered into by the CONTRACTOR with the firm who is qualified and submits the lowest responsive proposal. The CONTRACTOR shall request at least three (3) firms to submit sealed written proposals based on a written drawings and/or specification. The written proposals shall all be opened publicly at the location, date and time named by the Owner in the CONTRACTOR request for proposal.

3. Contracts exceeding $200,000 but not exceeding $500,000 may be entered into by the CONTRACTOR with the firm who is qualified and submits the lowest responsive proposal. The CONTRACTOR shall advertise these projects at least once with the last advertisement appearing at least 21 calendar days prior to the established bid opening date. These proposals shall be based on approved plans and specifications. Bids shall be received and opened publicly at the location, date and time names by the Owner in the CONTRACTOR request for proposal.

4. Contracts exceeding $500,000 shall be treated the same as described under 3 above except that the advertisement shall be run for at least 30 days prior to the established bid opening and at least 5 days prior to any scheduled pre-bid conference.

5. Individual purchases of materials or rentals or leases of equipment amounting to less than $1,000.00 each may be made with 1 bid or quote. However, the CONTRACTOR shall not divide or separate a procurement in order to avoid the requirements set forth above.

GC-36 COORDINATION WITH OTHER CONTRACTORS
CONTRACTOR shall arrange his work so as not to interfere with the operations of other contractors employed by the Florida School for the Deaf and the Blind and engaged upon adjacent work and to join his work to that or others in a proper manner, in accordance with the spirit of the plans and specifications, and to perform his work in the proper sequence in relation to that or other contractors, all as may be directed by the Project Manager.

GC-37 PROJECT MANAGER'S STATUS
The Florida School for the Deaf and the Blind's Project Manager may make on-site inspections at any time. He will have authority to reject all work and materials which do not conform to the contract, and to recommend solutions to questions which arise in the execution of the work. He has authority to stop work whenever such stoppage may be necessary to insure the proper execution of the contract.

GC-38 PROJECT MANAGER'S DECISIONS
The Florida School for the Deaf and the Blind's Project Manager will, within a reasonable time after their presentation, make decisions in writing on all claims submitted by CONTRACTOR, and on all other matters relating to the execution and progress of the work or the interpretation of the contract. All such decisions of the Florida School for the Deaf and the Blind's Project Manager shall be final.

GC-39 DISPUTE RESOLUTION
CONTRACTOR has the duty to seek clarification and resolution of any issue, discrepancy, fulfillment of the contract on the part of CONTRACTOR and the Florida School for the Deaf and the Blind. Unless otherwise specified, any formal request by CONTRACTOR for additional compensation, schedule adjustment, or other dispute resolution must be filed in writing by CONTRACTOR and submitted to the Florida School for the Deaf and the Blind's Project Manager no later than three (3) days after the occurrence of the event causing the dispute. CONTRACTOR's failure to provide such notice will constitute a waiver by occurring more than three (3) days prior to the date notice is provided to the Florida School for the Deaf and the Blind unless extended by the Florida School for the Deaf and the Blind.

Once a formal request for dispute resolution, additional compensation, extension of time, interpretation, or clarification is received, the Florida School for the Deaf and the Blind will make every effort to arrive at a timely determination. This determination will be provided to CONTRACTOR's authorized representative in writing. All determinations, instructions and clarifications of the Florida School for the Deaf and the Blind will be final unless CONTRACTOR files with the Florida School for the Deaf and Blind's Project Manager, copying the Project Manager within ten (10) days after receipt of such determination, instruction, or clarification, an informal written protest stating clearly and in detail the basis for it. The Florida School for the Deaf and the Blind Project Manager will issue a decision upon each such protest; provided, however, that at all times, CONTRACTOR shall proceed with the work in accordance with the determination, instructions, and clarifications of the Project Manager. CONTRACTOR's failure to protest Project Manager's determinations, instructions or clarifications within ten (10) days after receipt will be a waiver by CONTRACTOR of all his rights to further protest.

GC-40 SAFETY
In performing the contract, CONTRACTOR shall provide and maintain sufficient protection for the lives and health of employees and other persons preventing of damage to property, materials and equipment. To this end,

CONTRACTOR shall comply with all applicable state, federal and local governmental safety laws, rules, regulations and building codes. CONTRACTOR shall make certain that only authorized personnel are allowed on the worksite, and shall post notices warning both employees and members of the public of all safety hazards.

Construction signs shall be furnished, erected, maintained, moved and removed as required and as directed to adequately and safely inform and direct the traveling public. Signs and markers shall indicate actual conditions.

GC-41 ACCEPTANCE OF FINISHED WORK

The Project Manager will make final acceptance inspection of all work to be provided under this contract, when completed and finished in all respects in accordance with these plans and specifications.

GC-42 WARRANTY

CONTRACTOR warrants for a period of one (1) year from the date of substantial completion that the work and workmanship completed by CONTRACTOR conform to the contract Specifications.

GC-43 EXCLUSION OF OWNER FROM LIABILITY

Notwithstanding any other provision of the Contract Documents, should the Contractor sustain loss or be damaged by act or omission of a separate Contractor, the Owner shall not be liable for any such loss or damage and the Contractor shall not be entitled to obtain any monetary relief from the Owner to compensate for any such loss or damage, but shall be limited to such recovery as is otherwise available at law from persons and or entities other than the Owner.

GC-44 PUBLIC RECORDS

The CONTRACTOR shall comply with the public records laws of the State of Florida, specifically to: Keep and maintain public records that ordinarily and necessarily would be required by AGENCY in order to perform the services in this AGREEMENT.

Provide the public with access to public records on the same terms and conditions that AGENCY would provide the records and at a cost that does not exceed the cost provided in Chapter 119, F.S., or as otherwise provided by law.

Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law.

Meet all requirements for retaining public records and transfer, at no cost, to AGENCY all public records in possession of CONTRACTOR upon termination of this AGREEMENT and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be provided to AGENCY in a format that is compatible with the information technology systems of AGENCY.

In accordance with § 287.058(1) (c), F.S., the AGENCY may unilaterally cancel this AGREEMENT for refusal by the CONTRACTOR to allow public access to all documents, papers, letters, or other material made or received by the CONTRACTOR in conjunction with this AGREEMENT, unless the records are exempt from Section 24(a) of Article I of the Constitution of the State of Florida and § 119.07(1), F.S..

GC-45 TRANSPARENCY FLORIDA ACT

The CONTRACTOR acknowledges that the AGENCY will post electronic images of this AGREEMENT (the contract), including all attachments, modifications, renewals, and procurement documents to the state's contract tracking system, which is located on a secure website on the Internet, in accordance with § 215.985, F.S..

Pursuant to § 215.985(14), F.S., the CONTRACTOR shall have the right to request in writing that the AGENCY redact any portion of any document image that is confidential or exempt from public disclosure by law. A fee will not be charged for a redaction made pursuant to the request.

The CONTRACTOR shall have the right under law to petition the circuit court for an order directing compliance with § 215.985(14), F.S..

GC-46 PHOTOGRAPHS AND RECORDINGS

The CONTRACTOR will not, without the written authorization of the AGENCY'S President or designee, photograph, interview, audio tape, and/or videotape while on the campus of the AGENCY and will not engage in such activities when students of the AGENCY are attending off-campus events as invited guests.

AGREEMENT BETWEEN THE STATE OF FLORIDA THE FLORIDA SCHOOL FOR THE DEAF AND THE BLIND AND [COMPANY OR ORGANIZATION NAME]

This AGREEMENT is entered into in the City of Saint Augustine, St. Johns County, Florida, by and between THE STATE OF FLORIDA, THE FLORIDA SCHOOL FOR THE DEAF AND THE BLIND, hereinafter called "AGENCY", an agency of the State of Florida, with headquarters located at 207 North San Marco Avenue, Saint Augustine, Florida 32084, and [COMPANY OR ORGANIZATION NAME], hereinafter called "CONTRACTOR" authorized to do business in the State of Florida, with its principal office at [COMPANY OR ORGANIZATION ADDRESS]. Agency and Contractor are collectively referred to herein as the "Parties." This AGREEMENT shall bind the parties upon its execution by their representatives.

1. ENGAGEMENT OF THE CONTRACTOR

For the consideration herein mentioned, the AGENCY agrees to engage the CONTRACTOR and the CONTRACTOR agrees to perform at its own proper cost and expense, to do all the work and furnish all the materials, equipment, supplies, and labor necessary to carry out this Contract.

2. SCOPE OF SERVICES

CONTRACTOR shall provide all the work and furnish all the materials, equipment, supplies, and labor necessary to perform the services in the manner and to the full extent as set forth in the Specifications Package and the Plans, all of which are hereby adopted and made part of this Contract and incorporated by reference herein, and to the satisfaction of the duly authorized representatives of the AGENCY, who shall have at all times full opportunity to inspect the materials to be furnished and the work to be performed under this Contract.

3. DELIVERABLES

(1) CONTRACTOR shall provide the quantifiable, measureable, and verifiable units of Deliverables directly related to the work set forth in the Specifications Package and the Plans attached herein which must be received and accepted in writing by the Contract Manager before payment.

(2) The total amount to be paid to CONTRACTOR for all services and work performed under this AGREEMENT shall be [payment schedule and/or amount].

(3) Upon CONTRACTOR's completion of the services described above, the CONTRACTOR shall deliver to the AGENCY a statement of work performed in detail sufficient for a proper pre-audit and post-audit thereof, and including the dates and times that the work was performed, a summarization of hours worked and the total amount charged. CONTRACTOR's travel expenditures shall not be reimbursed by the AGENCY.

(4) Amounts due to the CONTRACTOR pursuant to this AGREEMENT shall become payable upon receipt of the required documents from the CONTRACTOR and verification and written acceptance of the work performed by the AGENCY's Contract Manager. Invoices returned to a vendor due to preparation errors will result in a payment delay. Invoice payment requirements do not start until a properly completed invoice is provided to the agency.

(5) Payments to the CONTRACTOR shall be issued in accordance with the Prompt Payment provisions of §215.422, Florida Statutes.

4. MINIMUM LEVELS OF SERVICE AND CRITERIA FOR COMPLETION OF WORK

(1) CONTRACTOR shall provide no less than the services listed in Article 2 of this AGREEMENT, within the times specified in Article 5 of this AGREEMENT, time being of the essence in the performance of the work.

(2) The work shall be complete upon the receipt and acceptance of CONTRACTOR's detailed statement of work specified in Article 3

of this AGREEMENT together with all invoices and other documentation specified herein, approved and accepted by the AGENCY's Contract Manager.

5. TIME OF PERFORMANCE AND TERMINATION

(1) This AGREEMENT shall be effective [long date], or upon the date of execution by both CONTRACTOR and AGENCY, whichever is later ("Effective Date") and shall expire on [long date], unless cancelled earlier in accordance with its terms ("Expiration Date").

(2) Termination Based on Breach. The AGENCY may terminate the Agreement if the CONTRACTOR fails to (1) deliver the product within the time specified in the Contract or any extension, (2) maintain adequate progress, thus endangering performance of the Contract, (3) honor any term of the Agreement, or (4) abide by any statutory, regulatory, or licensing requirement. The CONTRACTOR shall continue work on any work not terminated. If, after termination, it is determined that the CONTRACTOR was not in default, or that the default was excusable, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the AGENCY. The rights and remedies of the AGENCY in this clause are in addition to any other rights and remedies provided by law or under the AGREEMENT.

(3) Termination Based on Convenience. The AGENCY, by written notice to the CONTRACTOR, may terminate the AGREEMENT in whole or in part when the AGENCY determines in its sole discretion that it is in the AGENCY's interest to do so. The CONTRACTOR shall not furnish any product or service after it receives the notice of termination, except as necessary to complete the continued portion of the AGREEMENT, if any. The CONTRACTOR shall not be entitled to recover any cancellation charges or lost profits.

(4) Other Termination. The employment of unauthorized aliens by any contractor is considered a violation for §274A(e) of the Immigration and Nationality Act. If the CONTRACTOR knowingly employs unauthorized aliens, such violation shall be cause for unilateral cancellation of the Agreement.

(5) If CONTRACTOR terminates this Agreement or if the AGENCY terminates this Agreement for breach, CONTRACTOR shall not receive any payment for any services. Furthermore, CONTRACTOR will be liable for difference in the increased cost, if any, the AGENCY would incur for similar services from another person.

(6) Under no event shall the AGENCY be required to pay CONTRACTOR any fees should this AGREEMENT be terminated for any reason.

6. COMPLETION OF AGREEMENT

The CONTRACTOR agrees that this AGREEMENT will be completed upon AGENCY' s receipt and acceptance of all DELIVERABLES based upon the MINIMUM LEVELS OF SERVICE AND CRITERIA FOR COMPLETION OF WORK described in Article 4, of this AGREEMENT.

7. TAXES, GENERAL AND CONTINGENCY

(1) The AGENCY is exempted from payment of Florida State sales and use taxes. The CONTRACTOR, however, shall not use the AGENCY's tax exemption number to secure any materials or services. The CONTRACTOR shall be responsible and liable for the payment of all its payroll and other Federal taxes, state sales and use taxes and other tax liabilities incurred resulting from this AGREEMENT.

(2) The CONTRACTOR shall not pledge the AGENCY's credit or make the AGENCY a guarantor of payment or surety for any contract, debt, obligation, judgment, lien, or any form of indebtedness.

8. PUBLIC RECORDS

(1) The CONTRACTOR shall comply with the public records laws of the State of Florida, specifically to:

(a) Keep and maintain public records that ordinarily and necessarily would be required by AGENCY in order to perform the services in this AGREEMENT.

(b) Provide the public with access to public records on the same terms and conditions that AGENCY would provide the records and at a cost that does not exceed the cost provided in Chapter 119, Florida Statutes, or as otherwise provided by law.

(c) Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law.

(d) Meet all requirements for retaining public records and transfer, at no cost, to AGENCY all public records in possession of CONTRACTOR upon termination of this AGREEMENT and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be provided to AGENCY in a format that is compatible with the information technology systems of AGENCY.

(e) Upon termination of this AGREEMENT, before AGENCY'S final payment is made for any services rendered or any goods provided, CONTRACTOR shall certify to AGENCY, in writing, CONTRACTOR'S compliance with the provisions of Article 8(1)(d) of this AGREEMENT.

(2) CONTRACTOR shall notify AGENCY, in writing, within three (3) days after receiving a public records request pursuant to Chapter 119, Florida Statutes.

(3) In accordance with §287. 058(1)(c), Florida Statutes, the AGENCY may unilaterally cancel this AGREEMENT for refusal by the CONTRACTOR to allow public access to all documents, papers, letters, or other material made or received by the CONTRACTOR in conjunction with this AGREEMENT, unless the records are exempt from Section 24(a) of Article I of the Constitution of the State of Florida and §119.07(1), Florida Statutes.

(4) Notwithstanding any other provision of this AGREEMENT to the contrary, Paragraphs 8 (1) through (3), above, shall survive termination of the AGREEMENT.

9. TERMS OF RENEWAL

(1) This AGREEMENT may not be renewed.

10. FINANCIAL CONSEQUENCES FOR FAILURE TO PERFORM

(1) If the CONTRACTOR fails to perform in accordance with this AGREEMENT to the satisfaction of the AGENCY, the AGENCY may cancel any portion of the remaining work not completed at the time of non-performance and unilaterally cancel this AGREEMENT.

(2) The AGENCY agrees to submit to the state's Chief Financial Officer any of the CONTRACTORS invoices, statements or vouchers for work completed, inspected, and accepted prior to the time of non-performance with any lump sum prorated for un-received or unaccepted work and with a deduction for any damages incurred by the AGENCY as a result of CONTRACTOR's failure to perform.

(3) Failure of CONTRACTOR to complete all work and deliver all required documentation within the times specified herein will result in a deduction for liquidated damages of one-half of one percent (1/2 %) of the total contract cost for each day of delay. AGENCY shall not be responsible for any additional payments for labor, overtime or other, caused by CONTRACTOR's delay.

12. CHOICE OF LAW

This AGREEMENT will be subject to and interpreted by the Laws of the State of Florida.

13. ENTIRE AGREEMENT

The agreement between the PARTIES concerning the subject matter hereof consists of this Contract, the attached General Conditions, Competitive Solicitation Proposal, Specifications, Plans, and Drawings, and all other attachments and exhibits referenced herein. In the event there is any inconsistency between the provisions of this document and the provisions of any other attachment or exhibit, the provisions of this document shall govern and control. This document and all other attachments and exhibits referenced herein or in the document may be referred to collectively as the "Contract." The Contract represents the total and complete agreement of the PARTIES relating to the subject matter of the Contract. This Contract supersedes any prior or contemporaneous written or oral agreements or representations relating to the subject matter of the Contract. No purported modification of the Contract shall be valid or binding on either party unless such modification is contained in a document executed by both parties.

14. MODIFICATION OF AGREEMENT

Any modification of this AGREEMENT, including extension of the end date, must be made and agreed to by both the AGENCY and the CONTRACTOR in writing prior to the ending date of the AGREEMENT specified in Article 5 or as extended as specified in Article 9.

15. JESSICA LUNSFORD ACT

(1) In accordance with §1012.467(8)(b), Florida Statutes, CONTRACTOR'S employees, subcontractors and staff, including "day-laborers", shall wear a valid "uniform statewide contractor's identification badge" prescribed by the Florida Department of Education to be permitted access to AGENCY's campus.

(2) The CONTRACTOR agrees that, while on AGENCY's campus, the CONTRACTOR's employees, subcontractors and staff, including "day-laborers", shall at all times wear, so as to be clearly visible, their "uniform, statewide contractor's identification badges" and be subject to all of the AGENCY's rules and regulations that govern the behavior of full-time AGENCY employees, including all traffic rules and regulations and the prohibition of tobacco usage.

(3) The CONTRACTOR agrees that any breach of AGENCY's rules and regulations may result in immediate cancellation of this AGREEMENT.

(4) The requirements of this Part in no way obligate CONTRACTOR if CONTRACTOR requires no access to AGENCY's campus or facilities and does not attempt to access the campus or facilities.

16. FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT

(1) The CONTRACTOR acknowledges its responsibility under Title 34, Part 19, Code of Federal Regulations; 20 United States Code, 1232g; Section 1002.22, Florida Statutes; and Operational Policy and Procedures 10.35, Florida School for the Deaf and the Blind; pertaining to privacy of all records that contain student information.

(2) The CONTRACTOR will not, without the written authorization of the AGENCY'S President or designee, photograph, interview, audio tape, and/or videotape while on the campus of the AGENCY and will not engage in such activities when students of the AGENCY are attending off-campus events as invited guests.

17. TRANSPARENCY FLORIDA ACT

(1) The CONTRACTOR acknowledges that the AGENCY will post electronic images of this AGREEMENT (the contract), including all attachments, modifications, renewals, and procurement documents to the state's contract tracking system, which is located on a secure website on the Internet, in accordance with §215.985, Florida Statutes.

(2) Pursuant to §215.985(14)(d), Florida Statutes, the CONTRACTOR shall have the right to request in writing that the AGENCY redact any portion of any document image that is confidential or exempt from public disclosure by law. A fee will not be charged for a redaction made pursuant to the request.

18. LIABILITY

(1) The AGENCY shall not assume any liability for the acts, omissions to act or negligence of the CONTRACTOR, its agents, servants, and employees, nor shall the CONTRACTOR disclaim its own negligence to the AGENCY or any third party.

(2) The CONTRACTOR shall maintain, during the period of this AGREEMENT, a liability insurance policy for all acts and omissions and for the services and goods to be rendered and provide proof thereof upon execution of this AGREEMENT.

19. NONDISCRIMINATION AND COMPLIANCE

The CONTRACTOR shall comply with all federal, state and local laws and ordinances applicable to the work and shall not discriminate on the grounds of race, color, religion, sex, age, disability/handicap, marital status, veteran status, military status, genetic information, national origin and any other categories protected by law in the performance of the work.

20. APPROVAL AND EXECUTION

IN WITNESS WHEROF, the FLORIDA SCHOOL FOR THE DEAF AND THE BLIND and COMPANY OR ORGANIZATION NAME have caused this AGREEMENT to be executed by their undersigned officials, duly authorized.

COMPANY OR ORGANIZATION NAME	**FOR THE FLORIDA SCHOOL FOR THE DEAF AND THE BLIND**
X_____	**X**_____
[NAME][TITLE]	[NAME][TITLE]
_____	_____
Date signed	Date signed
EIN:_____	EIN: 59-1003668

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DIVISION 23

SECTION 23 00 02 – HVAC DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Heating, Ventilation and Air Conditioning: Remove all existing heating, ventilating and air conditioning equipment including as shown on the Contract Documents.

PART 2 – PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall obtain the permission of the Owners Representative and coordinate with other trades prior to commencement of demolition of the existing installations.

B. The Contractor shall provide for safe conduct of the work, protection of property, and coordination with other work in progress. The spread of dust and flying particles shall be minimized.

C. Existing construction to remain shall be protected from damage. Work damaged by the Contractor shall be repaired to match existing work.

D. When indicated, the contractor shall remove specific equipment in a careful manner so as to maintain the equipment in proper operating order. This equipment will be turned over to the owner and transported to a storage area as directed by the owner and further described herein.

E. Material demolished under this section shall become the property of the Contractor and shall be promptly removed and disposed of off the site.

F. Debris and rubbish shall not accumulate on the site, and shall be disposed of periodically by the Contractor.

G. All necessary precautions shall be taken by the Contractor to prevent spillage during removal activities. Pavement and areas adjacent to the demolition areas shall be kept clean and free from mud, dirt and debris at all times.

H. Existing utilities and mechanical systems including related equipment shall be disconnected by the Contractor to the extent shown on the contract drawings or specified and as required to perform the work in accordance with Division 23 of the specifications.

I. The Contractor shall exercise care during the progress of the work under this section so as not to damage or displace the work of the other trades performed under other sections. He shall coordinate work under this section with work under other sections, as necessary for the proper execution of the entire work.

J. When the contract documents indicate the removal of existing equipment to be temporarily stored and to be re-used, the contractor shall provide adequate protection for the stored equipment including the proper capping of several pipe connections, protection of power and control wiring and devices, and draining of coils to prevent freezing damage.

K. Equipment which contains refrigerants shall be pumped down prior to demolition. The refrigerant shall be properly contained and disposed of in accordance with the accepted local procedures.

L. Pre Demolition photographs shall be taken showing existing conditions of adjoining construction and site improvements, including finished surfaces that might be misconstrued as damage caused by selective demolition operations. Photograph items requested to be salvage by the Owner. Submit all photographic documentation before the start of demolition.

M. Pre-demolition Conference: Conduct conference at Project site with the Owner to inspect and discuss condition of construction to be selectively demolished, review areas where existing construction is to remain and requires protection, review list of items to be salvaged and delivered to the Owner.

END OF SECTION 23 00 02

SECTION 23 02 00 - BASIC MATERIALS AND METHODS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Waterproofing and flashing.

B. Piping and equipment identification.

C. Fire and smoke stopping.

D. Electrical requirements.

E. Painting.

F. Concrete work.

G. Fabricated steel supports.

H. Excavation, trenching and backfilling.

I. Placing of equipment.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced.

1. American Institute of Steel Construction (AISC) Publications
2. American National Standards Institute (ANSI) Standards
3. American Society for Testing and Materials (ASTM) Publications
4. American Welding Society (AWS) Publications
5. Underwriters Laboratories, Inc. (UL) Standards

1.4 SUBMITTALS

A. General: Where submittals are required, comply with Section 23 05 00 requirements.

B. Shop Drawings: Submit drawings of fabricated steel supports where proposed supports are not in accordance with details on drawings, or where drawings do not detail supports. Submittal for acceptance is required.

C. Product Data: Submittal for other than fabricated steel supports is not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for acceptance is not required.

1. Access doors.
2. Waterproofing and flashing material.
3. Piping and equipment identification.

4. Fire and smoke stopping material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Piping and Equipment Identification:

1. Communications Technology Corp.
2. Craftmark Identification Systems, Inc.
3. EMED Co., Inc.
4. Florida Marking Products, Inc.
5. Marking Services, Inc.
6. Seton Name Plate Corp.
7. W.H. Brady Co., Signmark Division

2.2 FABRICATION

A. Piping and Equipment Identification:

1. Pipe markers: Sub-surface printed plastic, with protective undercoating. Markers shall be permanently curled for snap-on installation for pipe sizes (including insulation) up to 6" diameter. For external diameters above 8". Marker shall be secured using cable ties for indoor use and stainless steel banding or ultraviolet resistant plastic for exterior use. Markers for outdoor installation shall be over-laminated with Tedlar™ on polyester ultraviolet damage and fading. Markers shall identify the pipe contents and direction of flow through 360 degree visibility range. Marker size, letter size, letter color, wording and background color shall be in accord with ANSI A13.1 – Scheme for the Identification of Piping Systems. Based on Marking Services Inc. Model MS-970 Coiled Plastic Markers for indoor use and Model MS-995 Maxilar Marker for exterior use.
2. Valve tags: Contractors Option:

a. Indoor:

1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.
2) 1/16 inch thick plastic, 1-1/2" round, with ¼ inch high black pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.

b. Outdoor Service:

1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc.

2) 19 gauge Type 304 stainless steel, 1-1/2" round, with ¼ inch high pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 stainless wire meter seal or #6 Type 304 stainless steel bead chain with locking link. Based on Marking Services, Inc.

3. Valve chart frame: Self-closing, satin-finished, extruded aluminum with glass window, 8-1/2 inch by 11 inch chart size.
4. Equipment nameplates:

a. Indoor: Shall be 1/16 inch thick plastic with black satin surface and white core. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment and 3/4 inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
b. Outdoor: Shall be 125 Mil rigid plastic constructed of printed legend sealed between two layers of chemically-resistant plastic to resist ultraviolet damage. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
c. Based on Marking Services Inc. Model MS-215 Max-Tex.

B. Fabricated Steel Supports:

1. Steel angles, channels, and plate shall be in accordance with ASTM A36.
2. Steel members, including fasteners, exposed to weather shall be galvanized.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of materials and equipment shall be in accord with the manufacturer's written instructions, except as specified.

3.2 INSTALLATION

A. Piping and Equipment Identification:

1. Install pipe markers adjacent to each valve and fitting, at each branch connection, on each side of wall, floor, and ceiling penetrations, where entering and leaving underground areas, and at minimum 40 foot spacing on horizontal and vertical pipe runs. Markers shall be arranged for easy reading at eye level.
2. Provide valve tags on all valves exposed or concealed unless otherwise noted.
3. Attach valve tag to stem of each valve to be tagged. Valve numbers shall follow in sequence the Owner's existing valve numbers, where applicable.
4. Provide a marker for each valve and equipment to be tagged, located above lift-out tile ceilings. The marker shall be 1/16 inch thick plastic with a satin surface and white core. Color of the marker shall match color of piping identification system.

Lettering shall be engraved through the surface color to expose the core color. Plate size shall be ¾ inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Plate manufacturer shall furnish suitable adhesive for permanently attaching plate to ceiling grid.

5. Provide a minimum of 4 valve charts. Chart information shall indicate job name, Contractor name, date of installation, valve number, valve location, valve type, valve purpose, and system in which installed. Mount framed chart in equipment room, and insert copy of chart in each operating and maintenance manual under separate tabbed section labeled "Valve Chart". Where project drawings include a piping flow schematic, request AutoCad file from Engineer and label all of the valves according to the valve chart and frame in an 18” x 24” frame in main mechanical or pump room.
6. Provide air and water flow diagrams installed in waterproof, laminated frames on the wall in each Mechanical Room. Air flow diagrams shall show locations of dampers, sensors, and exhaust fans associated with the air handling unit. Water flow diagrams shall show shut-off valves and control valve locations.
7. Permanently affix nameplate to each item of equipment using stainless steel pop rivets. Where irregular surface impede direct attachment of plates, affix plate to sheet metal bracket and attach bracket to equipment with screws, bolts or suitable adhesive from nameplate manufacturer.
8. Refrigeration System - Additional Requirements:

    a. Marking and Signage:

        (1) Provide a permanent sign containing the following information:

            (a) Name and address of installer.
            (b) Kind of refrigerant.
            (c) Lbs. of refrigerant.
            (d) Field test pressure applied.

        (2) Provide a permanent sign: Main electrical supply, i.e., main compr. disc.
        (3) Provide metal tags with 0.5" letters:

            (a) Shut-off valves to each vessel, i.e., L.P. receiver shut-off.
            (b) Relief valve.

        (4) Piping shall be marked as either:

            (a) Refrigerant - High Pressure - Liquid or Hot Gas.
            (b) Refrigerant - Low Pressure - Suction, Pumped Liquid Supply or Pumped Liquid Return.

B. Painting:

1. All equipment shall be furnished with a factory- applied galvanized, prime paint, or finish paint finish. Touch-up damaged surfaces of equipment immediately.
2. Paint for galvanized surfaces shall be in accordance with ASTM A780 using zinc rich compound.
3. Paint wooden mounting backboards with two coats of gray enamel prior to making attachments to the board.
4. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.
5. Paint immediately, under this Division, all damaged galvanized surfaces. Paint galvanized metal surfaces behind grilles with two coats of flat black paint.
6. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.

7. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.

C. Concrete Work:

1. Concrete pads and curbs for supports of equipment shall be a minimum of 4" high with chamfered edges and sized for approved equipment.
2. Surfaces of concrete shall be troweled smooth. When forms are removed, fill voids with cement and rub smooth with rubbing stone.
3. Do not pour concrete when ambient temperature is less than 40^{o}F, and falling.

D. Fabricated Steel Supports:

1. Because of the small scale of the drawings, details of equipment support are not always shown. It shall be the responsibility of the contractor to provide supports as required for safe and adequate support.
2. Fabricated steel supports and ladders may be shop or field-fabricated, and shall be in accord with details on drawings.
3. When details are not indicated, the contractor shall submit proposed support detail for review. The contractor shall bear all cost in producing this detail in the bid. This includes but is not limited to structural engineering support.
4. Steel members shall be saw cut, with corners ground smooth, and shall be assembled with welded or bolted connections at Contractor's option. Connections shall be in accord with specified AISC Publications.

E. Excavation, Trenching, and Backfilling:

1. Definitions:
   a. Satisfactory material includes all materials except those classified "unsatisfactory", "unyielding" or "unstable".
   b. Unsatisfactory material includes those materials containing roots, organic matter, trash, debris, frozen materials, stones larger than 3 inches in any dimension, and materials classified by ASTM D 2487 as OL, OH, and PT.
   c. Unyielding material consists of rock and gravely soils with stones greater than 3 inches in any dimension, or as defined by the pipe or tank manufacturer, whichever is smaller.
   d. Unstable material consists of material too wet to properly support the pipe or tank.
   e. Select granular material consists of well- graded sand, gravel, crushed gravel, crushed stone, or crushed gravel, crushed stone, or crushed slag composed of hard, tough, and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve, and no less than 95 percent by weight passing the 1 inch sieve. The maximum allowable aggregate size shall be 3 inches, or the maximum size recommended by the pipe or tank manufacturer, whichever is smaller.

F. Placing of Equipment:

1. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.
2. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe, duct, or electrical connections to equipment.
3. Adjust suspended equipment to final elevation prior to making pipe, duct or electrical connections.
4. Exercise caution during equipment placing operations to insure that structure is not

overloaded.

5. Do not move heavy equipment across floor or roof of insufficient load bearing capacity to support such equipment. Provide bracing or shoring as required, or use crane to place equipment directly on permanent and finished support.
6. Secure all roof mounted equipment to the structure adequately to resist overturning, uplift and sliding forces for basic wind speeds indicated for this location in 2010 Figure 1609B of the Florida Building Code, Latest Edition.
7. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliance, equipment, fan or component and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter sphere and shall comply with the loading requirements for guards specified in the Florida Building Code.

END OF SECTION 23 02 00

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.1 ARTICLES INCLUDED

A. Definitions.

B. Permits, Fees and Notices.

C. Applicable Publications.

D. Code Compliance.

E. Scope of Work.

F. Record Drawings.

G. Intent of Drawings and Specifications.

H. Quality Assurance

I. Submittals.

J. Product Requirements, Equals and Substitutions.

K. Manufacturers Instructions.

L. Transportation and Handling.

M. Storage and Protection.

N. Cutting, Patching and Demolition.

O. Cleaning Up/Removal of Debris.

P. Starting of Mechanical Systems.

Q. Operating and Maintenance Manuals.

R. Training of Owners Operators.

S. Guarantee of Work.

T. System Testing.

1.2 ARTICLES

A. Definitions:

1. The term "As indicated" means as shown on drawings by notes, graphics or

schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.

2. The term "Provide", means furnish and install as part of the work covered in Division 23.
3. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.
4. The term "Install only" means to install under the work of Division 23 equipment furnished by other Divisions, or by the Owner.
5. The term "Owner's Representative" when referenced herein shall be the Owner's Representative or the Engineer acting as his designated representative unless otherwise noted.
6. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the plumbing system. The design is generally schematic in nature and will require specific detailing after the accepted products are determined.
7. The term "detail" as it pertains to the work of this division shall describe the work required by the contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the contract documents.
8. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well organized high quality installation system (duct, pipe, control wire or tube, conduit, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (duct, pipe, control wire or tube, conduit, etc.) shall be run straight and true, parallel or perpendicular to building structure neatly supported.
9. For additional definitions refer to the General Conditions.

B. Permits, Fees and Notices: Comply with the General Conditions.

C. Applicable Publications:

1. Publications listed in each Section form a part of that Section to the extent referenced.
2. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
3. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.

D. Code Compliance:

1. Life Safety Code - NFPA 101
2. Florida Building Code, 2010
3. Florida Mechanical Code, 2010
4. Florida Accessibility Code, 2010
5. NFPA.
6. SREF
7. Local and County codes set forth by the Authority Having Jurisdiction

E. Scope of Work: The work to be performed under this Division consists of the satisfactory completion of all HVAC as indicated in the Contract Documents.

F. Record Drawings: Comply with the General Conditions.

G. Intent of Drawings and Specifications:

1. The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.
2. Existing conditions, dimensions, etcetera, depicted on the drawings are taken from the "as-built" drawings of the original construction supplemented by field observation. The contractor is cautioned to field verify all existing conditions, dimensions, etcetera, notifying the Owner's Representative of any discrepancies other than those minor in nature, for direction, prior to ordering or fabricating equipment or materials. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawing and specifications, the more stringent shall govern, unless the discrepancy conflicts with applicable codes, wherein the code shall govern.
3. The drawings are diagrammatic, intending to show general arrangement, capacity and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the contractor's responsibility.
4. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown but shall be provided at no additional change in contract cost.
5. In the event of a conflict, the Owner's Representative will render an interpretation in accordance with the General Conditions.

H. Quality Assurance:

1. All equipment furnished under this Division shall be listed and labeled by U.L., ETL or a nationally recognized testing laboratory (NRTL).
2. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.
3. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.
4. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.
5. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.
6. All work to be performed by qualified and experienced personnel specifically trained in their respective field.
7. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.

I. Submittals:

1. In addition to all other submittal requirements elsewhere in the contract documents, the contractor shall comply with the following.
2. Submittal for acceptance is required only on those items specifically requested in the specification section that applies.
3. For products and equipment that do not require a submittal for acceptance, submit a separate letter for each specification section certifying that all products and equipment will be provided in compliance with the contract documents.

4. Provide submittal data in accordance with the General Conditions and/or as listed below.
5. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that the submittals will be needed in order to meet construction schedule. This schedule shall be submitted prior to or in conjunction with the first submittal. Processing of submittals may be delayed pending the receipt of this schedule at the reviewer's discretion.
6. Submittal data shall be presented in a clear and thorough manner and referenced to the specification section.

    a. Where applicable, data shall be identified by reference to sheet and detail, schedule or room numbers, equipment or unit number as shown on Contract Drawings.

7. Prepare performance and product data as follows:

    a. Clearly mark each copy to identify pertinent products or models, delete non-pertinent data.
    b. Show performance characteristic and capacities.
    c. Show dimensions and clearances required.
    d. Show wiring or piping diagrams and controls.
    e. Clearly list any deviation in the submittals from the requirements of the contract documents.
    f. Include installation requirements.

8. Manufacturer's standard schematic drawings and diagrams:

    a. Modify drawings and diagrams to delete information not applicable to the work of this project.
    b. Supplement standard information to provide information specifically applicable to the work of this project.

9. Prohibition of Asbestos and PCB:

    a. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The requirements of this specification for complete and operating mechanical systems shall be met without the use of asbestos or PCB.
    b. Prior to the Final Review field visit the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 23 contain no asbestos or PCB. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. This statement shall be signed by a duly authorized agent of the manufacturer.

10. Letter of Certification: Where a submittal is not required, provide letter certifying that the work will be completed in strict accordance of the specified requirements. In the event the contractor wishes to alter the requirements of the specification for whatever reason, this should be clearly explained in this letter noting that this alteration may require additional submittal requirements.
11. Schedules: Where schedules are called for, submit schedule indicating which products will be used and to what extent by system, location, size, etc.
12. Where samples are requested, samples shall be of sufficient size and quantity to clearly illustrate:

a. Functional characteristics of the product, with integral related parts and attachment devices.
b. Full range of color, texture and pattern.
c. Where a mock-up is specified, erect at the Project site, in a location acceptable to the Owner's Representative. Size or area shall be that specified or as agreed upon during pre-construction or other job site meetings.
d. Where mock-up is not a permanent part of the installation, remove mock-ups at conclusion of work or when acceptable to the Owner's Representative.

13. The Contractor shall:

a. Review Shop Drawings, Product Data and Samples prior to submission.
b. Determine and verify:

1) Field measurements.
2) Field construction criteria.
3) Catalog numbers and similar data.
4) Conformance with specifications.
5) All submittals have been properly interfaced with the requirements of this and other divisions of work so as to assure a complete, functioning system in accordance with the contract documents.

c. Coordinate each submittal with requirements of the work and of the Contract Documents.
d. Clearly identify any deviations in the submittals from requirements of the Contract Documents. Any deviations not specifically disclosed in the submittal shall be solely at the risk of the Contractor, and shall be subject to discovery at any time. Any undisclosed deviations shall be corrected by the Contractor to comply with the requirements of the Contract Documents at no cost to the Owner regardless of the action code accorded the submittal by the Engineer.
e. Do not release equipment for shipment, begin fabrication or work on any items requiring submittals for acceptance until all submittals are returned with the Engineer’s acceptance.
f. Make submittals promptly, and in such sequence as to cause no delay in the work or in the work of any other contractor.

14. Number of Submittals: Comply with the General Conditions.
15. Submittals shall contain:

a. The date of submission and the dates of any previous submissions.
b. The Project title and number.
c. Contract identification.
d. The names and phone numbers including personal contact of:

1) Contractor.
2) Supplier.
3) Manufacturer.

e. Identification of the product, with the specification section number and contract document description clearly indicated.
f. Field dimensions, clearly identified as such.
g. Relation to adjacent or critical features of the work or materials.

h. Applicable standards.
i. Identification of deviations from Contract Documents.
j. Identification of revisions on re-submittals.
k. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
l. Each submittal shall be limited to a single specification section. Submittals shall not be grouped with other sections in common binders or under common control sheets except as defined in paragraph m. below. Each submittal shall have a cover/control sheet containing the information listed above (a thru k) and have a minimum of 8" x 3" clear space for the engineers and architects review stamp.
m. The first group of submittals shall be sent in a minimum of one (or if required) two hard cover view type 3-ring binder(s) White, sized to hold 8-1/2” x 11” sheets:

1) Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1”, maximum spline size to be 3” (provide additional binders if 3” size is not sufficient to properly hold submittals).
2) Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket. Description sheets are to be white with black letters, minimum of 11” high and full width of pocket. Description is to describe project and match project drawing/project manual description.

n. Submittals not complying with these requirements may be returned with no action taken at the reviewer’s discretion.

16. Re-submittals shall contain:

a. The date of re-submission and the dates of all previous submissions.
b. A copy of the Engineer's comments from the previous submittal.
c. An itemized response to each of the Engineer's comments specifically outlining the changes or corrections being made. As an example; this could be either noting the page(s) of the previous submission that are affected and what changes have been made or noting specific additional information being provided.
d. Submittals not complying with these requirements may be returned with no action taken at the reviewers discretion.

17. The Owner's Representative will (if they so desire):

a. Review submittals promptly and where special attention is requested, review in accordance with the schedule required.
b. Review the submittal for general compliance with the contract documents. The contractor is responsible for quantities, dimensions, placement of the product, coordination with all other trades occupying the space, maintain service clearance, function and compliance with the written installation instructions.
c. Determine the appropriate action for the submittal. Action codes will be as follows:

Action	Description

No exceptions noted.	No exceptions taken.
Make corrections noted.	Resubmittal not required. Make corrections to exceptions noted.
Revise and resubmit.	Make corrections to exceptions noted and resubmit.
Rejected	Not in compliance with contract documents. Resubmit
Submit Specific Item	Resubmit item as specified.
Review not required	Not required for review. No action taken. Copy retained for reference.

d. Turn around time will generally be within 14 calendar days on properly prepared submittals unless otherwise noted in Division 1.
e. Review comments will generally be on a separate attached sheet.

18. Resubmission requirements for "as specified" products.

a. Make any corrections or changes in the submittals required by the Owner's Representative and resubmit until accepted.
b. A submittal shall only be reviewed a maximum of 3 times. If upon the second resubmission an accepted action cannot be rendered (No Exceptions Noted or Make Corrections as Noted), the contractor shall supply the basis of design product and bear all costs incurred by the Owner's Representative during the review process until an accepted submittal is achieved.

19. The Contractor shall maintain one copy of all accepted submittal data including letters of compliance in a job site file.

J. Product Requirements, Equals and Substitutions:

1. In addition to all other requirements for submittals, equals and substitutions elsewhere in the contract documents, the contractor shall comply with the following.
2. Product Requirements:

a. The specifications sections under Article 2.1 "ACCEPTABLE MANUFACTURER", lists suppliers found acceptable for this project. The names listed are manufacturers who meet the minimum acceptable standards that this project dictates. The list is furnished as a guide. Even though a manufacturer is named, he must still provide the type and quality of equipment specified as well as equipment that will fit within the allotted space and within the design weight allowance, etc. Being named does not imply permission for that manufacturer to provide an alternative product or design. Other manufacturers not named will be considered to be equal providing they furnish a product of the type and quality specified.
b. In certain cases, foundations and/or structural supports or electrical requirements for equipment specified in this Division are provided under other divisions of the specifications. Where an alternate acceptable manufacturer's product is provided, this contractor shall coordinate the revised requirements and include an allowance for any cost differential.
c. If the list, under Article 2.1 "ACCEPTABLE MANUFACTURERS" names only one manufacturer followed by "No Substitutions" that product shall be supplied.

3. Substitutions.

   a. A substitution is defined as any product not meeting the requirements as outlined in PART 2 - PRODUCTS. A different design accomplishing the same result will be considered a substitution. The same design requiring a larger motor, or more space or a structural change to accommodate larger weight, etc., will be considered a substitution. If a manufacturer who is not listed as an "ACCEPTABLE MANUFACTURER" wants to have his product considered as an equal or as a substitution, he shall submit details to the Owner's Representative 10 days in advance of bid date and a decision will be rendered. If necessary, a clarification will be issued in the form of an Addendum. No substitution requests shall be considered after the Bid.
   b. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including.

      1) Comparison of the qualities of the proposed substitution with that specified in tabulated format.
      2) Changes required in other elements of the work because of the substitution.
      3) Effect on the construction schedule.
      4) Cost, extra credit or statement of no change in contract price.
      5) Any required license fees or royalties.
      6) Availability of maintenance service, and source of replacement materials.

   c. The Owner's Representative shall be the judge of the acceptability of the proposed substitution.
   d. A request for a substitution constitutes that the Contractor:

      1) Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
      2) Will provide the same warranties for the substitution as for the product specified.
      3) Will coordinate the installation of the substitution into the work, and make such other changes as may be required to make the work complete in all respects.
      4) Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
      5) Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
      6) Will absorb any cost incurred by the Owner's Representative in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs the billing structure shall be agreed upon prior to review by all involved parties.

4. Owner's Representative will review requests for substitutions with reasonable promptness, and will issue an addendum or notify Contractor, in writing, of the decision to accept or reject the requested substitution.
5. The Owner's Representative will review substitution submittals for compliance a

maximum of two times. If the submittal or substituted product does not comply with the contract documents on the second submittal, the submittal and product will be rejected and the specified product will be required.

6. The contractor may request further review of the substitution after the second submittal rejection if the contractor agrees in writing to accept responsibility for the cost of additional review time and expenses by the Owner's Representative.
7. In the event a substitution is rejected, supply the products which constituted the basis of design at no change in the contract price.

K. Manufacturer's Instructions:

1. Installation of work shall comply with manufacturer's printed instructions.
2. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Owner's Representative for clarification. Do not proceed with work without clear instructions.

L. Transportation and Handling: Comply with General Conditions.

M. Storage and Protection:

1. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
2. Store products to prevent damage by the elements. Space temperature shall be controlled as required to prevent condensation and metal corrosion or damage to electrical or electronic parts are the result of condensation.
3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
4. Provide protection as necessary to prevent damage after installation.
5. Products which suffer damage due to improper storage shall not be installed and if found in place, shall be removed and replaced at the contractors expense.

N. Cutting and Patching: Comply with the General Conditions.

O. Cleaning Up/Removal of Debris:

1. Comply with the General Conditions.
2. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.

P. Starting of Mechanical Systems:

1. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.
2. Provide labor to assist the Owner's Representative in acceptance review.
3. Provide point by point system check-out. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.
4. Provide information and assistance and cooperate with test, adjust and balance services.
5. Comply strictly with manufacturer's recommended procedures in starting up mechanical systems.
6. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems until acceptance and up to 1 full year after date of Owner acceptance.

Q. Operating and Maintenance Manuals:

1. Quantity: Four (4) sets
2. Format: Adequately sized for contents, minimum 1" and maximum 3" spline size, hard cover, view type, 8-1/2" x 11 loose leaf binders. Binder covers to have outer clear vinyl pocket on front cover and spline. Provide correct project designation and contents description in each pocket. Use as many as required. Do not overload binders.
3. Content:

    a. Cover sheet.
    b. Table of contents
    c. Point by Point System Check-out: Provide tabulated results indicating compliance with contract document requirements.

4. Detailed Preparation Requirements:

    a. The cover sheet shall list: project name, location, architect, structure engineer, mechanical engineer and electrical engineering firm name with address, telephone number and project managers name for this project.
    b. Each major heading in the table of contents shall have a large distinctive, clearly marked, non-erasable, plastic encased tab.
    c. The description of systems will be provided by the design engineer for insertion at the time of review and turn-over to owner. It will be the basis for the starting of the owners instruction program.
    d. Each section shall have the following sub-tabs. Sub-tabs shall be similar to the main tabs but of a different color.

        1) Specifications: The specification shall be copied and inserted complete with all addenda.
        2) Submittal: This section shall include all accepted submittal data. If submittal was not required, include technical data as specified.
        3) Installation Instructions: If the product, such as pipe, etc., does not have any written installation instructions, include a statement "Manufacturer's Written Installation Instructions not Available - Product Installed in Accordance with Specifications and Good Practice".
        4) Operation and Maintenance Instructions: These shall be the written manufacturer's data edited to omit reference to products or data not applicable to this installation.
        5) Parts List: These shall be edited to omit reference to items not applying to this installation.
        6) Equipment Supplier: This section shall include the name, address and telephone number of the manufacturer's agent and/or service agency supplying or installing and starting up of the equipment.
        7) System Description: This section shall include that portion of the overall description included in the beginning of the manual as it applies to each sub-section. In sections such as pipe, valves and fittings, a statement shall be included "Not Applicable to this Section." Data for this section will be added by the design engineer when the manuals are submitted for review and forwarded to the owner.
        8) Controls Description: This will be included in each section covering controlled equipment. It will include the description from the approved temperature control submission, complete with schematic diagram showing piping arrangement and control

location on 8-1/2 x 11 or 11 x 17 sheet. This data shall be provided by the temperature controls contractor in a form suitable for insertion by the mechanical contractor and for review by the design engineer.

9) Special Operating Instructions: This section shall include condensed instructions for start-up, shut-down, emergency operation, safety precautions and troubleshooting suggestions. Where control is clearly covered in controls description, it is not to be duplicated here.

10) Preventative Maintenance Instructions: This section shall include excerpts from the manufacturer's written instructions on weekly, monthly, quarterly, annually, etc. This summary shall be prepared by the mechanical contractor with help from the equipment supplier. It will be reviewed by the engineer prior to turning over to the owner.

R. Training of Owners Operators:

1. The owners shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.
2. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shut-down and any emergency procedures.
3. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative maintenance.

S. Guarantee of Work:

1. Comply with the General Conditions.
2. Where applicable, furnish manufacturer's written warranty for materials and equipment.
3. Insert warranties in appropriate locations in operating and maintenance manuals.
4. Materials and equipment having seasonal operation limitations, shall be guaranteed for a minimum of one year from date of seasonally appropriate test, and acceptance in writing by the Owner, unless specific Division 23 specifications specify a longer period.

T. System Testing:

1. Provide all necessary labor, materials and equipment to successfully complete all system testing necessary for building occupancy and owner acceptance.
2. Provide all necessary labor, materials and equipment to assist contractors of other division to complete system testing necessary for building occupancy and owner acceptance, wherever an inter-relationship between Division 23 and the work of other divisions exists.
3. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the owner accepts the project.

PART 2 – PRODUCTS (Not Applicable)
PART 3 – EXECUTION (Not Applicable)
END OF SECTION 23 05 00

SECTION 23 05 13 - MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Starters for all motors furnished under this Division, except where starters are provided in a motor control center by Electrical Specifications or where motors require adjustable frequency drives.

B. Motors for equipment furnished under this Section.

1.3 SUBMITTALS

A. Motor Starters:

1. Submission for acceptance is not required. Provide a schedule indicating duty, motor HP, starter size and heater size.
2. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

B. Motors:

1. Submission for acceptance is required. All three phase motors are based on NEMA Premium™ efficiency motors as described below by the minimum allowable efficiency. As a result, all motor starting codes are based on Code letter F or greater as defined by NEC Article 430, Table 430-152. In the event that a manufacturer provides a motor with a code letter less than F, the overcurrent protection of the motor shall be coordinated with the Electrical Contractor to comply with NEC Article 430.
2. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

1.4 APPLICABLE PUBLICATIONS

A. NEMA Publication ICS.

B. NEMA Publications MG-1, MG-2, MG-13.

1.5 QUALITY ASSURANCE

A. All starters to be standard product of single manufacturer.

B. Motor efficiencies in accordance with IEE Standard 112 Method B as defined by NEMA MG1-1.23 a and b.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Starters:

1. Allen Bradley
2. Cutler Hammer
3. General Electric
4. Siemens
5. Square D

B. Motors:

1. A.O. Smith/Century E-Plus
2. Baldor Electric Company, Premium Efficiency.
3. Emerson Electric Company, U.S. Electrical Motors Div., Premium Efficiency Type 'DE' & 'RE'.
4. General Electric Company, Premium Efficiency Energy Saver®
5. Reliance Electric Manufacturing Company, XE™ Premium Efficiency Motors.

2.2 FABRICATION – MOTOR STARTERS

A. Starters - Full Voltage, Single Speed, Magnetic:

1. Full voltage, non-reversing magnetic as scheduled.
2. 3 phase, 60 Hz, voltage as scheduled.
3. Electronic overload relay protection in all phases.
4. Manual reset in cover.
5. Under voltage release.
6. Hand-off-automatic selector switch.
7. Red and green panel lights that are multi-LED style. Full voltage lamps are not acceptable.
8. Size to suit motor being controlled.
9. Control transformer for 120 volt control, fused and grounded in accordance with NEC.
10. Non-fused disconnect switch.
11. Starters located indoors to have NEMA 1 General Purpose Enclosure. Starters located outdoors or in unheated spaces to have NEMA 3R watertight and dust tight enclosure.
12. Solderless lugs.
13. Two N.O. auxiliary contacts.
14. Starter for all motors shall include three-phase power monitor as manufactured by Time Mark Corporation Model 258 or equal, providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage. Monitor shall be UL recognized.

B. Manual Starters:

1. Bi-metal type thermal overload protection in all phases of type to cause switch handle to assume mid position on overload.
2. Quick break operating mechanism and silver contacts.
3. Pressure type terminals.
4. Mechanism trip free so contacts cannot be reclosed until bimetallic strip cools.
5. Starters located indoors to have NEMA 1 General Purpose Enclosure. Starters located outdoors or in unheated spaces to have NEMA 3R watertight and dust tight enclosure.

6. Manual starters for three phase motors shall utilize a full voltage single speed, magnetic starter as specified in paragraph 2.2-A. A toggle switch shall be provided to facilitate the manual control specified of the magnetic starter.

2.3 FABRICATION – MOTORS

A. 3/4 HP and Larger Horsepower Motors:

1. NEMA Premium™ efficiency type having the following minimum efficiencies:

Minimum Nominal Full-Load Motor Efficiency (%)						
	Open Motors			Totally Enclosed		
Number of Poles	2-Pole	4-Pole	6-Pole	2-Pole	4-Pole	6-Pole
Speed (RPM)	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM
HP						
0.75	---	85.5	---	---	85.5	---
1	82.5	85.5	82.5	77.0	85.5	82.5
1.5	84	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93	91.7	91.0	92.4	91.7
20	91	93	92.4	91.0	93.0	91.7
25	91.7	93.6	93	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0
40	92.4	94.1	94.1	92.4	94.1	94.1
50	93	94.7	94.1	93.0	94.5	94.1
60	93.6	95	94.5	93.6	95.0	94.5
75	93.6	95	94.5	93.6	95.4	94.5
100	93.6	95.4	95	94.1	95.4	95.0
125	94.1	95.4	95	95.0	95.4	95.0
150	94.1	95.8	95.4	95.0	95.8	95.8
200	95	95.8	95.4	95.4	96.2	95.8
250	95	95.8	95.4	95.4	96.2	95.8
300	95	95.8	95.4	95.4	96.2	95.8

2. Drip proof, except motors located outdoors to be TEFC or as otherwise specified.
3. Continuous duty, 40°C ambient.
4. Regreasable ball bearing design.
5. Speed/Torque curves shall be NEMA Design B so that overload protection provided by standard motor starters will be adequate to prevent over-heating during stall or slightly prolonged motor acceleration.
6. Class B insulation, except motors for variable speed drive application to be specially built for Adjustable Frequency Drive (AFD) duty and include Class F insulation and be suitable for operation down to 10% on fan and pump applications.

7. Assembly to meet application.
8. 1.15 service factor.
9. Suitable for starter type as scheduled on drawings.
10. Slide bases as required.
11. 60 Hz. terminal box large enough to accommodate the required conduit and wiring.
12. 200, 208, 230 or 460 volt, 3 phase as scheduled.

B. Fractional Horsepower Motors:

1. Permanent split capacitor.
2. 115 volt, 1 phase, 60 Hz.
3. Thermally protected.
4. Other features of motors supplied as an integral part of a factory assembly shall be acceptable as the manufacturers standard based on acceptance of the assembly as a whole.

PART 3 - EXECUTION

3.1 GENERAL

A. Furnish starters for all motors furnished under Division 23 except where starters are provided in motor control center by Division 26.

B. Receive, unload and deliver starters to electrical contractor on job-site for storage, uncrating and installation by Division 26.

C. Furnish all necessary wiring diagrams to Division 26 for installation and power wiring.

D. Starter Schedule:

1. All motors up to and including 40 HP at 460 V or 20 HP at 200V shall be provided with full voltage starters.
2. Single phase motors requiring automatic start-stop to be provided with manual starter and controlled by pilot relay.
3. Pump and fan motors listed as adjustable or variable speed to be controlled by adjustable frequency drive units specified in Section 23 05 17.

E. Starters to be mounted where indicated on the drawings or within sight of the motor controlled.

F. Starters may be mounted directly to masonry, CMU or concrete walls using appropriate fastening methods. When the wall is an exterior wall or any wall where condensation may occur, provide appropriate stand-off, i.e., Unistrut channel).

G. Starters may be mounted directly to equipment such as factory or field built AHU. In this case, through bolts and backing plates along with an appropriate stand-off shall be used. Seal all holes. Self-tapping screws with exposed ends will not be acceptable.

H. When starters are required to be located in areas where walls are not available, provide a Unistrut type frame securely mounted to floor adequately braced to form a rigid mounting surface.

I. Starters shall be generally mounted with the center of the unit at 60" above the finished floor. Service clearance shall be provided in accordance with the National Electric Code and under no circumstances less than the following:

Voltage to Ground	Minimum Clearance Distance
110V or 120V	3'-0"
208V, 220V, 240V or 277V	3'-6"
460V or 480V	4'-0"
Greater than 480V	5'-0"

J. Starters shall be accessible.

K. Provide housekeeping pad for all floor mounted starters.

3.2 MOTORS – INSTALLATION

A. Motors:

1. Install in accordance with requirements of the duty.
2. Lugs to be provided under this Division.
3. All motors shall have overload protection as required by NEC. Any motor without integral protection shall have a starter that provides overload protection furnished by Division 23.

END OF SECTION 23 05 13

SECTION 23 05 18 - CONTROL WIRING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Building Control System Wiring - Section 23 09 00

B. Plumbing Systems

1.3 DEFINITIONS

A. Control Wiring: All wiring, high or low voltage other than power wiring, required for the proper operation of the mechanical systems.

B. Power Wiring: All line voltage wiring to the mechanical equipment. Line voltage which also serves as a control circuit, such as a line voltage thermostat, or involves interlocking with a damper, shall be considered control wiring.

1.4 QUALITY ASSURANCE

A. All work will be in accordance with the requirements of the National Electrical Code – Latest Edition.

1.5 SUBMITTALS

A. Submittals are not required.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All material used in the completion of the wiring under this section will comply with the requirements of the electrical drawings and Section 23 09 00 – Instrumentation and Control for HVAC.

B. All wiring to be a minimum of 18 gage wire.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cooperate completely with the contractor for Electrical.

B. Provide all conduit, wire and accessories necessary to complete the control wiring as specified under WORK INCLUDED.

C. Because of variations in requirements from manufacturer to manufacturer, all details may

not be included in the Contract Documents. This sub-contractor must obtain approved coordinated wiring diagrams before proceeding with the control wiring.

D. All control wiring shall be properly installed in an approved raceway system or when allowed, run exposed in concealed spaces. All control wiring run in exposed areas shall be in an approved raceway unless otherwise noted.

E. Control wire run exposed shall be neatly bundled and routed parallel and/or perpendicular to building structure or equipment casing. Routing of wire shall be so that it does not interfere, chafe or obstruct service or maintenance of the equipment served.

F. Exposed control wire shall be properly secured and/or supported within equipment encloses. Cable shall be secured on no greater than 18" centers.

G. All openings made for the passing of control wire shall be properly bushed to prevent chafing. Hole size shall be suitable for the quantity of wires or tubing passing through while allowing for ease of pulling and future expansion. Oversized holes beyond these requirements are not allowed.

H. Holes made within air handling equipment which may allow the transfer or bypassing of air shall be properly sealed after wire is pulled. Expanding foam sealant and proper backing material will be acceptable. Seal shall be suitable for maximum unit operating pressures.

I. Attachments of control devices, raceway and cable supports shall be made with proper attachments. Self-drilling screws which result in exposed end will not be acceptable. Bolts and nuts shall be used with bolt head exposed to view. All fasteners located where exposed to weather or moisture shall be stainless steel or cadmium plated.

J. Any opening, holes or cuts in equipment enclosures or building structure not used shall be neatly sealed. On equipment, the seal or patch shall be of similar material sealed and painted to match.

K. The control contractor shall clean all unused or scrap material from the equipment enclosure.

L. All control wire shall be identified by proper cable identification methods. Verify how cables shall be labeled with the Owner's Representative prior to the start of work. All termination shall be labeled and labels clearly visible.

M. All control devices, cabinets, equipment and raceways shall be labeled. Verify how the hardware shall be labeled with the Owner's Representative prior to the start of work.

N. Splices in control wire are not allowed unless the length of run is too great to allow for a continuous run. When splices become necessary, they shall be solder connected with heat shrink tubing. When raceway is used, all splices shall be in junction boxes.

O. Control devices (i.e., flow switches), connected to cold equipment where the possibility of condensation may occur shall be vaporproof type. The connecting conduit shall be properly sealed with spray type foam after the wires are pulled through. If this is not possible, a weatherproof junction box shall be close mounted to the device to allow for proper moisture sealing. Conduit connections shall be sealed with a silicon type caulk/sealant.

P. All control devices or wiring located exposed to weather or moisture shall be in an approved raceway system. This system shall be properly supported and sealed to

prohibit moisture convection or transfer. Provide flexible conduit similar to seal tight for connection to all equipment. EMT and set screw fittings are not acceptable. All exterior raceway shall be IMC (Intermediate Metallic Conduit) or better with threaded fittings.

Q. Where a disconnect switch is mounted between an adjustable frequency drive and the motor, the disconnect must have a late make, early break auxiliary contact. This contact shall be wired into the AFD control circuit so that the control circuit is disconnected before the power circuit it broken.

END OF SECTION 23 05 18

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SECTION 23 05 19 - METERS, GAGES AND ACCESSORIES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Strainers.

B. Thermometers and Accessories.

C. Pressure Gauges and Accessories.

D. Pressure and Temperature Test Ports.

E. Pressure and Temperature Test Kit.

F. Install Miscellaneous Control Devices.

1.3 SUBMITTALS

A. Submit schedule of all products used. Include make, model and size. When multiple products will be used, generic size and flow range will be acceptable.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Section 23 05 00 requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Strainers:

1. Crane
2. ITT Grinnell
3. Mueller Steam Specialty Co. (MUESSCO).
4. Victaulic Co. of America

B. Thermometers and Accessories:

1. Duro Instrument Corp.
2. Taylor
3. Weksler
4. Winter’s ThermoGauges

C. Pressure Gauges and Accessories:

1. Duro Instrument Corp.
2. Weiss
3. Weksler
4. Winter's Thermogauges

D. Pressure and Temperature Test Ports:

1. Peterson Equipment Co., Inc.
2. Sisco P/T Plugs
3. Approved Equal

E. Pressure and Temperature Test Kit:

1. Peterson Equipment Co., Inc.
2. Sisco P/T Plugs
3. Approved Equal.

2.2 FABRICATION

A. Strainers:

1. "Y" Pattern:

a. HVAC Water Service:

(1) Size 1/4" thru 2": Cast iron body, threaded connection, threaded blow-off cover, removable stainless steel screen .045" perforations, rated at 450 PSIG. Temperature and pressure test port extended to clear required insulation on each side of strainer. Based on Mueller Steam Specialty Co. (MUESSCO) #11M.

(2) Size 2-1/2" and up: Cast iron body, flanged connection, flanged blow-off cover. Blow-off cover tapped for blow-off valve, removable stainless steel screen .045" perforations, rated at 125 PSIGG. If grooved mechanical system is in use a "T" type grooved end, ductile iron body, available with blow off, 304 SS removable screen, choice of mesh size. Temperature and pressure test port extended to clear required insulation on each side of strainer. Based on Mueller Steam Specialty Co. (MUESSCO) #751.

2. Basket Strainer:

a. HVAC Water Service:

(1) Size 4" and up: Cast iron body, flanged connection, flanged cover, cover tapped for air vent, body tapped for drain valve, removable stainless steel basket .125" perforations rated at 150 PSIG. Based on Mueller Steam Specialty Co. (MUESSCO) #165.

B. Thermometers and Accessories:

1. Industrial Reading Non-Mercury Type:

a. Construction: Adjust angle, 9" scale with lagging extension brass well, of

the blue and red fill type and guaranteed accurate to ± one scale division with appropriate graduation. Thermometer shall have glass front to exclude dirt and dust. Thermometers containing mercury are not acceptable. Thermometers installed outdoors shall be specifically designed and weatherproofed for this application.

b. Stem Length:

(1)	6" pipe and smaller	3-1/2"
(2)	8" to 12" pipe	6"
(3)	For storage tanks	9"

c. Ranges:

(1)	Chilled and condenser water	0 to 120°F or 0 to 100°F as available.
(2)	Domestic & heating hot water	30 to 240°F

d. Based on Weksler Type EG5H-9

2. Bi-Metal Dial Type:

a. Construction: 5" dial, adjust-angle, with lagging brass extension well. Stainless steel case bezel, fittings and stem. Head assembly sealed against dust, fumes and moisture with glass window. Accuracy of ± 1% of thermometer range and also be externally adjustable.

b. Stem Length:

(1)	6" pipe and under	2-1/2"
(2)	8" to 12" pipe	4-1/2"
(3)	For storage tanks	7-1/2"

c. Range:

(1)	Chilled and condenser water	0 to 150°F
(2)	Domestic & heating hot water	20 to 240°F

d. Based on Weksler Type AF.

3. Thermometer Well: Construction - Brass or ductile iron body, with lagging extension, length to accommodate thermometer stem length. Based on Weksler.

C. Pressure Gauges and Accessories:

1. Pressure Gauges:

a. Construction: 4-1/2" dial, high impact polypropylene case, 1/4" bottom connection, 1/2% accuracy in accordance with ANSI B40.1 - 1974 Grade A. Stainless steel rotary with stainless steel pinion gear; stainless steel sector gear; stainless steel link. Stainless steel bourdon tube, 316 stainless steel socket and slotted adjustable pointer.

b. Case of black high impact polypropylene suitable for surface or direct mounting and with bottom connection. For outdoor locations, provide glycerine filled gauges.

c. Range: Ranges shall be so selected to indicate pressure reading in midpoint of scale selected.

d. For condenser water, ice water and other open system pumps, provide a compound gauge with dial calibrated to read in. hg. vac. as well as pressure.
e. Based on Weksler Model AA44-2 and AY44-2.

2. Ball Valve Shut-Off: See Ball Valves Section 23 05 23.
3. Manifold Valves (Trumpet Valve) (Water): 2, 3 or 4 port - Brass body, spring return, push button brass valves, 1/4" compression connections. Gauge tap at top, calibrated gauge test port with gauge cock. 125 PSIG rated, 20°F to 220°F range. Based on Flow Conditioning Corporation Hydronic Indicator System.
3. Piston type snubber: Brass body, threaded connections, suitable for mounting horizontal or vertical. (Required at pump inlet and discharge.) Based on Weksler Type RS-1.
4. Filter type snubber: Brass body, threaded connection, micro metallic stainless steel filter. (For all gauges except pump service). Based on Weksler Type BW42.

D. Pressure and Temperature Test Ports:

1. Brass or stainless steel body with threaded cap and gasket, length to extend past insulation.
2. Two self-closing valves with intermediate pocket for added pressure protection. Sized for standard 1/8" probe.
3. Range: 20°F to 230°F.
4. Rating: 250 PSIG water.
5. Based on Peterson Equipment Co., Inc. "Pete's Plug" Model 110 or 110XL.

E. Pressure and Temperature Test Kit:

1. Pressure-temperature test kits consisting of 0-100 PSIG pressure gauge with adapter, 25-125°F testing thermometer, 0-220°F testing thermometer, gauge adopted and protective carrying cast and master air vent assembly.
2. Provide 2 test kits to the Standards & Design Office at the closeout of the project.
3. Based on Peterson Equipment Co., Inc., Series 1500 Test Kit.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturers written installation instructions.

3.2 INSTALLATION

A. Strainers:

1. "Y" Patterns:

a. Strainers preceding automatic steam control valves shall be installed with the strainer branch in the horizontal position to eliminate the formation of a water pocket in the strainer branch.
b. All non-steam “Y” pattern strainers shall be installed with the strainer branch in the downward vertical position.
c. For all “Y” pattern strainers, provide blow-off valve assembly consisting of ball-type drain valve with hose end cap and pipe nipple.
d. Provide pressure-temperature test plugs before and after each strainer.

2. Basket Strainer:

a. Install basket strainer on housekeeping pad with rubber mat between pad and strainer (See Section 23 05 48 or specs on rubber mat).
b. Provide manual air vent in top of cover.
c. Provide ball valve nipple and plug for drain valve assembly. Valve to be 3/4" unless otherwise noted.
d. Provide pressure-temperature test plugs before and after each strainer.

B. Thermometers and Accessories:

1. Install and adjust thermometers for optimum visibility.
2. Provide thermometers where indicated on schematic flow diagram or schematic equipment details.
3. Install thermometers in compatible thermometer wells.

C. Pressure Gauges and Accessories:

1. Install and adjust gauge for optimum visibility.
2. Provide ball valve shut-off for all hydronic gauges.
3. Provide a manifold valve to facilitate the use of a single gauge to monitor pressure differential from various points of a single piece of equipment (i.e. pump; strainer suction; pump suction; pump discharge, etc.). Mount valve for optimum visibility and access.
4. In lieu of the trumpet valve the contractor may assemble individual components using ball valves as the isolation valve provided the same functions of the trumpet valve are duplicated.
5. Provide piston type snubbers for pump service.
6. Provide filter type snubbers for all other fluid services.
7. Open shut-off valve only enough to obtain accurate reading. Valve to gauge to be closed at all other times.

D. Pressure and Temperature Test Ports:

1. Install in upright or vertical position as indicated on schematic flow diagram or schematic equipment details.
2. Install in tee or welded outlet.

E. Pressure and Temperature Test Kit: Turn complete kits in good working condition over to Owner, when the Owner takes over the building.

F. Install miscellaneous control devices such as thermometer wells, tees for flow measuring stations, connections for differential pressure sensors, etc.

END OF SECTION 23 05 19

SECTION 23 05 23 - VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Automatic Flow Control Valves.

B. Ball valves.

C. Butterfly valves.

D. Check valves.

E. Combination Automatic Flow Control and Shutoff Valves.

F. Combination Strainer and Shutoff Valves.

G. Drain valve.

H. Pressure reducing valves.

I. Relief Valves

J. Wheel operators.

K. Valves for Mechanical Joint Systems.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced to in the text by the basic designation only.

1. American National Standards Institute (ANSI).
2. American Society for Testing and Materials (ASTM).

1.4 QUALITY ASSURANCE

A. The manufacturers or their subsidiaries referenced herein are those that the specifications and drawings are based on. Equipment by other manufacturers will not be considered, no substitutions.

1.5 SUBMITTALS

A. Submit schedule and cut-sheets indicating service, make and model number, pressure class, end type and usage (i.e., balance, shut-off).

B. Product data shall be included in the operation for maintenance instruction manuals along

with installation, operation and maintenance instructions.

C. Submit in accordance with Section 23 05 00 requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Automatic Flow Control Valves: (NO SUBSTITUTIONS)

1. Flow Design, Inc.
2. Nexus Controls
3. Griswold Controls

B. Ball Valves:

1. Apollo
2. Crane Company
3. Milwaukee Valve
4. Nibco, Inc.
5. Watts

C. Butterfly Valves:

1. Crane Company
2. Hammond Valve
3. Milwaukee Valve
4. Nibco, Inc.

D. Check Valves:

1. API International, Inc.
2. Hammond Valve
3. Milwaukee Valve
4. Nibco, Inc.

E. Combination Automatic Flow Control and Shutoff Valves: (NO SUBSTITUTIONS)

1. Flow Design, Inc.
2. Nexus Controls
3. Griswold Controls

F. Combination Strainer and Shutoff Valves: (NO SUBSTITUTIONS)

1. Flow Design, Inc.
2. Nexus Controls
3. Griswold Controls

G. Drain Valves:

1. Apollo.
2. Nibco, Inc.
3. Watts

H. Pressure Reducing Valves:

1. Amtrol, Inc.
2. Bell & Gossett
3. Spence

I. Relief Valve:

1. Watson McDaniel Co.
2. Approved Equal.

J. Wheel Operator:

1. Babbitt
2. Roto Hammer

K. Valves for Mechanical Joint Systems: Where a mechanical joint system is proposed, valves shall be furnished by the system supplier where appropriate and shall be equal to those specified.

2.2 FABRICATION

A. Automatic Flow Control Valves:

1. HVAC Water Service:

a. Size ½" thru 2-1/2": Brass wye body design, thread or sweat connection, ground joint union, dual temperature and pressure test ports extended to clear required insulation, range 20°F to 230°F rated at 400 psi water. Stainless steel or nickel plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped. Based on Flow Design, Inc. AutoFlow Model YR

b. Size 2-1/2" thru 12": Ductile iron body, wafer style connection, dual temperature and pressure test ports, range 20°F to 230°F rated at 150 psi. Stainless steel or nickel plated piston brass orifice and spring, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped. Based on Flow Design, Inc. AutoFlow Model WS.

B. Ball Valves:

1. HVAC water service:

a. Size 1/4" thru 2". Two piece, adapter loaded, full port type with brass body, threaded or sweat connection, stainless steel stem, stainless steel ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.

b. Valves installed in insulated piping to have extended handles to clear insulation. Stem extension shall be made of a non-thermal conducting material with a sleeve to form an insulated vapor seal after the valve is

insulated.

c. Based on Nibco T-585-70-66.

C. Butterfly Valves:

1. HVAC water service – Above Ground Use:

a. Size 2-1/2" thru 4": 416 stainless steel stem, lug wafer body drilled and tapped for isolation and removal of downstream piping, cast iron or ductile iron body, long neck body extended to allow for a minimum of 2" insulation, aluminum bronze or stainless steel disc, bubble tight EPDM seat, infinite position, memory stop handle. Class 150, 20°F to 210°F range. Based on Nibco LD-2000-3.

b. Size 6" and up: As described above with totally enclosed weatherproof gear actuator with indicator and memory stop. Based on Nibco LD-2000-5 for sizes 6” to 12”. Based on Nibco LD-1000-5 for sizes 14” to 36”.

c. Size 2-1/2" - 12" grooved end: Ductile iron body to ASTM A-536 with PPS coating and ductile iron disc to ASTM A-536. 2-1/2" - 4" to have infinitely variable memory stop handle. Valves 6" and above to have gear operator. Valve has bubble tight shut off up to 300 psi and 230^{o}. Valve will have a bracket allowing up to 2" insulation. Based on Victaulic 300 or Nibco GD4765.

d. Valves installed in insulated piping to have extended handles to clear insulation.

2. HVAC water service – Below Ground Use:

a. Size 2-1/2" and above: 416 stainless steel stem, lug wafer body drilled and tapped for isolation and removal of downstream piping, cast iron or ductile iron body, long neck body extended to allow for a minimum of 2" insulation, aluminum bronze or stainless steel disc, bubble tight EPDM seat. Totally enclosed weatherproof, permanently lubricated gear actuator with operating not complying with ASWWA C504. Valve based on Nibco LD-2000 for sizes up to 12”. Valve based on Nibco LD-1000 for sizes 14” to 36”. Operator based on Mastergear USA or Dynatongue.

D. Check Valves:

1. HVAC water service.

a. Horizontal swing check valve:

(1) Size 1/4" thru 2". Bronze body threaded or sweat connection, "Y" pattern, bronze seat, renewable teflon or bronze, swing disc, 125 lb. SWP-200 lb. WOG (non-shock). Based on Nibco T-413-B, Y or S-413-B,Y or MIL 409T.

(2) Size 2-1/2" and up. Iron body flanged connection, bolted cover, bronze seat, renewable bronze swing disc, brass hinge pin, 125 lb. SWP-200 lb. WOG (non-shock). Based on Nibco F918-B.

b. Vertical lift check valve.

(1) Size 3/8" thru 2". Bronze body, threaded or sweat connection, renewable teflon disc and seat, copper or stainless steel spring loaded, stainless steel or silicone bronze stem, Class 125. Based on Nibco T-480 or S-480.

(2) Size 2-1/2" thru 10". Iron wafer type body, taped lug connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125. Based on Nibco W-910-B.

(3) Size 12" and up. Iron globe body, flanged connection, renewable bronze disc and seat, stainless steel spring loaded, bronze guide pin, Class 125. Based on Nibco F-910.

(4) Size 2-1/2" thru 12" (grooved end): Ductile iron body, grooved end connection 316 SS disc, EPDM seat, with tilted disc for 2-1/2 - 3", and dual disc 4" thru 12". Valve may be installed horizontally or vertically for temperature ratings up to 230^{o}. Based on Victaulic 715/716.

E. Combination Automatic Flow Control and Shutoff Valves:

1. HVAC Water Service:

a. Size ½" thru 2: Brass wye body thread or sweat connection, union, two-temperature and pressure test port extended to clear require insulation, brass or bronze ball valve with stainless steel ball and stem, non-thermal conductive material type actuator extended to clear required insulation for chilled water applications, steel lever type for heating applications. Range 20°F to 230°F rating 400 psi water. Stainless steel or nickel plated piston brass orifice and spring, replaceable without removing from installation, factory set to control the flow rate within 5% of the tagged rating over an operating pressure differential of at least 10 times the minimum required for full flow condition. GPM and direction of flow shall be clearly marked on flow control valves. Wide open pressure drop shall not exceed 10 ft. Valves shall be calibrated for the fluid being pumped. Based on Flow Design, Inc. AutoFlow Model AC.

F. Combination Strainer and Shutoff Valves:

1. HVAC Water Service:

a. Size ½" thru 2": Brass body, thread or sweat connection, ground joint union, temperature and pressure test port extended to clear required insulation (on each side of the valve), ball valve with non-thermal conductive material type actuator extended to clear required insulation for chilled water applications, lever type for heating applications. Removable stainless strainer, 40 mesh for .25 gpm and up, 20 mesh for 1.25 gpm and up. Unit side drain and strainer blow-down valve. Rated at 400 PSIG. Based on Flow Design, Inc AutoFlow Model YC.

G. Drain valves:

1. HVAC water service:

a. Size 1/2" and 3/4". Two piece, adapter loaded, single reduced port type with brass body, iron pipe thread inlet or sweat inlet, 3/4" hose thread outlet, brass cap and chain at outlet, stainless steel stem, stainless steel ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.

b. Valves installed in insulated piping to have extended handles to clear insulation.

c. Based on Watts B-6000-CC or B-6001-CC or Nibco T-585-70HC.

H. Pressure Reducing Valves:

1. HVAC water service:

a. Size 1/2" and 3/4". Brass body, threaded connection, teflon or bronze diaphragm, teflon or bronze seat, brass stem, strainer, check valve, bolted steel bonnet, adjustable range 8-25 psi or 25-60 psi (see drawings), Class 125. Based on Bell & Gossett B-3 or B-7.

I. Relief Valve:

1. ½" bronze body and spring case with stainless steel ball and cadmium plated steel spring.
2. Suitable for duty to 300 PSIG at 300°F (non-shock rating).
3. Pressure range 25 to 100 PSIG (adjustable).
4. Designed to relieve excessive system pressure from isolated secondary chilled water system to primary ice water system which may be under pressure. Valve to open upon increase in pressure above setpoint and instantly close upon relief of excess pressure.
5. Valve loading adjustable by spring within pressure range listed above.
6. Based on Watson McDaniel Type R relief valve.

J. Wheel Operators: Ductile iron sprocket rim equal to or larger than hand wheel, malleable iron guide arm, spider rust proof chain. Grooved end valves have chain wheels mounted to the gear operator hand wheels, sprocket rim and guide arms are made of cast aluminum, chain is galvanized steel. Based on Roto Hammer or Babbitt.

K. Valves for Mechanical Joint Systems: Valves shall be constructed as described above for the type used.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide shut-off valves on the inlet and outlet of each piece of equipment at the take-off of each major branch from a header and at the base of each pipe riser in order to facilitate service.

B. Provide drain valves at the base of each pipe riser and at each piece of equipment to facilitate service.

C. Provide locking device on handle of the expansion tank isolation valve to prevent accidental closing.

3.2 INSTALLATION

A. Flow Control Valves:

1. Install with taps in upright or vertical position.
2. Tag valve for:

a. Type of service.
b. Flow in GPM.

3. The contractor shall assume the responsibility to obtain the necessary gauges and thermometers to properly take the differential pressure and temperature

readings from the flow control valves.
4. All flows shall be verified.

B. Ball Valves:

1. Install valves with adequate access to lever actuator.
2. Provide adequate space for actuator handle in the open and closed position and for packing replacement.
3. Provide infinite position handle with memory stop on the outlet of all heat exchangers for balancing purposes.

C. Butterfly Valves:

1. Install valve between face of 125# or 150 standard ANSI flanges or standard grooved couplings.
2. Assure unrestricted valve movement after installation. Valves should be installed with stem of valve parallel to floor.

D. Check Valves:

1. Horizontal swing check valves: Install valve with swing disc in the pendent position, cover in upright position.
2. Vertical lift check valve:

a. Install valve in vertical position, upward flow.
b. Flanged valves will be installed between 125# or 150 ANSI flanges or other flanged valves.
c. A spool piece a minimum of 6" face to face will be used to separate a vertical lift check valve and a butterfly valve.
d. Inspect the face of the flange and valve for casting/matching burrs. If burrs exist remove by draw filling prior to gasket placement.
e. Grooved end check valves shall be installed with standard grooved couplings.

E. Combination Flow Control and Shutoff Valves:

1. Install with taps in upright position in a manner that will allow all the tap to be used as an air vent.
2. Tag valve for:

a. Type of service.
b. Flow in GPM.

3. Obtain the necessary gauges and thermometers to properly take the differential pressure and temperature readings from the flow control valve.
4. All flows shall be verified.

F. Combination Strainer and Shutoff Valves:

1. Install with taps in upright position in a manner that will allow the tap to be used as an air vent.
2. All strainers shall be blown down prior to turning system over to Owner.

G. Drain Valves: Install valves to provide adequate space for hand wheel, access, stem travel, disc replacement cap removal and clearance for easy hose connection without crimping hose.

H. Pressure Reducing Valves:

1. Install valve in the horizontal position with the cover in the upright position.
2. Remove, clean and replace strainer after system fill is complete.
3. Adjust pressure as indicated on the drawings.

I. Relief Valve:

1. Install 3/4" valve in upright, vertical position with inlet pressure connection to bottom.
2. Adjust relief pressure to approximately 90 PSIG differential pressure per manufacturer's written instructions.
3. Pipe downstream connection to floor drain.

J. Wheel Operator: Install chain driven operators on valves in excess of 7'-0" above finished floor. Extend chains to 5'-0" above finished floor and hook to clips arranged to clear walking aisles.

K. Valves for Mechanical Joint Systems: Valves shall be installed as described above for the type used.

END OF SECTION 23 05 23

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

C. Refer to Division 7 for all requirements pertaining to Firestopping.

1.2 WORK INCLUDED

A. Inserts, Shells and Upper Attachments.

B. Pipe Hangers, Rods, Supports and Accessories.

C. Pipe Sleeves.

D. Pipe Seals.

E. Duct Hangers and Supports.

F. Duct Sleeves.

G. Fabricated Steel Support.

1.3 QUALITY ASSURANCE

A. Design of pipe supporting elements shall be in accordance with ANSI B31.1.

B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards.

1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.
2. SP-69 Pipe Hangers and Supports: Selection and Application.
3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.

C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications, and hot galvanized for exterior applications.

D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.

E. Welding of steel members shall be in accordance with AWS D1.1.

F. Duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible as applicable.

G. Steel supports for ducts, pipe anchors, pipe guides, and piping supported from below shall be fabricated in accordance with AISC Specification for the Design, Fabrication and

Erection of Structural Steel for buildings. If required, the contractor shall include the cost of the services of a structural engineer to design or review the system.

1.4 APPLICABLE PUBLICATIONS

A. Applicable sections of the publications listed below form a part of this Section. The publications are referenced to in the text by the basic designation only.

1. American Institute of Steel Construction (AISC)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. American Welding Society (AWS)
5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
6. National Fire Protection Association (NFPA)
7. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA)

1.5 SUBMITTALS

A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Section 23 05 00 requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Inserts, Shells and Upper Attachments:

1. Anvil International, Inc.
2. Carpenter Paterson, Inc.
3. Cooper B-Line®, Inc.
4. Elcen Metal Products
5. Hilti
6. Michigan Hanger Company
7. PHD Manufacturing, Inc.
8. Unistrut®

B. Pipe Hangers, Rods, Supports and Accessories:

1. Anvil International, Inc.
2. Carpenter Paterson, Inc.
3. Cooper B-Line®, Inc.
4. Elcen Metal Products
5. Hilti
6. Michigan Hanger Company
7. PHD Manufacturing, Inc.
8. Unistrut®

C. Pipe Sleeves:

1. Metraflex – Metraseal
2. Thunderline Corporation - Link Seal
3. Owner Approved Equal.

D. Pipe Seals:

1. Metraflex – Metraseal
2. Thunderline Corporation - Link Seal
3. Owner Approved Equal.

E. Duct Hangers and Supports: Fabricated per Specifications

F. Duct Sleeves: Fabricated per Specifications

G. Fabricated Steel Support: As Detailed on Drawings.

2.2 FABRICATION

A. Inserts, Shells and Upper Attachments:

1. Inserts; MSS Type 18; malleable iron body and nut, galvanized finish, opening in top of insert for reinforcing rod, lateral adjustable. Rated for 1,140 lbs. Based on Anvil Fig. 282.
2. Shells: Steel shell and expander plug, snap off end fastener. Based on Phillips Concrete Fasteners Red Head.
3. Upper Attachments:

a. Top beam clamps; MSS Type 19: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut. Rating is contingent on rod and bolt size. Based on Anvil Fig. 94.
b. Bottom Beam Clamp; MSS Type 23: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut, and retaining clip. Rating is contingent on rod and bolt size. Based on Anvil Fig. 86 Clamp and Fig. 89 Retaining Clip (or Fig. 87).
c. Welded Beam Attachment; MSS Type 22: Carbon steel suitable for eye rod or rod and locknut, rating is contingent on rod and bolt size. Based on Anvil Fig. 66.
d. Center Beam Clamp; MSS Type 21: Malleable iron jaw and square head bolt and nut with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 134.
e. Center Beam clamp; MSS Type 29: Forged steel, weldless eye nut, tie rod to secure clamp to beam all with galvanized finish, rating is contingent on rod and bolt size. Based on Anvil Fig. 292 or 292L.

B. Pipe Hangers, Rods, Supports and Accessories:

1. Pipe Hangers:

a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 260 or 300.
b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 69 or Fig. 97C for copper pipe.

c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 181.

2. Rods:

a. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

Copper Tube, Plastic Fiberglass Reinforced Pipe Size	Steel, Cast Iron or Glass Pipe Size	Rod Size	Max Equip. Load
¼" to 2"	¼" to 2"	3/8"	730 lbs.
2-1/2" to 5"	2-1/2" to 3"	½"	1350 lbs.
6"	4" to 5"	5/8"	2160 lbs
8" to 12"	6"	¾"	3230 lbs.
14"	8" to 12"	7/8"	4480 lbs.
16"	14" to 16"	1"	5900 lbs.
18" to 20"	18" to 20"	1-1/4"	9500 lbs.
22" to 42"	22" to 42"	1-1/2"	13,800 lbs.

b. Rods may be reduced one size for double rod hangers with 3/8" minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8" in maintained.
c. Based on Anvil Fig. 146.

3. Supports:

a. Pipe Saddle; MSS Type 38: Cast iron saddle, black steel lock nut nipple, cast iron reducer all with galvanized finish. Suitable for standard field cut and threaded galvanized steel pipe. Cast iron floor flange. Based on Anvil Fig. 264 Saddle, Fig. 63 Floor Flange.
b. Pipe Saddle Cold Piping: MSS Type 40. Single bonded unit consisting of a galvanized metal shield and a molded section of rigid polyurethane foam insulation. Rigid urethane foam shall have a density of 4 pounds per cubic foot, a thermal conductivity of 0.13 Btu.in/sq.ft./hr.^{o}F at 75^{o}F mean temperature. Insulation thickness to be equal to thickness specified for pipe being supported.
c. Adjustable Pipe Roll and Base; MSS Type 46: Cast iron base plate steel stand and roll, adjusting screws with galvanized finish. Based on Anvil Fig. 274.
d. Welded Steel Bracket; MSS Type 32: Welded carbon steel rate for 1500 lbs., with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 195.
e. Riser Clamps; MSS Type 8: Carbon steel, galvanized finish for black steel or galvanized pipe, plastic coated for cold steel, copper, glass or brass pipe rated for a minimum of 220 lbs. at 3/4" size. Based on Anvil Fig. 261.

4. Accessories:

a. Protective Shields; MSS Type 40: Carbon steel, galvanized minimum of 12" length sized for required insulation. Based on Anvil Fig. 167.
b. Protective Saddles; MSS Type 39: Carbon steel plate, minimum of 12" length, sized for required insulation. Based on Anvil Fig. 160 thru 165.

c. Steel Turnbuckle; MSS Type 13: Forged steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 230.
d. Steel Clevis; MSS Type 14: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 299.
e. Weldless Eye Nut; MSS Type 17: Forged steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 290 or 290L.

C. Pipe Sleeves:

1. Wall: Schedule 40 carbon steel pipe sized to accommodate pipe, insulation and firestopping (Refer to Division 7 Firestopping). If sleeves are field cut coat cut edges with cold galvanizing spray, ZRC or equivalent.
2. Floor or Exterior Walls below Grade: Schedule 40 steel pipe with anchor and water stop hot dip galvanized after fabrication. Sized to accommodate pipe (pipe insulation if required) and waterproofing or firestopping (Refer to Division 7 Firestopping). Sleeve length will be sized to allow a minimum of 1/2" extension below floor or exterior side of a wall below grade and 1-1/2" extension above floor and 1/2" extension on interior side of an exterior wall below grade.
3. Roof: All penetrations of roof to be in accordance with requirements of Division 7 - Thermal and Moisture Protection.
4. Based on Thunderline Corp. Link Seal Wall Sleeve.

D. Pipe Seals: Composition Plastic Pressure Plates, zinc coated bolts, nuts and metal parts, composition rubber sealing element designed for long term stability rated for temperatures of 40°F to +250°F. Based on Thunderline Corp. Link Seal LS Series.

E. Duct Hangers and Supports: Fabrication and application of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.

F. Duct Sleeves: Sleeves shall be provided for ducts penetrating concrete and masonry walls, stud framed fire rated walls, and poured- in-place concrete floors and roofs. Sleeves shall be sized to accommodate duct, insulation and firestopping (Refer to Division 7 Firestopping).

G. Fabricated Steel Supports:

1. Field or shop fabricated. See details on drawings.
2. If not detailed on drawings the contractor is to provide suitable supports as required.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Where applicable install in accordance with the manufacturers written installation instructions.

B. Where supports are in contact with copper pipe provide copper plated support, or wrap pipe with sheet lead.

C. Where supports are in contact with glass, aluminum or brass pipe provide plastic coating on supports, or wrap pipe with sheet plastic.

D. General interior supports, including attachments that are plain steel shall be primed black prior or after installation.

E. Hangers and supports, including attachments, exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication.

F. Fabricated steel supports exposed to weather or located in utility tunnels and accessible utility trenches or subject to spillage shall be hot dipped galvanized after fabrication, whenever possible. Cut, welded, drilled, or otherwise damaged surfaces of galvanized coating shall be repaired in accordance with Section 23 02 00.

3.2 INSTALLATION

A. Inserts, Shells and Upper Attachments:

1. Inserts:
   a. Contractor shall have inserts at site and dimensioned location drawings ready at the beginning of the involved concrete work.
   b. Install inserts by securing to concrete forms and inserting reinforcing rod thru the opening provided in the insert in accordance with shop drawings.
   c. Provide necessary supervision while concrete is being poured to correct any misalignment caused by the concrete.

2. Shells: Size shell length to assure a minimum of 1" solid concrete remaining from shell end to concrete face.
3. Upper Attachment:
   a. Select proper attachment for building construction.
   b. For plain steel devices, prime with black paint prior to installation.
   c. Adjust attachment location for proper alignment and no more than 4 deg. offset from a perpendicular alignment.
   d. If proper alignment cannot be achieved from the existing building structure provide a trapeze type support size to handle the design load with a minimum safety factor of 5.

B. Pipe Hanger, Rods, Supports and Accessories:

1. Select proper hanger for piping systems.
2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.
3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.
4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.
5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
6. For vibration isolation hanger intermediate attachment requirements for isolated equipment refer to Section 23 05 48 – VIBRATION AND SEISMIC CONTROLS FOR HVAC.
7. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.

8. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
9. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.

MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT SPACING TABLE

a. Steel Pipe (Schedule 40 & 80):

Up to 1":	7 ft. on center
1-1/4" and larger:	10 ft. on center

b. Copper Pipe (Types L, K and M):

Up to 1" size:	5 ft. on center
1-1/4" and larger:	7 ft. on center

c. Ductile Iron and Cast Iron: Two hangers per section length.
d. Polyvinyl Chloride (PVC):

Up to 1-1/2":	3 ft. on center
2" and larger:	4 ft. on center

10. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.
11. Parallel piping may be supported by trapeze hangers consisting of steel angle, channel, or beam suspended by steel rods attached to upper structure. Piping may be supported above, or suspended below, the angle, channel, or beam.
12. Provide protective shields on all cold and dual temperature piping required to be insulated (see specification Section 23 07 00 - Insulation for extent of insulation).
13. Provide protective saddles sized to match insulation thickness on all hot piping required to be insulated (see specification Section 23 07 00 - Insulation for extent of insulation). Fill void between saddle and pipe with insulation as specified.
14. Provide turnbuckles on all hangers which require leveling or aligning.
15. Provide steel clevis where detailed and/or required.
16. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required. Use in combination with steel clevis.

C. Pipe Sleeves:

1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.
3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
4. Sleeves shall not be installed in structural members, except where indicated or approved.
5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
7. Sleeves passing through floors in wet areas, such as areas containing plumbing

fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4 inch concrete curb.

8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the pipe and inside of sleeve, or between jacket over insulation and sleeve.
9. Provide membrane clamping devices on sleeves for waterproof floors.
10. Provide firestopping (Refer to Division 7 Firestopping), waterproofing and/or insulation as required.
11. Sleeves are not required in existing structures where openings through existing concrete floors, walls, or roof are core drilled.

D. Pipe Seals:

1. Provide pipe seals for all pipe sleeves used in:
   a. External walls.
   b. Floor slabs on grade.
   c. Upper floors where spillage may occur.

E. Duct Hanger and Supports: Installation of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.

F. Duct Sleeves:

1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.
3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
4. Sleeves shall not be installed in structural members, except where indicated or approved.
5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
7. Sleeves passing through floors in wet areas, such as areas containing plumbing fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4 inch concrete curb.
8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the duct and inside of sleeve, or between jacket over insulation and sleeve.
9. Provide membrane clamping devices on sleeves for waterproof floors.
10. Duct sleeves shall be secured to opening and have a flange turned back to wall to cover any irregularities in the opening provided for the sleeve.
11. Provide firestopping (Refer to Division 7 – Firestopping), waterproofing and/or insulation as required.

G. Fabricated Steel Supports: Steel for supports shall be saw cut, with sharp edges ground smooth. After fabrication remove all foreign material, including welding slag and spatter, and leave ready for painting or galvanizing, as applicable.

END OF SECTION 23 05 09

SECTION 23 05 48 - VIBRATION & SEISMIC CONTROLS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Vibration isolators.

B. Grooved-Joint Flexible pipe connectors.

C. Braided Flexible pipe connectors.

1.3 QUALITY ASSURANCE

A. The vibration isolation materials manufacturer shall be responsible for the proper selection of spring rates to accomplish the specified minimum static deflections for all spring and pad type isolators based on the weight distribution of equipment to be isolated.

B. The vibration isolation materials manufacturer shall be responsible for the structural design of steel beam bases and concrete inertia bases to support mechanical equipment scheduled to receive a supplementary base.

C. Vibration isolation shop drawings shall show isolator locations, and load on each isolator, deflection, compressed spring height, solid spring height, spring diameters and color coding.

D. Where grooved-joint flexible pipe connectors are specified, manufacturer shall design the isolation system and include drawings showing all supports, restraints, etc. as required to ensure performance.

1.4 SUBMITTALS

A. Submit a schedule indicating make, model, type and deflection for each system or weight range.

B. Product data and shop drawings, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Section 23 05 00 requirements.

D. Submit manufacturer's certification of installation quality.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Vibration Isolators:

1. Amber/Booth Company
2. Mason Industries, Inc.
3. Peabody Noise Control, Inc. - Kinetics.
4. Vibration Mountings and Controls, Inc.

B. Grooved-Joint Flexible Pipe Connectors:

1. Central Sprink
2. Grinnell (Gruv-Lok)
3. Tyler Pipe (Gustin-Bacon)
4. Unisource Manufacturing Inc.
5. Victaulic Co. of America

C. Braided Flexible Pipe Connectors:

1. Flexonics
2. Keflex, Inc.
3. Mason Industries, Inc.
4. Metraflex Co.
5. Proco Products, Inc.
6. Southeastern Hose
7. Unisource Manufacturing Inc.
8. Wheatley Gaso, Inc.

2.2 MATERIALS

A. Vibration Isolators:

1. Type A: Vibration Hangers: Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30^{o} arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Based on Mason Model 30N.
2. Type B: Neoprene Isolation Pads: Neoprene isolation pads shall be single rib or crossed, double rib neoprene in-shear pads, in combination with steel shims when required, having minimum static deflections as tabulated. All neoprene pads shall be true neoprene in-shear using alternately higher and lower ribs to provide effective vibration isolation, and shall be molded using 2500 PSI tensile strength, oil resistant, compounds with no color additives. Pads shall be 45 or 65 durometer and designed to permit 60 or 120 psi loading, respectively, at maximum rated deflections. Neoprene in-shear isolation pads shall be provided to meet tabulated minimum operating static deflections without exceeding published maximum static deflections. Use single or, crossed, double rib or laminated composites of both as required. When two pads of ribbed material are laminated, they shall be separated by, and bonded to, a galvanized steel shim plate. Based on Kinetics NPS, NPD, NGS or NGD.

B. Flexible Pipe Connectors:

1. Grooved-joint flexible pipe connectors shall consist of a minimum of three flexible pipe couplings. Coupling shall contain a resilient elastomeric gasket conforming to the internal cavity of the coupling housing and providing a pressure responsive seal against the pipe to create a permanent leaktight seal. Assembly shall permit expansion, contraction and deflection and shall dampen noise and vibration.

2. Braided flexible pipe connectors constructed of stainless steel annular corrugated metal surrounded with a woven braid of high tensile stainless steel. Units capable of absorbing pump vibration and noise accept thermal expansion and reduce piping stress due to minor misalignment and pressure variations. Sizes 1/2" through 2" to have carbon steel male pipe thread connections. Sizes 2-1/2" and larger to have carbon steel plate flanges with ASA #150 bolt hole patterns. Sizes through 8" to be suitable for 150 psig working pressure at 200°F. Based on Keflex KSSPC.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All floor mounted equipment shall be installed on a housekeeping pad, in addition to any isolation or inertia base requirement as specified in Section 23 02 00 - Basic Materials and Methods.

B. Installation of all vibration isolation materials and supplemental equipment bases specified in this section of the specifications shall be accomplished following the manufacturers written instructions.

C. On completion of installation of all isolation materials and before start up of isolated equipment all debris shall be cleared from areas surrounding and from beneath all isolated equipment, leaving equipment free to move on the isolation supports.

D. No rigid connections between equipment and building structure shall be made that degrades the noise and vibration isolation system herein specified. Electrical conduit connections to isolated equipment shall be looped to allow free motion of isolated equipment.

E. Adjust all isolators for uniform support.

F. Readjust all isolators after system start-up to assure constant support.

3.2 INSPECTION

A. The Contractor shall notify the local representative of the vibration isolation materials manufacturer prior to installing any vibration isolation devices. The Contractor shall seek the representatives guidance in any installation procedures he is unfamiliar with.

B. The local representative of the vibration isolation materials manufacturer shall conduct periodic inspections of the installation of materials herein specified, and shall report in writing to the Contractor any deviations from good installation practice observed.

C. On completion of installation of all noise and vibration isolation devices herein specified, the local representative of the isolation materials manufacturer shall inspect the complete system and report in writing any installation errors, improperly selected isolation devices, or other fault in the system that could effect the performance of the system.

D. The installing Contractor shall submit a report to the Owner's Representative including the manufacturer's representatives final report indicating all isolation reported as properly installed or requiring correction, and include a report by the Contractor on steps taken to properly complete the isolation work.

3.3 VIBRATION ISOLATION SCHEDULE:

B. Pumps (Grade Level):

1. Base Type: Housekeeping Pad.
2. Isolator type: None Required.
3. Deflection: N/A
4. Accessories: Flexible Pipe Connectors.

END OF SECTION 23 05 48

SECTION 23 05 80 - AIR CONTROL AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Automatic Air Vent

B. Manual Air Vent

C. High Capacity Automatic Air Vent

1.3 QUALITY ASSURANCE

A. Expansion tanks shall be constructed with materials and standards which comply with the following standards:

1. American Society of Mechanical Engineers (ASME) Codes
2. Boiler and Pressure Vessel Code: Section VIII Pressure Vessels, Division 1.

1.4 SUBMITTALS

A. Submit shop drawings in accordance with Section 23 05 00 requirements.

B. Submit schedule indicating make, model, size, etc. by system.

C. Submit statement of Code compliance where applicable.

D. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURE

C. Automatic Air Vent:

1. Armstrong Pump Company
2. Bell & Gossett. Inc.
3. Taco, Inc.
4. Thrush

D. Manual Air Vent:

1. Armstrong Pump Company
2. Bell & Gossett. Inc.
3. Taco, Inc.
4. Thrush

E. High Capacity Automatic Air Vent:

1. Armstrong Pump Company
2. Bell & Gossett. Inc.
3. Taco, Inc.
4. Thrush

2.2 FABRICATION

C. Automatic Air Vent: Non-ferrous, automatic air vent rated for 240°F and 150 PSIG. Based on Bell and Gossett Model 87.

D. Manual Air Vent: Hydroscopic air valve, manual shutoff valve thumb screw actuator. Rated at 30 psi and 225°F. Based on Bell and Gossett Model 17SR.

D. High Capacity Automatic Air Vent: Cast iron body and bolted bonnet, threaded connection stainless steel and brass internals, composition disc, pilot operated, snap action, high capacity, instant non-modulating venting thru full range of 2 psi thru 150 psi with backflow prevention to prevent air from entering the system should pressure drop below atmospheric. Rated at 150 psi and 240°F. Based on Bell and Gossett Model 107A.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturers written instructions.

B. Install air vents at all high points of system to facilitate air removal for proper flow and heat transfer.

3.2 INSTALLATION

C. Automatic Air Vent:

1. Install where shown on drawings or standard details.
2. Install 1/2" ball valve and nipple between automatic air vent and system.
3. Provide proper access.
4. Do not install automatic air vent in concealed or non-accessible areas or where leakage may cause damage.
5. Pipe discharge to nearest floor drain.

D. Manual Air Vent:

1. Allow access.
2. Install manual air vent on air chamber when used on system high points and where continuous venting may be coincided.
3. Construct air chamber from:
   a. 1/2" x 2" thread reducer.
   b. 2" x 0'-4" nipple.
   c. 1/4" x 2" thread reducer.
   d. 1/4" x 1/8" brass bushing.
4. Manual air vent.
5. Provide manual air vent on all high points. Where high point will be concealed, route vent to nearest accessible location.
6. In lieu of the manual air vent assembly a pressure and temperature test port may be used to vent air when used with the master air vent tool supplied with the

pressure and temperature test kit specified in Section 23 05 19 - Meters, Gages and Accessories for HVAC Piping.

E. High Capacity Automatic Air Vent:

1. Install where shown on drawings or standard details.
2. Install 1/2" ball valve and nipple between automatic air vent and system.
3. Provide proper access.
4. Do not install automatic air vent in concealed or non-accessible areas or where leakage may cause damage.
5. Pipe discharge to nearest floor drain.

END OF SECTION 23 05 80

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

C. The Division 23 Contractor is solely responsible for coordinating their work with their contracted Test and Balance firm. Prior to test and balance, the contractor shall replace all filters with poly media type for every AHU being tested and provide pre-balance as outlined in Parts 3.2 and 3.3 of this section. All discrepancies, drive changes, etc. reported by the Engineer or Test and Balance Firm shall be corrected by the contractor within five calendar days at no additional cost.

1.2 WORK INCLUDED

A. Checking installation for conformity to design.

B. Checking each piece of equipment for proper installation and operation.

C. Balancing air and water distribution systems to provide design fluid quantities.

D. Measuring and recording of fluid quantities.

E. Electrical measurement.

F. Verification of performance of all equipment and sequence of operation of automatic controls.

G. Checking sound levels and vibration isolators for proper function and measurement and correction where a problem or question of acceptability exists.

H. Recording and reporting results on sub-contractors standard report forms and on commissioning data sheets where these have been provided.

1.3 SUBMITTALS

A. Submit in accordance with Section 23 05 00 Requirements.

B. Submit complete description of procedures, instrument calibration and qualifications of personnel actually doing testing and balancing on this project prior to beginning of any balancing.

C. Submit schedules of test data readings in organized, schematic, tabulated format. Include schematic drawing showing location of all readings.

D. Submit as-built drawings showing locations of all readings.

1.4 QUALITY ASSURANCE

A. Adjusting, balancing and testing procedures and compilation of test data shall be performed by a Certified Test and Balance Engineer or by personnel trained and super-

vised by a Certified Test and Balance Engineer.

B. Test and balance personnel shall be qualified to perform testing and balancing in accordance with AABC or NEBB procedures.

1.6 TOLERANCES

A. Balance final air and water flow to within plus or minus 5 percent of specified quantities. Caution is urged on systems where diversity has been taken and the total flow exceeds the equipment capacity. In this case, the system must be sectioned as necessary to get proper terminal flow.

1.7 GENERAL COMMENTS

A. Water Balance: Readings from venturi flow meters, or automatic pressure independent flow control devices will be given highest priority as to accuracy. Where neither is specified pump curves and chiller or boiler pressure drops are to be correlated to establish flow. Pressure drop across coils or chillers is to be used to proportion flow. Volt and ampere readings will be used as checks. Temperature data will be used only as a performance check and not for balancing.

B. Air Balance: Readings from a pitot tube traverse will be given highest priority as to accuracy. Terminal flow shall be as taken from the terminal DDC flow readings. Outlet flow as established by flow hood will be used to pro-rate air flow. Pressure readings as well as voltage and ampere readings will be used for check purposes only. Temperature readings will be used as a check against performance.

C. All readings shall be cross-checked for accuracy. These cross-checks shall be tabulated within the report.

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 INTENT OF DRAWINGS AND SPECIFICATIONS

A. Review drawings and specifications with regard to adjusting and balancing.

B. Additional balancing devices which, in the opinion of the TAB sub-contractor, would aid in the adjusting and balancing of the systems shall be brought to the attention of the contractor prior to bid time so that the contractor may make allowances to cover the provision of these additional devices in the original bid.

C. Minor modifications in system design, which in the opinion of the Contractor, would aid in the adjusting and balancing of the systems may be provided subject to approval of the Owner's Representative at no additional cost to the Owner. Design modifications shall not lessen the operating efficiency of the systems.

3.2 WATER BALANCE

A. Ascertain that piping systems have been cleaned, flushed, drained and properly refilled and that all strainer baskets have been removed, cleaned and properly reinstalled prior to beginning water balancing procedure.

B. In the event that TAB work is started prior to the completion of the water treatment portion of work, the TAB contractor shall make a random recheck as directed by the

Owner's Representative. The results of this re-check shall be included in the final report.

C. Variable flow pumping systems having two-way control valves and using automatic pressure independent system of flow control for secondary hot water heating and chilled water systems.

1. With one pump running and all manual and automatic control valves open, record GPM stamped on each automatic flow control device and read and record the pressure drop across those which have dual pressure taps, as well as across each coil and applicable equipment.
2. With pump running as described above and all manual and automatic control valves open read and record pressure drop across each pump. Also read and record pressure drop at shut off. Plot these points on the submitted pump curves using the sum of the flow control device GPM as the total system flow.
3. Record the pump speed required to get the pressure drop across the flow control valve having the highest pressure drop to 6 PSI. If this is 85% or greater, no pump impeller change will be required. If less than 85%, the pump impeller will have to be trimmed. Advise the Owners Representative before proceeding.
4. Operate lag pump to be sure performance is the same at each step.
5. Manually set pump speed to 20% (minimum speed) and record flow and pressure difference.

D. For constant flow pumping systems using three way control valves and using automatic, pressure independent system of flow control for chilled water system coils. Before balancing the system, the following procedure shall be executed.

1. With one pump running and all manual and automatic control valves open, record gpm stamped on each automatic flow control device and read and record the pressure drop across those which have dual pressure taps as well as across each coil or heat exchanger.
2. With pump running as described above and all manual and automatic control valves open read and record pressure drop across each pump at full flow. Also read and record pressure drop at shut off. Plot these points on the submitted pump curves using the sum of the flow control device gpm as the total system flow.
3. If the pressure drop across all flow control device exceeds 3 psig, the pump has excess head capability. If the drop across all of the devices equal or exceed 6 psig then the pump impeller may require trimming to keep energy use to a minimum. Submit this data to the Owners Representative for early review if this excess head condition exists, prior to proceeding with balancing to determine if an impeller trim is warranted.

3.3 CONTROLS ADJUSTMENT

A. Check the automatic temperature controls to ascertain that the specified sequence of operation is occurring. Record thermostat set point and room conditions in each space. This includes checking each terminal box to ensure that supply air goes to minimum position before heat comes on.

B. Compare temperature of space (taken with test instrument) to temperature read by thermostat or temperature sensor. Tabulate results.

C. In cooperation with the controls contractor, set adjustments of automatically operated dampers to operate as specified, indicated, and / or noted.

D. Check all controls for proper calibrations, and list all controls requiring adjustment by control installers.

3.4 CONTRACTOR'S RESPONSIBILITIES

A. Final testing and balancing of the HVAC systems shall be performed as specified in this section. It is the responsibility of the Contractor to be completely familiar with all the provisions and responsibilities of the Balancer, and to provide such certification, cooperation, and support required.

B. The Contractor shall repair all deficiencies noted by the Balancer in a timely manner. The Balancer will notify the contractor in writing, on a daily basis, of any deficiencies discovered and Contractor will notify the Balancer immediately, in writing, upon completion of the repairs. The cost for extra re-testing by the Balancer due to un-repaired items that were certified as repaired, will be the responsibility of the Contractor. *The final testing and balancing report will contain no punch list items. All deficiencies will have been corrected prior to submission of the final report. Preliminary reports are not to be submitted to the Owner.*

C. The Contractor shall:

1. Allow adequate time in the construction schedule to perform the Testing and Balancing work.
2. Notify the Balancer upon commencement of work related to the HVAC system.
3. Provide required shop drawings and equipment data.
4. Provide test openings as required for testing and balancing HVAC systems.
5. Provide updated job schedule and timely notice prior to scheduled events.
6. Provide test openings and temporary end caps or otherwise seal off ends of ductwork to permit leakage testing prior to installation of diffusers, grilles, and similar devices.
7. Make preliminary tests to establish adequacy, quality, safety, completed status, and satisfactory operation of HVAC systems and components. The systems shall be free of electrical grounds and short circuits.
8. Perform duct leakage tests, in the presence of the Balancer, on all supply, return, outside air make-up, and exhaust air systems.
9. Within the intent of the contract documents, provide, at the request of the Balancer, all equipment, material, supplies, workmen, and supervisions necessary to provide a satisfactory, operating system.
10. During the test and balance period, operate all HVAC equipment as necessary to permit systems to be tested and balanced as fully operating, functional systems.
11. Work harmoniously with the Balancer, providing all courtesies normally extended to professional consultants.
12. Perform all work necessary to make ceiling plenums air-tight and functional.
13. Remove and replace ceilings as necessary to permit test and balance operations.
14. Remove and replace equipment, lights, or other items which obstruct testing and balancing operations. Where equipment, lights, or other items will interfere with future adjustments of the HVAC system, such equipment, lights, or other items shall be relocated by the Contractor, as directed by the Architect.
15. Provide completed start-up forms on each piece of equipment.
16. Replace belts and drives as required for proper balancing. Drives shall be adjusted and aligned by the Contractor to prevent abnormal belt wear and vibration.
17. Adjust fan speed as required not to exceed RFLA of motor.
18. Open all manually adjustable dampers and test dampers for smooth, vibration-free operation.

19. Verify that all controls are installed and operating in accordance with the sequence of operation.
20. Before requesting final testing and balancing, submit signed statement that HVAC systems are installed, adjusted, fully lubricated, operating satisfactorily, and are ready for use.

3.5 TEST DATA SCHEDULES

A. Submit typewritten schedules of test data readings.

B. Schedules shall record the specified reading, the first reading taken and the final balanced reading for the following items.

C. Where Commissioning Forms are provided, equipment data shall be recorded on these forms for comparison with submitted design data.

D. Witness and record the testing of the ductwork for leakage to insure proper sealing. The Balancer shall randomly select sections of the completed duct system for testing. The sections selected shall not exceed more than 20% of the measured linear footage of supply, return, exhaust or plenum duct length. All selected ductwork shall be leak tested in accordance with SMACNA. Maximum allowable leakage at any tested section shall not exceed 2% of the total air. If any of the selected duct sections exceed the specific leakage allowance, those sections shall be repaired by the Contractor and retested by the Balancer. If initial testing exceeds specification allowance, testing of all remaining duct ductwork shall be required at the Contractor's expense. All additional costs for duct leak repair and retesting shall be the responsibility of the Contractor.

E. Advise Contractor in writing of all ductwork that shall be repaired to reduce air leakage. Retest to confirm minimum allowable leakage. The cost of retest of failed systems will be the responsibility of the Contractor.

F. In the case of an off-season performance testing of air handling equipment and refrigeration equipment, include manufacturer's projected performance for comparison.

1. Motors:

a. Designation.
b. Nameplate HP, voltage and full load amperes.
c. RPM.
d. Motor amperes and voltage under operating conditions.
e. For belt drive applications, motor amperes and voltage under no load condition.

2. Pumps:

a. Designation.
b. Nameplate data.
c. GPM (unbalanced).
d. Pressure, suction and discharge (unbalanced).
e. Suction and discharge pressure with discharge valve closed (shut-off).
f. GPM (final balance).
g. Pressure, suction and discharge (final balance).
h. Pressure entering and leaving strainer.

3. Boiler:

a. Designation.
b. Nameplate data.
c. Pressure and temperatures.
(1) Steam pressure in boiler room (psig).
(2) Heating water pressure at boiler outlet (psig).
(3) Heating water temperature at boiler outlet (^{o}F).
(4) Feedwater temperature entering boiler (^{o}F).
(5) Heating water temperature entering boiler (^{o}F).
(6) Air temperature for combustion (ambient) (^{o}F).
(7) Flue gas temperature (leaving boiler) (^{o}F)
(8) Furnace pressure (inches WG).

d. Flows.
(1) Steam flow (Lb/Hr).
(2) Heating water flow (GPM).
(3) Natural gas flow (Ft^3/Hr).
(4) Propane flow (Ft^3/Hr).
(5) (No. 2) (No. 6) fuel oil flow (GPM).

e. Flue gas analysis.
(1) O_2 (% Vol).
(2) CO_2 (% Vol).
(3) CO (% Vol).
(4) Excess air (%).

f. Fuel analysis.
(1) Heating value
(2) Natural gas (BTU/Cu.Ft.)
(3) Propane (Btu/Cu.Ft.)
(4) (No. 2) (No. 6) Fuel oil (BTU/Gal).

(5) Combustion Efficiency (%).
(6) Boiler efficiency (%).

3.6 OPERATING TESTS

A. Operate systems to demonstrate that systems have been properly adjusted and balanced, and to demonstrate that the systems' performance conforms with the intent of the specifications and drawings.

B. The balancing contractor shall make available to the Owner's operating personnel a Certified Test and Balance Engineer for a minimum of 16 hours, two working days, not necessarily consecutive, with all necessary equipment to demonstrate that all systems operate as intended and that the balancing reports are accurate.

C. This demonstration will occur after the balancing contractor has submitted his reports to confirm that all systems or portions of the systems that coincide with the building's occupancy schedule, are adjusted and balanced.

D. Conduct tests with natural building heating and/or cooling loads for a minimum 4 hours duration.

END OF SECTION 23 05 93

SECTION 23 07 00 - HVAC INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

C. Refer to Division 7 for all requirements pertaining to Firestopping materials.

1.2 WORK INCLUDED

A. Piping Systems Insulation.

B. Equipment Insulation.

C. Underground Pipe Insulation.

D. Cold Pipe Hanger Support Blocks.

E. Accessories.

1.3 QUALITY ASSURANCE

A. All products within the conditioned air stream or active plenums shall comply with the NFPA 90A Flame/Smoke rating of 25/50 and comply with UL 181 erosion limitations. Fire hazard ratings shall be as determined by NFPA-255, "Method of Test of Surface Burning Characteristics of Building Materials" - ASTM E84 or UL 723.

B. All adhesives, cements, finishes, jackets, etc., shall be UL listed or labeled for use as applied to insulation and designed specifically for use in the installation.

C. All insulation shall be installed in accordance with National Commercial & Industrial Insulation Standards (NCIA).

1.4 SUBMITTALS

A. Submit schedule indicating type of insulation, thickness, vapor barrier or coating by system and size.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit details of insulated removable covers using the actual equipment dimensions, concrete base sizes and piping arrangements.

D. Submit in accordance with Section 23 05 00 requirements.

1.5 GENERAL REQUIREMENTS

A. Factory-applied insulation is specified under the applicable equipment Section of these specifications. It is listed here for reference only.

B. Acoustical duct liner is specified under Section 23 31 01 - Shop Fabricated Ductwork. It is listed here for reference only.

C. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.

1.6 DEFINITIONS

A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other spaces as indicated.

B. The term "concealed" means concealed from view, and includes all spaces not defined as exposed.

C. The term "unconditioned" space shall mean all places where the temperature surrounding the pipe or duct has not been conditioned consistent with conditioned spaces, and shall include mechanical equipment rooms, non-active ceiling plenums, and non-accessible chases. This term shall also include conditioned spaces where the humidity levels are allowed to rise above 70% RH.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fiberglass Insulation:

1. Owens-Corning Fiberglas
2. Knauf Fiberglass
3. CertainTeed
4. Johns Manville

B. Closed Cell Elastomeric Insulation:

1. Armacell LLC
2. Johns Manville
3. Rubatex

C. Foamglass Insulation:

1. Pittsburgh Corning
2. Cell-U-Foam Corp.

2.2 INSULATION REQUIREMENTS

A. Refer to the drawings.

2.3 MATERIALS

A. Pipe Insulation (to 450°F):

1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket vapor barrier with self sealing pressure sensitive lap joints, molded to accommodate pipe, maximum vapor permeance of .02 perm/in. and a puncture resistance of 50 units, minimum density 4.0 lb/cf, maximum conductivity per 1"

thickness of .23 at 75°F, .29 at 200°F and .43 at 400°F mean temperature. Based on Knauf Pipe Insulation.

2. Closed Cell Elastomeric (Small Pipe Sizes up to 5 Inches): Flexible, elastomeric, closed cellular, tubular molded to accommodate piping, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non absorbent, ozone resistant, minimum density of 4 lb/cf, maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC AP Armaflex and Self-seal Armaflex 2000.
3. Closed Cell Elastomeric (Large Pipe Sizes, 6" and Larger): Sheet type, flexible, elastomeric, closed cellular, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non absorbent, ozone resistant, minimum density of 4 lb/cf, maximum conductivity per 1" thickness of 2.7 at 75°F mean temperature. Based on Armacell LLC Armaflex II.
4. Foamglas: Rigid, preformed sections of 100% rigid cellular glass dimensionally complying with ASTM C585 standards, non-absorptive of moisture after immersion, water vapor permeability 0.00 perm/in. impervious to common acids (except hydrofluoric), non-combustible, 100 PSI compressive strength when capped with hot asphalt, 8.5 #/cu.ft. density, thermal conductivity 0.33 BTU-In./Hr./Sq.Ft./F @ 50°F. Based on Pittsburgh Corning Foamglas.

B. Equipment Insulation:

1. Closed Cell Elastomeric Sheet type, flexible, elastomeric, closed cellular, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non absorbent, ozone resistant, minimum density of 6 lb/cf, maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC Armaflex II.

2. Foamglas: Sections of 100% rigid cellular glass, non-absorptive of moisture after immersion, water vapor permeability 0.00 perm/in., impervious to common acids (except hydrofluoric), non-combustible, 100 PSI compressive strength when capped with hot asphalt, 8.5 #/cu.ft. density, thermal conductivity 0.32 BTU-In/Hr./Sq.Ft./F @ 50°F. Based on Pittsburgh Corning Foamglas.

C. Insulation Accessories: Aluminum Pipe Jacket and Fitting Covers: Jacket shall be 0.016" thick (26 gauge) embossed aluminum, sized to provide a 2" (min.) lap joint both longitudinally and circumferentially, with 3/4" min. wide x 0.015" min. (30 gauge) thick draw bands. Fitting covers shall be aluminum, 0.025" (22 gauge), min., thickness.

D. Cold Pipe Hanger Support Blocks: Lightweight, rigid, closed cell material having 100 lb/sq.in. compressive strength when capped with hot asphalt according to ASTM C240. Based on Pittsburgh Corning Foamglas.

E. Accessories:

1. Aluminum Pipe Jacket and Fitting Covers: Jacket .016" thick (28 ga.) embossed aluminum sized to provide a minimum 2" lap joint both longitudinal and circumferentially, minimum 3/4 inch x .015 inch thick (30 ga) draw bands. Covers .024 inch thick.
2. PVC pipe jacket and fitting covers used with insulation for pipe, elbows, tees, couplings, 25/50 flame/smoke ratings, suitable for temperatures to 500°F.
3. Glass Cloth Pipe, Duct and Equipment Jacket: Glass lagging cloth, 8 oz/sy treated weight. Secure with elastomeric insulating adhesive on elastomeric insulation, for fiberglass insulation use appropriate mastic finish as recommended by the insulation manufacturer with the perm rating of the mastic equal to or less than that of the insulation it is sealing.

4. Corner angles shall be minimum 28 gauge, 1 inch by 1 inch aluminum adhered to 2 inch by 2 inch heavy kraft paper.
5. Glass tape shall be a minimum density of 1.6 ounces per square yard, 4 inch wide with a 10 x 10 thread count per inch of width. Glass cloth shall be untreated.
6. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accord with ASTM A 167 or Monel® coated.
7. Wire shall be soft annealed galvanized, or copper, 16 gauge, or nickel copper alloy.
8. Closed cell elastomeric insulated finish shall be a white water based flexible, acrylic latex enamel equal to WB Armaflex finish.
9. Insulation Tape: Closed cell elastomeric insulation: 2" wide x 1/8" thick.
10. Elastomeric Insulation Adhesive: Air drying contact adhesive for securing sheets to flat or curved metal surfaces and joining seams and butt joints of elastomeric insulation. Suitable for temperatures to 180°F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method.
11. Vapor Barrier Mastic: Air drying flexible water based mastic used for applying a vapor barrier joint with glass cloth at insulation joints. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08. , Childers Products Company, Inc. CP-35 Chil Therm® WB, Foster Products Corp. Product Data 30-80 Foster Vapor Safe® Coating, Marathon Industries, Inc. 590 LO-PERM, Richard’s Paint Manufacturing CO., Inc. VBM-4, Vimasco Corp. 749 Vapor-Blok, or equal.
12. Acrylic Latex Finish and Sealers:

    a. Elastomeric Insulations: Air drying flexible water based finish used for finishing flexible elastomeric insulation. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell LLC WB Armaflex finish.
    b. Foamglass Insulation: Air drying flexible water based sealer used for applying a vapor barrier seal over microscopic cracks that develop in the insulation. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08. , Childers Products Company, Inc. CP-35 Chil Therm® WB, Foster Products Corp. Product Data 30-80 Foster Vapor Safe® Coating, Marathon Industries, Inc. 590 LO-PERM, Richard’s Paint Manufacturing CO., Inc. VBM-4, Vimasco Corp. 749 Vapor-Blok, or equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install all insulation in strict accordance with the manufacturers written installation instructions.

B. Provide a PVC jacket on all exposed rain leader piping, including but not limited to the Gym.

C. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.

D. Properly coordinate the insulation work with the other trades so that installation is performed with a minimum of conflict.

E. Insulation shall not be applied on any piping or duct system requiring testing until testing is completed and approved by Owner's Representative.

F. Insulation shall not be applied until all systems are clean, dry, free of dirt, dust or grease.

G. The finished installation shall present a neat and acceptable appearance which includes but is not limited to: all jackets smooth, all vapor barriers sealed properly, no evidence of "ballooning" of the jackets, or sagging insulation, all valves, dampers, gauges, unions, etc. accessible. The Owner's Representative shall be the final judge of acceptance of workmanship.

H. All equipment nameplates on hot equipment shall be left uncovered. All equipment nameplates on cold equipment shall have a removable section sized to expose the name-plate. This section shall be clearly marked "NAMEPLATE".

I. If proper maintenance procedures require access to the insulated equipment removable panels, sections or covers shall be provided to accomplish this. These access devices shall be constructed in a manner to assure easy access and sturdy construction. The contractor shall assume the responsibility to coordinate all equipment requiring insulation to be either factory or field insulated.

J. Insulation and accessories shall be applied only at suitable application temperature and conditions as recommended by the manufacturer. Do not apply insulation to any surface while it is wet.

K. Insulation shall be protected from moisture and weather during storage and installation.

L. Insulation which has sustained moisture damage, torn jackets, or other damage due to improper storage or other reasons shall not be used. If evidence of this is sighted the Owner's representative reserves the right to require the insulating contractor to remove any and/or all insulation until the Owner's Representative is satisfied that there is no longer any inferior insulation installed on this project.

M. Insulation, fabric and jacketing shall be protected from damage during construction. Damage by the insulator shall be repaired without cost to the Owner. Damage by others shall be reported in writing to the contractor.

N. The insulation subcontractor is responsible for proper material storage at the work site.

O. Work performed prior to receipt of approved documents or submittals, which later proves to be incorrect or inappropriate, shall be promptly replaced by the contractor without cost to the purchaser.

P. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns and walls have been provided.

Q. All insulation at handholes, access doors or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.

R. Where an insulated pipe or ductwork passes through a sleeve or opening in a non-rated partition, the full specified thickness of the insulation shall pass through the sleeve or opening. Where an insulated pipe or ductwork passes through a rated partition, refer to Division 7 Section Firestopping.

S. All materials, accessories and methods of installation and fabrication are subject to the Owner's Representatives inspection and approval during any phase of the work.

T. The insulation subcontractor shall prevent the accumulation of insulation debris in the

buildings and on the premises of the Owner.

U. The insulation subcontractor shall be responsible for his own safety program at the work site, and shall provide instruction on safe practices for his workers assigned to the project. All employees are subject to the work rules at the job site.

V. The insulation subcontractor shall familiarize himself with the progress and execution of the job and notify the proper parties of interferences and any problems with the proper installation of his materials.

3.2 INSTALLATION

A. Pipe Insulation:

1. General:

a. All locations where the insulated surface is supported by hangers, the insulation shall be protected by shields or saddles properly skimmed to maintain a smooth outer surface, and proper insulation thickness. Chilled water piping, 3" and over shall have a section of foamglas insulation installed between the pipe and shield. 3 and 4" to be 12" long, 5" and 6" to be 18" long and 8" and over, 24" long. If the possibility exists that the hanger may conduct the temperature of the conveyed medium and thus cause condensation or personal injury due to high temperature, the hanger shall also be insulated. Joints between foamglas and pipe insulation shall be properly sealed.

b. All devices connected to or in line with the piping system shall be insulated greater than or equal to the connecting piping. This includes but is not limited to valves, air separators, expansion tanks, control valves, control devices, gauge connections, thermometer stems, chemical feed equipment, piping flexible connectors, etc. This is particularly important on ice water and refrigerant lines.

c. The insulation at threaded unions in steam and hot water piping shall be tapered and terminated with cement and glass lagging cloth and lagging adhesives.

d. Insulate exterior surfaces of all anchors and guides for chilled water and dual temperature piping systems.

e. A complete moisture and vapor barrier shall be installed wherever insulation is penetrated by hangers or other projections through insulation and in contact with cold surfaces for which a vapor seal is specified.

f. Cover fittings, flanges, unions, valves, anchors, and accessories with premolded or segmented insulation of the same thickness and material as the adjoining pipe insulation. Where nesting size insulation is used overlap pipe insulation 2 inches or one pipe diameter. Fill voids with insulating cement and trowel smooth. Elbows shall have not less than 3 segments per elbow. Secure insulation with wire or tape until finish is applied. Blanket inserts in lieu of premolded or segmented insulation is not allowed. Cover fittings with preformed PVC fitting covers.

g. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.

h. Seal all raw edges of insulation.

i. For piping supported by hangers outdoors, apply a rainshield to prevent water entry.

2. Rigid Fiberglass:

a. Provide PVC fitting covers for all fittings.
b. Align all jacket seams.
c. Assure all vapor barriers are properly sealed.
d. Provide PVC jacket over all exposed insulation in the equipment room.
e. All corner angles below 6'-10" shall have padded insulation and be marked with yellow stripes.

3. Closed Cell Elastomeric:

a. All joints shall be sealed with adhesives.
b. Where the thickness is to be obtained by use of two layers of insulation, install with staggered joints.
c. Finish:

1) Concealed Indoors: No additional finish.
2) Exposed Indoors: Provide PVC jacket over all insulation.
3) Concealed Indoors: Provide PVC jacket over fittings fabricated from insulation sections or sheet.
4) Outdoors: Provide aluminum pipe jacket.

4. Foamglas:

a. All joints, both longitudinal and circumferential shall be sealed with a vapor barrier mastic.
b. Thickness shown for refrigeration pipe to be obtained by use of two layers of insulation with staggered joints.
c. Finish:

1) Exposed Indoors: Provide PVC jacket over all insulation that shall be sealed with an acrylic latex finish.
2) Concealed: Provide PVC jacket over fittings fabricated from insulation sections or sheet. Provide ASJ over all other.
3) Exposed Outdoors: Provide acrylic latex finish and aluminum pipe jacket.

B. Equipment Insulation:

1. Vessel and Large Pipe Insulation:

a. Insulation shall be of the same material as the piping which serves it and it shall be layered to obtain the required thickness. Maximum of 1-1/2" thick per layer.
b. All joints shall be staggered to avoid thermal gaps.
c. Sheet size shall be as large as possible to minimize seams. Do not use "scraps".
d. Securing shall be by welded studs and/or non-corrosive banding wire. Do not weld brackets, clips or other devices to ASME coded pressure vessels or piping. Insulation pins or studs shall be as specified and installed in accordance with NCIA standards.
e. Finish shall be with PVC jacket or galvanized steel mesh wire and a finish coat of insulating cement minimum of 1/4" thick. After cement has cured apply glass lagging cloth and proper coating as directed by manufacturer. All corners shall have metal corner beads and provide acrylic latex finish.

2. Removable Covers:

a. Equipment specified to have removable covers shall have insulation as specified in Paragraph 2.4, fastened to the inside surfaces of a 20 gauge galvanized sheet metal equipment cover.
b. The covers shall be of a sectionalized design, and shall be custom-fitted around each piece of equipment. For ease of removal, joints between sections shall coincide with the splits or joints in the equipment. Joints between sections of the cover shall be held together with quick-connect trunk latches, and shall be gasketed to form a vapor-tite seal cover (for the passage of pipes, etc.) shall be provided with closed cell elastomeric collars to ensure a tight fit.
c. The box shall be fitted around each piece of equipment and split for removal to coincide with the split in the casing. The sections of the box shall be held together with quick disconnect trunk latches. Joints between box sections shall be gasketed to form a vapor seal. Void spaces in the box shall be packed with flexible fiberglass insulation. Openings around pump casing shall be provided with closed cell elastomeric collar to ensure tight fit.
d. Provide acrylic latex finish.
e. Coordinate the piping of the drain, vent, gauge, and control lines to exit through the base or back section of the removable cover. The insulation of these pipes shall be totally independent of the removable cover.

3. Chilled Water Compression Tank and Filtering Systems: Surfaces shall be insulated with 1-inch thick closed cell elastomeric insulation board or pipe insulation, as applicable. Finish as specified for vessel and large pipe insulation.

D. Cold Pipe Hanger Support Blocks:

1. Provide on all chilled fluid systems pipe hangers and supports.
2. Apply Pittcote 404 acrylic latex mastic filler over insulation and on ends.
3. Apply Pittseal 444 butyl joint and penetration sealant at joint between foamglas and adjacent insulation.
4. Provide vapor barrier system to match the vapor barrier on the adjacent system.
5. Provide 20 gauge (min.) galvanized shield between the insulation and the hanger or support.

E. PVC Jacket:

1. Provide PVC sheet jacket over all exposed, indoor piping or insulation.
2. Provide PVC pipe jacket over all exposed, indoor foamglas or elastomeric pipe insulation.
3. Provide PVC fitting covers over all fittings fabricated from insulation sections or sheet material.
4. PVC pipe jacket shall be applied with special attention given to achieving positive seal at all longitudinal and circumferential joints using a welding solvent on the longitudinal joint as recommended by the manufacturer. Slip joints to have 4" minimum lap and no welding solvent.

F. Glass Cloth Jacket:

1. Provide where specified.
2. Provide acrylic latex finish.

G. Flexible Acrylic Latex:

1. Apply two coats to glass cloth jacket, concealed foamglas and closed cell elastomeric insulation.
2. Refer to Division 9 for color to be used. If no instructions are given, provide a white finish.

3.3 MISCELLANEOUS ITEMS

A. General: Provide insulation of any portion of a system or piece of equipment not previously discussed where ambient operating conditions will allow condensation to occur or whose surface temperature exceeds 115°F. Insulation materials and method shall be as directed by the Designer.

B. Final Inspection: At final inspection, the finished surfaces of all exposed insulation shall be clean and without stains or blemishes. Repair and clean the insulation surfaces and, if necessary, to obtain a new appearance, shall coat discolored surfaces with off-white latex water-base semi-gloss paint or lagging adhesive, without a change in the contract price.

END OF SECTION 23 07 00

SECTION 23 09 00 - INSTRUMENTATION AND CONTROLS FOR HVAC SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Complete stand alone, open protocol Direct Digital Control (DDC) Building Control System (BCS) including all control devices, valves and dampers except where furnished under other sections.

B. Complete system of control and interlock wiring including wiring specified in Section 23 05 18 Control Wiring and Section 23 09 93 Sequence of Operations.

C. Interface with Product Integrated Controls specified in other sections of the specifications.

1.3 QUALITY ASSURANCE

A. The installation of the building control system shall be by the manufacturer of the controls or his local authorized agent who has a minimum of three years of representation.

B. All electrical components 25 V and above shall be U.L. listed or labeled.

C. All equipment or piping used in the conditioned air stream, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable local building codes or requirements.

D. All wiring shall conform to the National Electrical Code (NEC).

1.4 DEFINITIONS

A. Control Wiring: All wiring, 120 VAC or low voltage other than power wiring, required for the proper operation of the mechanical system.

B. Power Wiring: All line voltage wiring to the mechanical equipment. Note: Where line voltage serves a control circuit such as power to a transformer, power to a DDC control panel, power for a line voltage thermostat, or damper this shall be considered control wiring.

1.5 SUBMITTALS

A. Submit in accordance with Section 23 05 00 requirements.

B. Provide complete catalog data and installation instructions for each control component. Include damper and valve sizing details.

C. Control system submittal shall contain the following graphics and documentation for each system being controlled:

1. Communications bus schematic showing all panel locations and hardware

requirements.

2. Schematic wiring diagrams in ladder form for each system including power source.
3. Schematic diagram with detail of all hardware, components used, location of instruments, bulbs, dampers, valves and other components. The chart shall include control chart including control symbols, quantity, manufacturer's part number, tech sheet reference (include in submittal) and description of part.
4. Each DDC field panel shall be detailed in the submittal to identify termination boards within each panel and terminal of their respective field points. Each termination point shall define the point name and point description by each terminal with the field panel. Point names and descriptors shall be consistent throughout the submittal on the schematics, wiring diagrams, equipment list, etc.
5. Submit the system architecture or configuration complete with all processors, terminals, other peripheral devices, modems, etc., with interconnecting diagrams.
6. A report shall be included in the submittal to include every point in the entire system. The report shall include the programmed data for each point:

   Point Name
   Point Type (analog, digital, etc.)
   Point Descriptor
   Physical Address (enclose legend)
   Alarm (yes or no)
   Print Alarm (yes or no)
   High Limit
   Low Limit
   Totalized (yes or no)
   Hours or Minutes Totalized
   Engineering Unit of Point

7. A flow chart form of sequence of operation in abbreviated English language.
8. English language sequence of operation defining flow chart with control company programmed inputs to reflect English language sequence. Each sequence task shall be followed by the control company coded program. One list of coded programmed inputs at the end of each sequence of operation shall be acceptable.

D. For each Direct Digital Control (DDC) panel provide:

1. Point List identifying each input and output by point name, point type, hardware description, wiring terminations, mounting arrangements and software features.
2. Complete English language description of all software.
3. Flow diagram and complete details program.

1.6 CONTROL SYSTEM GENERAL REQUIREMENTS

A. The control system shall be of the electronic microprocessor type employing Direct Digital Control (DDC) technology for all control sequences unless specifically stated otherwise in the Sequence of Operation portion of this specification.

B. All DDC controllers shall be connected via a communications bus to an operators panel. The operators panel may be located on the face of one of the DDC controllers, or at an alternate location as approved by the Engineers. In addition, a portable operators panel may be connected to the system at any DDC controller location.

C. All DDC controllers shall be connected to a global information handler, which shall send and receive information of a global nature throughout the system. The information handler shall allow each DDC controller and operators panel access to all information contained within the system, regardless of location. The information handler shall also allow commands from any DDC controller or operators panel to be directed to any other DDC controller on either a global or individual basis. The information handler may be furnished as an integral part of one or more DDC controllers.

D. Provisions shall be made to allow additional DDC controllers to be added at any point on the communications bus for future expansion.

E. Field Installed Devices (FID) shall be capable of stand-alone operation, as well as interfacing with the networked Building Control System.

F. Valve and damper operators shall be of the electronic type.

G. The Building Control System shall be made up of HVAC equipment with factory installed microprocessor-based Product Integrated Controls (PIC), distributed microprocessor-based Field Installed Devices (FID), input/output modules and necessary software.

H. The Product Integrated Controls (PIC) shall be factory installed controls capable of stand-alone operation. The controller shall be specifically designed to operate and monitor the functions of the HVAC equipment on which it is installed. The PIC shall be capable of interfacing onto the network.

1.7 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship and to provide a complete and operable building control system.

B. The drawings are diagrammatic intending to show a workable general arrangement and location of system components and are not necessarily complete or rigid in all details.

C. Deviation in the detailed building control system due to the inherent differences in alternate control systems will be allowed provided the intent and minimum quality standards detailed and specified are maintained.

D. No deviation in the specified sequence of operation, as specified in Section 23 05 93, Sequence of Operation, will be allowed without written approval from the Engineer.

1.8 OPERATION AND MAINTENANCE MANUALS AND INSTRUCTIONS FOR OWNER

A. Operation and maintenance manuals shall be provided as outlined in Section 23 05 00. The manuals shall include all data which was a part of the original submittal with as-built wiring diagrams with communication trunck line diagrams and all control wiring diagrams and device locations, parts lists and operating and maintenance instruction manuals.

B. A total of 40 hours of on the job owner training conducted by a technician or technicians fully qualified to conduct such training shall be provided. Instruction or Training shall include, but not be limited to:

1. Instructions in the manufacturers recommended maintenance and operating procedures.
2. Instructions in the detailed sequence of operation of the mechanical equipment controls.

3. Instructions in reading and using the control wiring diagrams.
4. Instructions in control setpoint adjustment as relating to each specific system provided under this section.
5. Performance testing as described in Part 3.

1.9 COOPERATION WITH OTHER CONTRACTORS

A. The Building Control Sub-Contractor shall coordinate with other trades to assure a complete and operational Building Control System.

B. This contractor shall furnish to the air balance contractor (Section 23 05 93) a notebook PC computer for terminal box set-up. At the completion of the balancing, the terminal shall be turned over to the owner.

1.10 MATERIALS, STORAGE AND HANDLING

A. All components shipped to the job-site and stored on-site shall be stored in a clean, dry storage location.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Trane Controls (extension of existing system)

1. Substitutions are accepted if the contractor replaces all the existing controls throughout the building with their new system. This includes, but is not limited to, all wiring, devices, actuators, valves and sensors. The reuse of any existing controls equipment or wiring is not permitted.

2.2 EQUIPMENT

A. Direct Digital Control (DDC) Controllers:

1. Direct Digital Control (DDC) Controllers shall be field programmable microprocessor based, electronic controllers incorporating direct digital control technology. The DDC controllers shall be capable of performing their assigned control and energy management functions as stand alone units or as part of a comprehensive Building Management System. The controllers shall be capable of performing energy management functions including, but not limited to supply air and water reset, economizer, duty cycling, chiller optimization, morning cool-down and warm-up, solar compensation, unoccupied setback, and real-time scheduling.
2. The controllers shall have built-in, non-volatile, real-time calendar clocks capable of generating real and elapsed time signals in years, months, days of the week, hours, minutes and seconds, as well as elapsed time in days, hours, minutes and seconds. The controller shall be provided with a minimum of 72 hour back-up capability to protect against loss of time in the calendar clock and the programmed software.
3. The controllers shall be capable of interfacing with a standard RS485 twisted pair communication channel for local operation and shall be protected with software security code keys to prevent unauthorized access. Where practical, controllers shall be fully distributed and dedicated to an individual piece of equipment or system. When input/output requirements exceed the capacity of a controller, additional controllers shall be connected serially in a daisy chain configuration to allow for the use of a single RS485interface channel for multiple controllers.

Global level controllers shall allow full Internet Protocol (IP) communication through a static IP connection through a 10/100 megabit per second Ethernet protocol.

4. The controllers shall be programmed for the sequences of operation defined hereinafter. The execution of these sequences shall be fully automatic and without operator intervention. The controllers shall sense all of their inputs, test for multiple input programmed conditions and execute appropriate action on valves, dampers, pumps, fans and other equipment. The programmed conditions may include any combination of inputs, outputs, time and the mathematical operations (addition, subtraction, greater than, less than, square root, or absolute value). Program changes shall be entered into the controllers without interruption of the system operation.
5. The controllers shall be completely field programmable from a standard portable programming unit, a CRT terminal or from a remote location through a telephone modem. The program logic shall allow changes without interruption of the system operation.
6. The controllers shall be programmed to examine their inputs for emergency conditions and to automatically initiating the actuation of the appropriate alarm mode.
7. The operator, through a terminal, shall be capable of overriding the programmed control sequence to manually operate the outputs for system checkout. All sequences of operation shall be demonstrated through this simulation technique. The controllers shall be stepped through their sequence to verify system operation. During the maintenance routine, the controllers shall be capable of selectively disabling inputs and outputs without affecting the operations of the remaining inputs and outputs. The controllers status shall be accessible through the ASCII channel. Upon appropriate commands, the controller shall read out time, analog input values, output status, program line number being processed, disabled inputs, disabled outputs and sequencing program logic. Through the ASCII channel, the controllers shall be capable of printing a data history log for maintenance and trouble shooting of the system.
8. The controllers shall have a minimum of four levels of access available for terminal operation of the unit. The number of functions allowed an operator shall be determined by the level of password that is correctly entered into the controller.
9. The executive operating system provided with the controllers shall provide for all the functions described herein. The executive system shall provide English error messages to the user when any command or date is entered that cannot be understood by the microprocessor. An editing system shall also be provided for program entry. A program and variable trace routine shall also be provided to allow for easier program testing and debugging.
10. Digital Controllers used to control terminal equipment, such as variable volume boxes, shall be designed as individual control units. All variables shall be capable of being viewed and changed from the operators panel, or the portable operators console.

B. Input-Output Devices:

1. Valves and Operators:

a. Valves shall be provided with equal percentage ball valves with stainless steel bodies ball and stem. All valves shall have blowout-proof stem design, glass reinforced teflon thrust washer, with a minimum of 400 psi rating.

b. Valves shall be sized as indicated or as required to guarantee sufficient size to meet the heating or cooling requirements with specified pressure drops. Water valves shall be sized for 2 psig minimum and 5 psig maximum pressure drop. Valves 2 inches and smaller shall be screwed and valves 2-1/2 inches and larger shall be flanged.
c. Valve operators shall be gear driven electronic. Operators shall be of sufficient size to ensure smooth positive, operation and tight shut-off against system pressure. The water valves shall be designed to go to the open position on power or other failure. The source of power for valve operation shall be the responsibility of the BCS Contractor.

2. Butterfly Valves and Operators:

a. Isolation valves and control valves 4" and over may be butterfly type.
b. Valves to have 416 stainless steel stem, full lug, cast iron or ductile iron body to permit removal of downstream piping, long neck body extended to allow for a minimum of 2" insulation, aluminum bronze or stainless steel disc, bubble tight EPDM seat, infinite position throttling, Class 150, 20F to 220F range.
c. Where three way valves are shown, factory furnished T-assemblies with mounted valves and cross linkage may be used.
d. Valves to have gear driven electronic operators. Operators to be of sufficient size to ensure smooth, positive operation and tight shut-off against system pressure. Preheat coil valves and valves on the primary and secondary heating water circuits shall have spring returns. The water valves shall be designed to go to the open position on power or other failure.
e. Based on Keystone Fig. 122.

3. Panels:

a. All relays and similar devices shall be mounted within Control Panels. Quantity and location of control panels shall be dictated by contractors system architecture.
b. Control panels shall be dust tight and furnished with hinged locking doors. Provide an engraved nameplate on the face of the panel clearly describing its function. All devices located within the panel shall be clearly labeled. All wiring within the panel shall be in accordance with NEMA, UL standard, NEC and local codes. Details and proposed mounting location of each panel shall be submitted prior to construction. All panels shall be factory prewired and prepiped to terminal strips prior to arrival at job site.
c. Provide wiring diagram mounted inside door with plastic protective covering.

4. Relays:

a. All relays shall be plugged in, interchangeable, mounted on a circuit board and wired to numbered terminal strips.
b. Start/stop relay modules shall provide either momentary or maintained switching action as appropriate for the motor being started.

5. Differential Pressure Switches: Binary differential pressure sensors shall be used to indicate pump and fan operation and for indicating high pressure drop across filters. These sensors shall be of the diaphragm type and shall be adjustable and furnished in ranges compatible with their service.

6. Current Sensing Relays:

   a. Solid state switch which operates when current level sensed by internal current transformer exceeds the threshold value set by the adjusting device. Internal circuits totally powered by induction from line being monitored.
   b. Current range and switching characteristics as required for intended duty.

7. Water Flow Meters:

   a. Flow meters shall be insertion rotary type, suitable for hot tap insertion and removal as required. The meter shall mount on a 2 inch full opening isolation valve. The meter assembly shall consist of a retractor, rotor, and all necessary interface electronics to transmit a compatible digital pulse train flow signal to the digital system controller.
   b. Wiring installed by the contractor between the control system and the transducer shall be Belden 9320, two wire, shielded twisted cable, and shall not be included in conduit containing AC circuit wiring.
   c. The flow transducer shall utilize a non-magnetic sensing mechanism with a forward-swept rotating impeller to produce a frequency signal proportional to flow. The flow transducer shall have an achievable accuracy of +/-1% of flow rate with flow velocities of 1 to 30 fps when installed with 10 pipe diameters of straight pipe before the transducer and 5 pipe diameters after the transducer.
   d. The transducer shall be constructed of brass with a glass reinforced impeller, tungsten carbide shaft and glass reinforced polyphenylene sulfide housing. The unit shall be both insertable and removable through a gate-type valve when the pipe is under pressure.
   e. Based on Onicon Model F-1210 (No substitute).

2.3 SYSTEM SOFTWARE *(As it applies to the new boilers and controls only)*

A. General:

1. The Contractor shall provide all software required for efficient operation of all functions required by this specification. Software shall be modular in design for flexibility in expansion or revision of the system. The software shall, as a minimum, include:

   a. Complete database entry
   b. Configuration of all application programs to provide the sequence of operation indicated
   c. Complete graphics package, including graphics floor plans and individual graphics, for each system.
   d. Alarm limits and alarm messages for all critical and non-critical alarms
   e. Configuration of all reports and point summaries indicated

2. The system software shall be complete such that each control loop shall function as specified in the Sequence of Operation.

3. The building control system manufacturer shall be required to write the software program and test the operation of every control loop. A letter certifying that the system is ready for inspection shall be submitted to the engineer prior to the controllers being shipped to the field. The engineer may at his option visit the contractor's office and witness proper operation of each control loop prior to shipping from the contractor's point of fabrication. The control contractor shall provide a means of simulating every input to the system as a requirement for debugging the software. Prior to shipping of the microprocessor controller, the debugged software shall be transmitted to the owner for approval.
4. After all field connections have been made and control power is available in the control panel, the owner shall be notified and the control system shall be energized. Any required reloading of the software shall be performed and start-up of the mechanical system and building control system shall commence.
5. The building control contractor shall be responsible for all necessary revisions to the software as required to provide a complete and workable system consistent with the letter and intent of the specification. All control performance criteria are specified in the Sequence of Operations section of the specification.
6. After the system has operated properly for 90 days following start-up of the final component of the heating and air conditioning systems, an as-built copy of the software shall be transmitted to the owner for permanent record purposes. Any software upgrading or enhancements to improve the system operation or as required for proper operation of the system during the first year of operation is the responsibility of the building control system contractor. Any changes to the software shall be immediately transmitted to the owner
7. The software required to provide the initial operation routines shall not consume more than 70% of the programmable capability of the controller.
8. The software shall be provided in these five categories:

    a. System executive software
    b. Software for user control over system configuration at the Central Site location, and by Maintenance Personnel in the field
    c. Facility monitoring functions
    d. Direct digital control
    e. Application software

9. Each category of software shall consist of interactive software modules. Each module shall have an associated priority level and shall execute as determined by the program controller as defined in the real time operating system.
10. The building operator shall be able to communicate and direct all control functions through the use of a 2-button "mouse" operator interface to monitor and control all functions and sequences within the system.
11. The central site shall allow receipt of alarms and messages while in a functional mode other than energy management. i.e. incoming alarms shall be displayed while the operator is in a word processing, spreadsheet or other operating mode. The system must automatically switch from a non- energy management mode, respond to an alarm, and return to the exact position left in the previous functional mode.
12. The central site must be able to generate standard ASCII file formats to allow use with third-party software (MicroSoft Excel) to generate and store owner-designed reports.

B. Systems Software:

1. The central site shall display graphically, in up to 64 different colors, the following system information:

a. Floor plan maps shall show heating and cooling zones throughout the buildings in a range of colors which provide a visual display of temperature relative to their respective setpoints. The colors shall be updated dynamically as zones' comfort condition change. Locations of space sensors shall also be shown for each zone. Setpoint adjustment and color band displays shall be provided as specified.

b. Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. It shall also provide a current status of all I/O points being controlled and applicable to each piece of equipment including analog readouts in appropriate engineering units at appropriate locations on the graphic representation.

c. The following information shall be selected from a "pop- up" menu available on various graphics:

Quit	Trends
Alarms	Setpoints
Messages	Module Status
Schedules	Programming Parameters
Schedule Graphs	Utilities
Schedule Groups	

d. Programming, scheduling and set-point changes shall be accessible for modification on each menu for the associated equipment. Operator shall be able to automatically download changes from the central site to the appropriate program for the equipment being controlled. Operator shall be able to upload information from the field modules to the central site.

2. Input Format: Allowable operators, as defined under user access, shall be able to control system functions by their inputs at an appropriate user terminal. The primary operator interface shall be via two button mouse.

3. Verification of Operator Input: The system shall acknowledge all inputs as functions or commands to be performed. The system's handling of operator inputs, such as requests to start a motor, output a log, change a time program, acknowledge an alarm, or do any of the other commands described in this specification, shall be in a similar format.

4. Operator Commands: All operator commands shall be in graphics data base and menu driven. After the operator selects the desired object item or menu, the system shall display either the status of selected object item or the allowable options available. Upon entry of a command to the point or points desired as described above, the system shall, before performing any command requested and any entered data. System shall include error monitoring software for user's input error.

5. Output Format: The system shall operate on a System Format basis, regardless of the manner or hardware configuration in which the data is acquired. A "system" shall consist of a logical grouping of data points, related to a piece of mechanical equipment, an energy distribution system, or an architectural area. For example, in some cases, it may be desired to display, as a single system, a space temperature with its associated air handling unit, and in other cases to display all space temperatures on a floor or in a building. The DDC shall allow such determinations to be made without regard to the physical hardware locations of a point or group of points. Likewise, the system shall accommodate future changes of system grouping and operations without field hardware changes.

a. All displays and logs shall contain a header line indicating date,

day-of-week, and time.

b. All output displays or logs of a point or group of points shall contain, as a minimum, the following information:

(1) Graphic presentation of the System
(2) User name of point
(3) Point descriptor
(4) Current value/status
(5) Associated engineering units
(6) Alarm description

c. User names, point descriptors, and engineering units shall be operator definable on a per point basis.

6. Setpoints:

a. The system shall utilize a contiguous band of colors each corresponding to actual zone temperatures relative to the desired heating and cooling setpoints. The ideal temperature shall be shown as a green color band. This color band corresponds to the dead band between the on-set of mechanical heating or cooling. Temperatures slightly warmer than ideal shall be shown in yellow, and even warmer temperature band shall be shown in orange.

b. Temperatures slightly cooler than ideal shall be light blue, and even cooler temperatures shall be shown as dark blue. All alarm colors shall be in red.

c. The system shall be capable of utilizing the mouse operator interface device to change individual zone temperature setpoints. The change shall be accomplished by pointing to a graphic temperature bar and by depressing a button, moving the mouse cursor to an increased or decreased temperature set-point within that zone. The system shall also be capable of utilizing the mouse interface device or a conventional keyboard to change a numeric temperature set-point value instead of utilizing the graphic temperature bar. The floor plan graphic shall then be able to change colors on a zone by zone basis to reflect the actual temperature in each zone relative to the changed desired heating or cooling set-point.

d. The system shall be capable of globally changing all setpoints. The global change capability shall be accessed via a "pop up menu" called by depressing a button on the mouse.

7. Graphic Structure:

a. The intent of the graphics is to ensure the operator is always aware of his position within the system as well as how to logically progress through the graphical hierarchy to select any desired graphic or other source of information. Software shall provide the operator with the capability of returning to any previous graphic by pointing to a graphic tab then pushing a single button on the mouse operator interface.

b. The system shall be programmed to provide a color graphic for:

(1) each piece of equipment monitored or controlled.
(2) each floor and zone controlled - both HVAC and lighting.
(3) each schedule
(4) each trend
(5) each report

8. User Access Restriction. Operator sign-on shall require an assignable password. Passwords shall have six levels of system access or user defined:

    a. Level 1 - Trainee: The level shall allow readout of data only. The system shall display all operation data base.
    b. Level 2 - Maintenance: This level shall allow performance of Level 1 functions plus the changing of all setpoints.
    c. Level 3 - System Programmer: This level shall allow performance of Level 3 functions plus the modifying the system configuration.
    d. Level 4 - System Manager: This level shall allow performance of Level 4 functions plus the changing of passwords.

9. Power Failure/Automatic Restart:

    a. Power failures shall cause the system to go into an orderly shutdown with no loss of program memory.
    b. Upon resumption of power, the system shall automatically restart and printout the time and date of the power failure and restoration at the Central Site.
    c. The restart program shall automatically restart affected field equipment. The operator shall be able to define an automatic power up time delay for each piece of equipment under control.

C. User Control Over System Configuration:

1. Database Creation and Modification. All changes shall be done utilizing standard procedures and be capable of being done while the system is on-line and operational. The system shall allow changes to be made through the portable operator terminal and form the central site. To aid the user, instructive prompting software shall be provided.
2. The system shall permit the operator, with proper password, to perform as a minimum the following:

    a. Add and delete points
    b. Modify point parameters
    c. Create and modify control sequences
    d. Reconfigure application programs
    e. Add and/or modify graphics

3. All data points within the database shall be completely accessible as independent or dependent variables for custom programming, calculation, interlocking, or manipulation.
4. Graphics Software:

    a. The graphics software shall permit the easy construction of infinitely variable shapes and sizes through the use of the mouse pointing device.
    b. A selection of 64 colors and various fill textures, line types and text styles shall all be accessible through the use of the mouse interface. The software shall resemble many of the computer aided design programs currently available and allow graphics to be easily moved, edited, added or deleted.

c. Graphics software shall be fully implemented and operational to accomplish the following:

(1) Create a new graphic picture
(2) Modify a portion of a graphic picture
(3) Delete a graphic picture, or any portion thereof
(4) Call up a graphic picture
(5) Cancel the display of a graphic picture
(6) Assign conditions which automatically initiate the display
(7) Overlay alphanumerics and graphics
(8) Save the graphic picture
(9) Display latest process data fully integrated with the graphic display

D. Facility Management Functions:

1. Logging:

a. The system shall be able to trend and display either numerically or graphically any analog or digital points in the system.
b. System shall be able to simultaneously graphically display any two trended points within a module function block or any point in the module versus the outside air temperature, enthalpy or relative humidity.
c. Each field module shall be capable of storing the most recent 60 samples for each single trend point or the most recent 30 samples for each of two trended points from one module function block.
d. Each module shall be capable of automatically uploading on a daily basis all accumulated trend data to the central site for permanent storage on hard disk.

2. Run Time:

a. The system shall provide run time information for all digital output and input points on command from the operator. Maximum run time limits shall be operator definable and shall be capable of automatically issuing a visual message when the run time maximum is exceeded. The operator shall be able to reset the run time accumulator.
b. Run time hours and start time date shall be retained in non-volatile module memory.
c. Each module shall be capable of automatically uploading all accumulated data to the central site for permanent storage on hard disk.

3. Alarm Conditions and Maintenance Messages:

a. The central site shall allow receipt of alarms and messages while in a functional mode other than energy management. i.e., Incoming alarms shall be displayed and generate an audible alarm while the operator is utilizing another mode such as word processing and allow the operator to automatically return to word processing after the alarm is received.
b. The system shall distinguish between alarms and messages with alarms having a higher priority.
c. The system shall be capable of calling up to three different remote locations to deliver an alarm or message through E-Mail, E-Page or alphanumeric page. The operator shall determine if alarms or messages are to be based on temperature limit, status or off-normal reporting.
d. The system shall be capable of printing maintenance messages when

run time accumulation maximum limits are exceeded.

e. The text for operator alarm and messages shall be operator definable. the system shall be capable of storing at least 100 messages each of any length. Generic messages used for multiple points throughout the system shall only count as one message. In the event the central site is powered down, the alarms shall be stored in the modules until the central site is restored.

f. The central site shall be capable of transferring all alarms to hard disk for storage.

4. Reports and Archiving:

a. The field modules shall be capable of calling the central site during off peak phone rate hours to automatically upload all current and accumulated data. This shall be delivered to the central site for printing and/or permanent storage on hard disk. The system shall further be capable of transferring hard disk information onto a floppy disk or magnetic tape for remote site storage.

b. The system shall be capable of reporting and archiving the following information as a minimum:

(1) Outside air temperature history and degree day history
(2) Electric demand and usage history
(3) All trended points
(4) All alarms and messages
(5) Equipment runtime information

c. The system shall also provide the following additional reports for which archiving is not applicable:

(1) All points summary
(2) Building operating schedules
(3) Printout of any graphic screen

d. The system shall be capable of providing all points summaries on a hierarchical basis. e.g., Only the points associated with a particular graphic shall be selectable and printed. For example, if the operator is viewing an air handling unit (AHU), he may request an all points summary at this level and receive only the points associated with the AHU. If the building is being viewed and an all points summary selected, all building points will be listed. Similarly, the system shall print building operating schedules pertinent to the graphic level being viewed. e.g., If a zone or tenant zone group is being viewed on the graphic display, then the system shall be capable of printing the building operating schedules for the zone or tenant zone group. If the entire building graphic is being viewed, the system shall be capable of printing schedules at the building level. All systems reports shall be capable to being viewed at the operators terminal and printed at the operator's discretion.

E. Direct Digital Control Software:

1. The system shall continuously perform DDC functions at the local DDC controller in a stand-alone mode. The operator shall be able to design and modify the control loops to meet the requirements of the system being operated. The operators shall use system provided displays for tuning of PID loops. These displays shall include the past three input variable values, the setpoint for the loop as well as the sample interval and the results of the proportional, integral and derivative effects of the final output.
2. Each Controller shall perform the following functions:

   a. Identify and report alarm conditions
   b. Execute DDC algorithms
   c. Execute all application programs indicated on the I/O Summary table
   d. Trend and store data

3. In the event of a Controller failure, all points under its control shall be commanded to the failure mode.
4. All DDC software shall reside in the respective DDC Controller.

F. Application Software: Application software shall be as required to produce the sequence of operation specified in Section 23 09 93 - Sequence of Operation.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and requirements. All necessary interconnections, services and adjustments required for a complete and operable system shall be provided by this contractor.

B. The contractor shall review all contract drawings and specifications, including addenda and referenced material and shall visit the job site, if applicable in order to become informed prior to bidding as to existing conditions and limitations of the project. The contractor shall bring exceptions and inconsistencies in drawings, specifications, addenda, referenced material, other contract documents and site conditions to the attention of the engineer.

C. The location of material, equipment and devices shown on the drawings are approximate and are subject to such revisions as may be necessary or desirable at the time that the work is being installed. The contractor shall install the work in relation to existing conditions. Should project conditions require rearrangement, or if equipment or accessories can be installed to better advantage in a different manner, prepare and submit five copies of shop drawings indicating the proposed rearrangement for the Engineer's review.

D. Control Wiring:

1. All wiring incidental to the building control system, including electrical interlocks shall be included in this section and provided as part of the building control system.
2. All control wiring shall be run in conduit where required by code or where the possibility of harm or permanent damage exist. In addition, all wiring installed below 8 feet or below suspended ceilings shall be installed in conduit.
3. Any wiring not installed in conduit shall be multi-conductor cable, with individual wires color codes for ease of installation and troubleshooting. All wiring installed above a plenum ceiling shall be Teflon coated and rated for plenum service.

4. All wiring shall be concealed wherever possible, and installed in a neat and workmanlike manner. All wiring and conduit shall be run parallel or perpendicular to the building structure. All cables shall be supported at frequent intervals and attached to supports by the use of nylon tie-wraps.
5. Control wiring shall conform to the requirements of Section 23 05 18 - Control Wiring.

E. System Start-up and Check-out:

1. The manufacturer shall provide a control technician for the start-up, check-out of all input and outputs, implement and check the software function and submit report on check-out of each system.
2. Demonstrate to the Owner that all functions are operating as per final approved sequences.
3. The manufacturer shall provide a control technician for the training of the Owner's operators.

F. System Acceptance & Trend Log Submittal:

1. After completion of the installation, check-out and control loop tuning, and trend logs shall be submitted, as listed below, to demonstrate the satisfactory performance of the system and to serve as a data base for the owner's future use.
2. The trend logs shall be organized in spread sheet format and presented in both tabular and graphical form. A disc or tape copy of each final accepted trend log set shall also be provided. Trend logs shall be as follows:
3. Control Stability Trend Logs:

    a. Each digital or analog output to valves, dampers, adjustable frequency drives and other control devices shall be included.
    b. Scan time shall be at five second intervals for a duration of ten minutes.
    c. Start of the sets shall be immediately after change from one mode to another, i.e., unoccupied to occupied, no economizer to economizer, off to on, etc. Only one log will be required for each output as long as it addresses all controlled elements.
    d. Where control of a piece of equipment is by factory furnished packaged controls, then the controlled temperature which is monitored shall be included. For instance, where a chiller is controlled by its own control system and control is from leaving chilled water temperature, then leaving chilled water temperature shall be included in the log set.

4. System Operation Trend Logs:

    a. Each measured value (temperature, pressure, amps, etc.), equipment status (on-off, percent speed or position, etc.), each mode (unoccupied, cool-down, occupied, etc.), each setpoint and each alarm shall be included.
    b. Scan time shall be at operation adjustable intervals with a duration of 24 hours.
    c. Sets shall be included for cooling only, cooling plus economizer and heating only. Where start up occurs at a defined season and both heating and cooling cannot be logged, then the system will be accepted subject to a final demonstration of the other season, when weather permits.

5. Load Profile Trend Log Sets:

   a. The total campus load in tons shall be calculated using flow and temperature difference between supply and return water.
   b. Chiller plant load shall be calculated using chiller flow and temperature difference between supply and return water.
   c. Compressor power input (KWH) shall be calculated based on measured KW or volts and amps and a look-up table provided by the compressor supplier. This shall be logged and converted to tons (KW x 3414 divided by 12,000) and compared to the compressor tons obtained by subtracting chiller tons from condenser tons.

   d. Tonnage shall be calculated by averaging six instantaneous readings per hour taken at ten minute intervals. Tonnage for each of the 24 hours shall be listed.

6. Custom Trend Log Sets:

   a. The operator shall have the ability to customize all trend logs by adjusting both sampling time and duration.
   b. After the initial graph data is accepted, the print-out shall be changed from a fixed interval to a change of value.

7. Trend Log Design: As a part of the initial submittal process, the proposed trend log format shall be submitted for approval.

3.2 SOFTWARE ENHANCEMENTS

A. Include an allowance for revisions to the software as required to provide a complete and workable system consistent with the intent of the specification. All control performance criteria are specified in the Sequence of Operations section of the specification.

B. After the system has operated properly for 90 days following start-up of the final component of the heating and air conditioning systems, an as-built copy of the software shall be transmitted to the owner for permanent record purposes. An allowance shall also be included for any software upgrading or enhancements to improve the system operation or as required for proper operation of the system during the first year of operation. Any changes to the software shall be immediately transmitted to the owner.

3.3 ALIBRATION AND TESTING

A. The Building Control Contractor shall calibrate all building controlled system equipment and verify operation before this system is placed on-line. All testing, calibrating, and adjusting shall be completed by the contractor prior to the start of the acceptance test; including all DDC control loops, interlocks, sequences, energy management programs, and alarms shall be tested and proper operation verified.

B. The Product Integrated Controls shall be factory installed, configured and tested for stand-alone operation. Specific configuration, such as setpoints and time schedules, shall be completed before the HVAC equipment on which it is installed and is placed in operation. All testing, calibrating and adjusting of individual HVAC equipment PIC controls shall be done as a part of that individual unit start-up and acceptance. Only the PIC's network communications function shall be included with the automation (BCS) acceptance test.

3.5 ACCEPTANCE TEST

A. After start-up and calibration, the building controls sub-contractor shall submit to the engineer trend logs of all points on each system demonstrating stable and proper operation. The demonstration shall cover the following conditions:

1. Heating Only (Boiler loop maintaining 190 degree F LWT and a 30 degree delta T)

B. The trend logs shall be as follows:

1. 24 hour period at 15 minute intervals.
2. 3 hour start-up period at 5 minute intervals.
3. A total of two sets covering two days during each period are required.

C. After submission of the logs for any one of the periods, the engineer will review them for acceptability, and if acceptable, schedule a final walk-thru of the system for final acceptance and start of hardware warranty.

D. During the hardware warranty period, the controls sub-contractor shall submit trend data covering the other two periods. Any adjustments or modifications to get acceptable results in each period shall be considered to be part of the warranty obligation.

3.6 SEQUENCE OF OPERATION

A. Refer to Section 23 09 93 - Sequence of Operation for HVAC Controls, drawings and schedules for actual system and equipment details.

END OF SECTION 23 09 00

SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Provide all labor, material, documentation and services required for the implementation of the Sequences of Operation detailed herein.

1.3 RELATED WORK

A. Section 23 09 00 – Instrumentation and Control for HVAC.

1.4 APPLICABLE PROVISION

A. Were modulation of a valve or damper is referred to then it shall mean the direct digital control of the valve or damper based on a control algorithm resident in the BCS software at the remote field panel. Unless noted otherwise the control algorithm shall be PID control. Optimum loop response shall be ensured by the use of a built in automatic loop tuner.

B. An Operator having the required level of password access shall be able to modify the Operator changeable or definable parameter(s) on-line from an I/O device such that the monitoring and control functions of the BCS shall not be affected during the period of the change. The mechanism by which the change is made shall be simple and shall be adequately described in the Operator's manuals. Where setpoints for control parameters such as setpoint or changeover temperatures, humidities, or times are referred to in this Section they shall be Operator changeable on-line.

C. Where the sequences refer to the start/stop of a system this shall be initiated either by an Operator manually entered command or automatically by a software routine such as "Optimum Stop/Start", "Power Demand Control", "Programmed Stop/Start", etc. or via an interlock in the sequences of operation to other equipment or event(s).

D. When the motor controller is equipped with a HOA the motors shall only be controlled by the BCS when the HOA switch is in the auto position.

E. Firestats, freezestats, smoke and fire detectors and interlocked dampers shall be wired to shutdown motors when the HOA switch is in both the hand and auto positions. It shall not be possible for the BCS to override these or any other safety devices or any fire alarm system control functions, except in the case of an engineered smoke control system in which case freeze protection safeties shall be overridden.

F. Refer to the Point Definition Sheets and System Schematics, which form part of these Contract Documents, to facilitate the interpretation of the sequences of operation as defined herein.

G. Provide additional I/O points, whether or not such points are indicated in the Point Definition Sheets, if they are required in order to attain the requirements of the Contract Documents.

H. Where fans and dampers are to be interlocked, provide hardwire interlocks between the motor terminal strip and damper such that the damper shall be driven open when the motor is required to start. Motor start-up shall not occur until the damper end switch indicates the damper is in the full open position.

I. Where fans and dampers are hardwire interlocked, the interlocks shall apply in both the "hand" and "auto" positions of the HOA switch at the motor controller.

J. Where electric heat coil control calls for the electric heating coil to be staged/cycled on and off to maintain the required temperature set point, the control algorithm shall incorporate a deadband, changeable by the Operator, which shall prevent the too frequent on/off cycling of the heating coil.

K. Where electric heating coils are controlled by the BCS, the BCS shall not override any safety interlocks.

L. Where there are fans not identified within the sequence of operation, point definition sheets or schematic drawings that provide supply and/or exhaust air that are not controlled via a thermostat, they shall be hardwire interlocked to the controlling device. The supply fans shall be hardwire interlocked with their associated exhaust fan (if applicable) to operate simultaneously. The dampers shall be hardwire interlocked with the fans via end switches such that the fans cannot operate when the damper is not fully open. The damper status shall not be monitored by the BCS. If the supply or exhaust fan serves a riser with multiple dampers, the end switches of the riser dampers shall be wired in parallel as a group then wired in series with the fan's associated damper end switch to prevent the fan from operating unless both the fan's damper is open and at least one of the riser dampers are open.

M. The point list is provided for convenience and is not intended to be all-inclusive. All points required to provide the Sequence of Operation shall be included as if listed.

N. All wiring required to provide the Sequence of Operation shall be included.

1.5 ABBREVIATIONS

AFD	Adjustable Frequency Drive
AUX	Starter Auxiliary Contact
AI	Analog Input
AO	Analog Output
CFM	Air Flow in CFM from Air Monitor
CSR	Current Sensing Relay
D	Damper Operation
DI	Digital Input
DO	Digital Output
DP	Differential Pressure
ES	End Switch
Fa	Failure Alarm
FR	Freezestat
FS	Flow Switch
H	Humidity Sensor
Ha	High Static Pressure Alarm
IAQ	Indoor Air Quality
IGV	Inlet Guide Vanes
La	Low Static Pressure Alarm
Ma	Maintenance Alarm
Pd	Discharge Static Pressure

Pdd	Downduct Static Pressure
Pds	Discharge Static Pressure Safety
Ps	Suction Static Pressure
Pss	Suction Static Pressure Safety
R	Relay
Sa	Safety Alarm/Shut-down
SD	Smoke Detector
DP	Static Pressure Sensor
SR	Damper Smoke Rated
SS	Start-Stop
T	Temperature Sensor
Ta	Temperature Alarm
V	Valve Operator
VP	Virtual Point
X	Hardwired Item

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION – HEATING PLANT

A. Heating Water Boilers:

1. Operation of the boilers and their associated heating water pumps shall be controlled by a signal from the Building Control System (BCS). The boiler and pump combinations shall be scheduled to run continuously. Each boiler has a dedicated primary pump.
2. OFF Operation: If the BCS indexes the heating plant for “OFF” operation, the boiler and its associated pump shall be de-energized.
3. ON Operation: If the BCS indexes the heating plant for “ON” operation, the heating water pump shall be started. After heating water flow has been established, as proven by a flow switch, each boiler’s internal factory supplied controls shall operate the burner to maintain a discharge water temperature of 190°F (adjustable).
4. All operations shall be controlled by the boiler manufacturer’s controls, the BCS shall monitor the system only beyond the “ON” & “OFF” commands.
5. Control Description (points are for each boiler and each boiler system V, J & G):

Point	Type	Description	Alarm	Comments
1.	AI	Heating Water Return Temp (T)	(H) (L)	
2.	AI	Heating Water Supply Temp (T)		
3.	DI	Boiler Status (DP)	(F)	
4.	DO	Boiler Start/Stop (S/S)		
5.	DI	Heating Water Pump Status (DP)	(F)	
6.	DO	Heating Water Pump Start/Stop (S/S)		
7.	AO	Heating Water Setpoint Adjustment		

Note: Controls Contractor shall coordinate with boiler specification attached for reference only to make all boiler points specified visible.

END OF SECTION 23 09 93

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Heating Water (HWS/HWR) Piping.

B. Equipment Drain (D) Piping.

C. Natural Gas (G) Piping

1.3 DEFINITIONS

A. The pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products, and shall be of the manufacturer's most recent design that is in regular production.

B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:

1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
2. Refrigeration Piping - ASME/ANSI B31.5
3. All other metallic piping - ASME/ANSI B31.1

C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.

D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

E. Contractor qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the fuel gas piping and assemblies on similar projects for a minimum of five (5) years. Installers shall be state-certified or licensed Sub-Contractors, or locally registered Sub-Contractors in Seminole County, Florida.

F. Source Limitations: Unless specifically noted otherwise, provide products of the same manufacturer for each type of unit specified.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The work of this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.

1. American National Standards Institute (ANSI) Standards
2. American Petroleum Institute (API) Specification
3. American Society of Mechanical Engineers (ASME) Publications
4. American Society for Testing and Materials (ASTM) Publications
5. American Welding Society (AWS) Publication
6. American Water Works Association (AWWA) Standards
7. Cast Iron Soil Pipe Institute (CISPI) Standards
8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual

1.6 SUBMITTALS

A. General Requirements: All submittals shall be made in accordance with Section 23 05 00 requirements.

B. Materials List: Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipe fittings, valves and joints. Include the basic designation of the publication applicable for each type of material and method.

C. Welding Qualifications: Submit current welder qualifications for all welders proposed for this project. Welding certificates shall be for the company performing the welding at this project as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

D. Welding Inspection Reports: Submit certified welding inspection reports as directed in paragraph 3.2 - WELDING, BRAZING, AND SOLDERING.

E. Refrigeration Piping Requirements: Submit a letter from the refrigeration equipment manufacturer stating that the refrigeration piping system, as shown on the contract documents, is acceptable for the equipment the manufacturer proposes to furnish, or submit drawings prepared by an authorized representative of the refrigeration equipment manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Heating Water (HWS/HWR) Piping
System Design Pressure: 150 psig.

1. Piping, 1/2" thru 2": Contractor's option:

a. Type L Hard-drawn Copper Tubing: ASTM B88.
b. Schedule 40 carbon steel, seamless; ASTM A-106, Grade B, Type S.

2. Piping, 2-1/2" thru 10": Schedule 40 carbon steel, seamless or electric resistance welded, ASTM A-53, Grade B, Type S or ERW.
3. Piping, 12" through 24": Standard Wt., carbon steel, electric resistance welded, ASTM A-53, Grade B, Type ERW.

4. Piping, 30" and larger: Standard Wt., carbon steel, double submerged arc welded, API - 5L, Grade B, Type DSAW.
5. Pipe Fittings: 1/2" thru 2": Contractor's option:

    a. Wrought Copper, ANSI B16.22.
    b. 150lb. malleable iron threaded; ASTM A-197.
    c. Mechanically formed tee fitting, as created by T-Drill, is an acceptable method of installation.

6. Pipe fittings 2-1/2" and larger: Schedule to match mating pipe, carbon steel, butt weld type, ASTM A-234. Weld-o-lets and thread-o-lets will be limited to 2 pipe sizes smaller than the pipe to which they are connected.
7. Brazing: Contractors Option:

    a. 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BcuP-3. J.W. Harris Stay-Silv® 5 or equal.
    b. 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BcuP-5. J.W. Harris Stay-Silv® 15 or equal.
    c. 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BcuP-5. J.W. Harris Dynaflow® 5 or equal.

8. Unions: 1/2" thru 2": Contractor's option:
    a. Wrought Copper, Pressure Class 150, w/solder ends.
    b. Malleable Iron, Pressure Class 150, w/ threaded ends, ANSI B 13.39.
    c. Note: Dielectric unions shall be used to connect copper to steel pipe, and shall have metal connections on each end threaded to match the adjacent piping. Metal components shall be separated by a nylon insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the system operating pressures and temperatures.

9. Flanges: 150 lb. rated forged carbon steel; weld neck type, with raised face, bored to match the mating pipe I.D.; ASTM A-181, Grade 2, or ASTM A-105, Grade 2.
10. Bolting studs: ASTM A-193, Grade B7. Nuts shall be heavy duty hex type; ASTM A-194, Grade 2H.
11. Gaskets: Full faced style, 1/8" thick. Gasket material shall be Nitrile (NBR) sheet, ASTM F104, Line Call Out F712100A9B4E22K5M6; Based on Garlock Blue-Gard® Style 3000 or acceptable equivalent.
12. Mechanical joints employing grooved-end pipe may be used on this piping system. See Paragraph 2.2 "Mechanical Joint Systems", this section, for specifications.

B. Equipment Drain (D) Piping.
System Design Pressure: 10 psig.

1. Piping, 1/4" thru 1: Type L Hard-drawn Copper Tubing: ASTM B88.
2. Piping, 1" thru 2": Schedule 40 carbon steel, seamless, galvanized; ASTM A-106, Grade B, Type S.
3. Piping, 2-1/2" thru 10": Schedule 40 carbon steel, seamless or electric resistance welded, galvanized; ASTM A-53, Grade B, Type S or ERW.
4. Pipe Fittings, 1/4" thru 1": Wrought Copper, ANSI B16.22.
5. Pipe Fittings, 1-1/2" and larger: 125 lb. rated galvanized malleable iron, threaded type; ASTM A-197.
6. Solder: Lead-free, per code.
7. Unions: 1/4" thru 1": Wrought Copper, Pressure Class 150, w/solder ends.

8. Unions: 1" thru 2": Malleable Iron, Pressure Class 150, w/ threaded ends, ANSI B 16.39.

   Note: Dielectric unions shall be used to connect copper to steel pipe, and shall have metal connections on each end threaded to match the adjacent piping. Metal components shall be separated by a nylon insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the system operating pressures and temperatures.

9. Flanges: 150 lb. forged carbon steel, threaded type, with raised face, bored to match the mating pipe I.D.; ANSI B16.3.
10. Bolting studs: ASTM A-193, Grade B7. Nuts shall be heavy duty hex type; ASTM A-194, Grade 2H.
11. Gaskets: Full faced style, 1/8" thick. Gasket material shall be Nitrile (NBR) sheet, ASTM F104, Line Call Out F712100A9B4E22K5M6; Based on Garlock Blue-Gard® Style 3300 or acceptable equivalent.
12. Mechanical joints, grooved-end type, may be used on 2-1/2" IPS and larger. See paragraph 2.2 "Mechanical Joint Systems", this section, for specifications.
13. All above ground condenser water piping shall be cleaned, primed and painted black, within two weeks of installation. The piping shall have a final epoxy or Tnemic coating, contractor to verify that the final coating will adhere to the paint selected for this process

C. Natural Gas (G) Piping:
System Design Pressure: 20 psig.

1. Piping: Schedule 40 carbon steel, seamless; ASTM A-53, Grade A or B.
2. Piping: Copper type K or L only. Pipe conforming to ASME B16.18 and B16.22.
3. Direct buried pipe shall be coated with an extrusion applied, fusion bonded epoxy-coated jacket, 0.040” minimum thickness. Equal to 3M-Skotchkote™.
4. Pipe Fittings 2" and smaller: 150 lb. rated malleable iron, threaded, type, ASTM A-197.
6. Pipe fittings 2-1/2" and larger: Schedule 40 carbon steel, butt weld type, ASTM A-234-WPB.
7. Flanges in gas piping runs shall be 150 lb rated forged carbon steel, weld-neck type, with raised face, bored to match the mating pipe I.D.; ASTM A-181 Grade 2, or ASTM A-105, Grade 2. Flanges shall have the manufacturer's trademark affixed in accordance with MSS SP-25.
8. Flanges for connection to flat-faced flanges, or to flat equipment surfaces, shall be flat-faced cast iron, 125 lb rated, ANSI B16.5. Flanges shall have the manufacturer's trademark affixed in accordance with MSS SP-25.
9. Bolting studs for raised-face flanges shall be ASTM A-193, Grade B7. Nuts shall be heavy duty hex type; ASTM A-194, Grade 2H.
10. Bolts for flat-faced flanges shall be square-headed, carbon steel, ASTM A-307, Grade B. Nuts shall be heavy-duty hex type full nuts; ASTM A-194, Grade 2.
11. Gaskets for raised-face flange joints: Full faced style, 1/8" thick. Gasket material shall be Nitrile (NBR) sheet, ASTM F104 Line Call Out F712100A9B4E22K5M6; Based on Garlock Blue-Gard® Style 3300 or acceptable equivalent.
12. Gaskets for flat-faced flange joints: Full faced style, 1/8" thick. Gasket material shall be Nitrile (NBR) sheet, ASTM F104, Line Call Out F712100A9B4E22K5M6; Based on Garlock Blue-Gard® Style 3300 or acceptable equivalent.
13. Vent cap to be a mushroom type to match piping and fittings and shall be complete with insect screen.

2.2 MECHANICAL JOINT SYSTEMS

A. General:

1. All couplings, fittings, and gaskets shall be the products of a single manufacturer.
2. Valve ends shall be compatible with the couplings used on the connecting piping.
3. All exposed piping shall be cleaned, removing all rust, primed and painted black. At substantial completion all exposed piping shall be free of rust and in a “like new condition”.

B. Pipe Wall Thickness (Schedule Number):

1. Where rolled groove joints are used, the pipe wall thickness may, in some cases, be decreased below that specified for the particular fluid system. In all cases, the minimum pipe wall thickness shall be in accordance with ANSI/ASME B31.9, Chapter II, using 150% of the system operating pressure as the design pressure.
2. Pipe having cut (machined) grooves shall have a nominal wall thickness of not less than the wall thickness specified for Schedule 40 pipe of the particular pipe size.
3. Non-metallic pipe shall not be joined with grooved-end pipe mechanical joints.

C. Couplings:

1. Mechanical joint couplings shall be of the external type, for use with cut or rolled-groove end pipes, fittings, and valves.
2. Couplings shall be self-centering, and shall engage and lock-in-place the grooved-end pipes, fittings, and gaskets.
3. All couplings shall be of the rigid style. Flexible couplings shall not be used without the written approval of the Engineer.
4. Couplings shall be Ductile Iron, ASTM A536; or malleable iron, ASTM A47, and shall be designed for not less than 250 psig at 230 Deg. F.
5. The coupling assembly shall be held together by two or more track-head, oval-neck steel bolts, ASTM A183.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted

without the approval of the Owner's Representative.

6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipe lines shall be grouped in the same horizontal or vertical plane.
11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped or hung with shock absorbing hangers and equipped with air chambers, mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
15. Avoid bushings. Reducing fittings shall be used wherever practical.
16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes

and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.

18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1, and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
23. Connections between plastic and metallic pipe shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Hydronic HVAC Systems Additional Requirements:

1. Provide a 3/4 inch drain valve and a capped hose nipple at each low point in each system, and where indicated.
2. Provide, at each high point in each system, and where indicated, an automatic air vent with drain line routed to the local floor drain.
3. Mechanically formed tee shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a tee having a height of not less than three times the thickness of the branch tube wall s as to comply with the American Welding Society lap joint weld. The device shall be fully adjustable as to insure proper tolerance and complete uniformity of the joint. The branch tube shall be notched to conform with the inner curve of the run tube and have two dimple/depth stops pressed into the branch tube (one ¼" atop the other). This is to insure penetration of the branch tube into the tee is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube. Dimple/depth stops shall be in line with the run of the tube. The second dimple shall be ¼" above the first and shall serve as a visual point of inspection. All mechanical formed tee fittings shall be brazed in accordance with the Copper Development Associations Copper Tube Handbook using BCuP series filler metal. *NOTE:* Soft soldered joints will not be permitted. Contractor assumes responsibility for joints being installed in accordance with code and manufacturers' recommendations.
4. On liquid systems, make branch connections to top of mains for up-feed arrangement, and to bottom of mains for down-feed arrangement, except where main and branch line are of equal size the branch connection may be made to the side of the main for both up-feed and down-feed applications.
5. On gas systems, make branch connections to top of mains for both up-feed and down-feed arrangement.
6. Provide water seal in the condensate drain from each air handling or air conditioning unit. The depth of each seal shall be equal to the total static pressure rating of the unit to which the seal is connected. Water seals shall be constructed of two tees and an appropriate U bend with the open end of each tee

plugged.

7. Slope piping 1 inch per 40 ft, in the direction of flow.

C. Gas Systems Additional Requirements:

1. Installation shall be in accordance with NFPA No. 54 and ANSI Z 223.1 unless specified otherwise herein.
2. Provide a capped 6" dirt leg at the base of main risers.
3. Valves in natural gas service shall be lubricated plug cocks.
4. Horizontal pipe shall slope upward, in the direction of flow, at not less than 1/4 inch in 15 feet.
5. Where piping is concealed, all plugged or capped openings shall be exposed and accessible. Bushings and unions shall not be used in concealed work.
6. Branch connections shall be made on the side or top of the main for both up-feed and down-feed applications.
7. Piping shall not be installed below concrete slab-on-grade floors.
8. Vent gas pressure regulator and safety shut-off reverse vent valve relief lines to outside the building individually. Relief lines from pressure switches may be combined in another line, or run separate, for venting to the outside.
9. After testing is completed, and before connecting any appliances, all piping shall be fully purged. Piping shall not be purged into the combustion chamber of an appliance. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA No. 54, or ANSI Z 223.1 are followed.
10. After the piping has been placed in operation, all equipment shall be purged and then placed in operation, as necessary.

D. Mechanical Joint System Additional Requirements:

1. Install in strict accordance with the manufacturers written installation instructions.
2. Coordinate with Section 23 07 00 - HVAC Insulation to ensure full thickness insulation at mechanical joints.

3.2 WELDING, BRAZING, AND SOLDERING

A. Operator and Procedure Qualifications: All welding and/or brazing operators and all welding and brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

B. Welding:

1. All pipe welding performed under this division of the specifications shall be examined in accordance with ANSI B31.1 requirements for each piping system. The pipe weld examination is hereby made a part of the work of this division of the specifications. An independent outside inspection firm, regularly performing this type of examination, shall be hired by the contractor or subcontractor performing the welding as part of the work of their contract. The examination shall be performed by a representative of the Inspection Company (hereafter called the Inspector) who is qualified and certified for each examination method required.
2. The Inspection Company performing the examination shall certify in writing that all pipe welds performed under this contract conform to the requirements of ANSI B31.1 for each piping system and to all other governing codes.
3. Before final acceptance of the welded piping, certified test reports shall be submitted for review. The reports shall include the following data: name and location of project, date of test, type of piping system, working pressure and

temperature, standard used for testing and applicable test method, number and location of welds tested and names of persons performing test.

4. Welders and procedures for fire protection system piping qualified in accordance with NFPA No. 13.

C. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".

D. Soldering: Joints in copper tubing shall be made with solder- type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self- cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. All joints to be wiped clean after soldering. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxy-acetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

E. Piping Identification: All piping shall be marked in accordance with the provisions of Section 23 02 00 - BASIC MATERIALS AND METHODS FOR HVAC SYSTEMS.

3.3 TESTING OF PIPING SYSTEMS:

A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:

1. HVAC related systems shall be tested with water at 1-1/2 times the system working pressure, but not less than 100 psig. Joints will be visually examined for leaks.

a. Initial Hydrostatic Test: Before insulation is applied to field connections, hydrostatically pressure test each pipe as a complete unity with fresh water to 150 psig or not less than 1.5 times systems pressure rating, whichever is greater. Pressure testing with air will not be permitted, unless approved prior to testing. Limit pressure rise to 100 psi per minute at beginning of test and pressure drop to 100 psi at conclusion of test. Remove air from system before start of tests. Pressure must hold for a minimum of four (4) hours with a 4-psi maximum drop. Examine system for leaks and porosity. Replace porous sections and repair leaks in accordance with pipe manufacturer’s instructions, repeat tests until system is proven tight. During a 4-hour pressure holding period, valve off system and completely disconnect method of system pressurization.

b. Cycle Test: Pressure cycle test system at 150 psig or 1.5 times system pressure rating, whichever is greater, for 10 cycles. Each cycle shall consist of a one-minute period at 150 psig or 1.5 times system pressure rating and a 4-minute period when the pressure is dropped at least 40%. Examine system for leaks and porosity, repair leaks, replace porous pipe, and repeat test until system is proven tight.

c. Post Cycle Hydrostatic Test: Repeat initial hydrostatic test.

d. Operational Test: Operate complete system with water flowing through system. During 48 hours, cycle system 8 hours on and 8 hours off for 3 complete cycles. Examine system for leaks until system is proven tight.

e. Second Hydrostatic Test Series: After successful completion of operational testing, repeat first hydrostatic test series sequence. Examine pipe system for leaks and porosity. Repair leaks, replace porous pipe, and repeat test until system is proven tight. After successful completion of the second hydrostatic test series, backfill trenches.

f. Final Hydrostatic Test: After completion of the final phase of construction, repeat the initial hydrostatic test on the entire piping system(s).

2. Gas Piping Systems shall be tested with air at not less than 25 PSIG for a period of not less than 15 minutes without showing any drop in pressure.

3. Gas Distribution Systems utilizing Copper Viega Pro-*Press* fittings with SC Feature Contour Design shall be initially tested at a minimum of ½ psig but not more than 50 psig. Joints shall be visually examined for leaks.

4. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.

B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.

C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed and approval is granted.

D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.

E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems, and blow out piping with compressed air to remove trapped water.

F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.

G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.

H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.

I. During tests, isolate system components that have test pressures less than pressures specified for system tests.

J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

3.4 CLEANING OF PIPING SYSTEMS

A. HVAC Piping systems shall be thoroughly cleaned as described in Section 23 25 00 – HVAC Water Treatment.

END OF SECTION 23 21 13

SECTION 23 23 01 - HVAC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Vertical Inline Pump

1.3 QUALITY ASSURANCE

A. Maximum suction velocity shall be less than 10 FPS. Pump discharge velocity shall be less than to 14 FPS

B. Pump selections shall be no more than 5% less than the scheduled pump efficiency.

C. Maximum impeller diameter shall not exceed 85% of the cutwater diameter.

D. Pump motors shall be NEMA Premium™ Efficiency. Motors for pumps with variable speed drive must have Class F insulation.

E. Pumps shall be factory tested, thoroughly cleaned and painted. Discharge and suction shall be factory covered to protect the volute/impeller from dirt and damage during shipment and storage.

F. Pumps shall be constructed with materials and standards which have been tested or proven and have published test data available if requested, stating that these materials and standards have been found acceptable for use in pump manufacturing by one or more of the following:

1. American Society for Testing and Materials (ASTM)
2. International Organization for Standardization (ISO)
3. American National Standards Institute (ANSI)
4. National Electrical Manufacturers Association (NEMA)

G. Provide full two year on-site parts and labor warranty including travel time and expense. Warranty period shall begin at date of substantial completion.

1.4 SUBMITTALS

A. Submit dimensioned performance and product data for acceptance.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Refer to Section 23 05 00 for submittal requirements.

1. Submit pump curves with pump operating point plotted, brake horsepower and pump efficiency indicated on curve.

2. Where two or more pumps are operating in parallel, submit combined pump curve with all pump operating points plotted, system curve indicated and brake horsepower and pump efficiency indicated on curve.
3. Where pumps are used in open type systems (i.e. condenser water) submit net positive suction head curve (NPSH) with the system requirements plotted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Vertical Inline Pump:

1. Armstrong Pump Company
2. Bell & Gossett
3. Taco

2.2 EQUIPMENT

A. Vertical Inline Pump:

1. T Type: Centrifugal, single stage, split coupled with rigid spacer type coupling, suitable for vertical operation.
2. Casing: Cast iron, rated for 175 psi suction and discharge gauge port, air vent, wear rings, seal flush connection, drain plug, flanged suction and discharge.
3. Impeller: Bronze, fully enclosed, keyed to shaft and secured with locknut, hydraulically and dynamically balanced.
4. Shaft: Stainless steel.
5. Seals: Stainless steel outside multi-spring balanced type with Viton secondary seal. Bronze gland plate with stainless steel hardware. Factory installed flush line with manual vent.
6. Bearings: Vertical solid shaft ball bearings with a minimum design bearing life of 15,000 hours (based on AFBMA bid rating).
7. Drive: Direct, close coupled.
8. Motor: Outdoor applications shall have a TEFC (Totally Enclosed Fan Cooled) motor and indoor locations shall have an open drip-proof motor; voltage and horsepower as scheduled.
9. Range: 40°F to 230°F.
10. Based on Bell & Gossett Series 80.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturers written instructions.

3.2 INSTALLATION

A. Vertical Inline Pumps:

1. Support pipe as close to pump as valve assemblies will allow, do not support pump from motor lift rings.
2. Provide adequate access and service area.

END OF SECTION 23 23 01

SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. Feeding and control equipment with all piping and wiring for each system.

B. Pre-Operation Cleaning of each System.

C. Initial water analysis and recommendations.

D. Water treatment chemicals for each system.

E. Test equipment.

F. Training of operating personnel including written instructions, log sheet and record forms.

G. Follow-up service for one (1) full year from date of start-up including laboratory assistance.

1.3 SYSTEMS TO BE TREATED

A. Heating Hot Water (HWS/HWR).

1.4 QUALITY ASSURANCE

A. All electrical components shall be UL or ETL listed or labeled.

B. All wiring shall conform to the NEC.

C. The pre-cleaning and chemical charging shall be by or supervised by personnel trained in the field of water treatment. Chemicals shall be charged into the system within 24 hours of flushing and before circulation.

D. All chemicals shall be compatible with system materials of construction and shall comply with all applicable EPA and regulatory agency standards.

E. After charging of the system and for a period of 1 year after the date of start up the water treatment supplier shall periodically inspect the system and perform all necessary tests (minimum of 4) to properly evaluate the chemical concentration.

F. After completion of the system the water treatment supplier shall train the owner in the proper maintenance procedures and future system requirements.

G. After completion of the system water treatment, the contractor shall provide a water analysis and certify in writing to the Owners Representative that the system or systems have been properly flushed, cleaned and charged with the proper chemical concentration

and that the Owner has been instructed in proper maintenance procedures.

H. Corrosion coupon analysis by manufacturer's laboratory with test report at the end of the first year of operation.

I. The manufacturers or their subsidiaries referenced herein are those that the specifications and drawings are based on. Equipment by other manufacturers will not be considered, no substitutions.

1.5 SUBMITTALS

A. Submit schedule indicating make, model and size by system.

B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

C. Submit in accordance with Section 23 05 00 requirements.

D. Submit letter of certification as described in 1.4.G.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Chem Aqua.

B. Mitco

C. Nalco

2.2 PIPING SYSTEMS AND WATER TREATMENT SYSTEMS

A. Heating Hot Water (HWS/HWR) : Closed Loop

2.3 WATER TREATMENT REQUIREMENTS

A. Closed Loop:

1. General: Manual feeding of chemicals into filter style shot feeder and in turn into system in accordance with initial water evaluation and continuing test result requirements.
2. Feeding and Control Equipment:

a. Five gallon combination filter-feeders, quantity as shown on drawings. Equal to Efficiency Dynamics, Ft. Worth, TX 76101, FF- 100, including steel shell with stainless steel basket, filter bag capable of 40 gpm flow with filter efficiency of 5 microns at 3 psi pressure drop and hand removable cap. Suitable for 150 psi and temperatures to 200°F.
b. Twelve (12) filter bags.
c. Corrosion coupon assembly including corrosion probe connection fittings, one carbon steel and one copper corrosion coupon with holders and two (2) corrosion coupon tees.
d. Totalizing make-up water meter equal to Master Meter Multi-Jet for installation in make-up water line.
e. Installation accessories including piping, fittings, shut off valves, drain valves, pressure gauges to measure pressure loss thru filter and

automatic flow control valve set for 8 GPM as specified in Section 23 05 19 Piping Specialties.

3. Water Treatment Chemicals:

a. All chemicals necessary for flushing and pre- cleaning.
b. All chemicals, in liquid form, necessary to control scale, corrosion, microbiological growth and water PH. Quantity to last one (1) full year from date of start up.

2.4 TEST EQUIPMENT

A. Test equipment to properly evaluate the chemical levels within the system. The test equipment shall include but not be limited to: Carrying case or cabinet, all necessary reagents for determination of corrosion inhibitor level pH, P & M, alkalinity and chlorides as well as microbiological colony population and biocide effectiveness.

PART 3 - EXECUTION

3.1 GENERAL

A. Each piping system is to be provided with the specified hardware. Where multiple evaporative condensers or closed circuit fluid coolers are specified, each is to be provided with its own chemical feed equipment.

B. All products shall be installed or services performed in strict accordance with the manufactures written installation/procedure instructions.

C. All piping systems and related equipment shall be thoroughly flushed with pre-cleaning detergent and dispersant designed to remove deposition from construction, such as pipe dope, oils, most loose mill scale, and other extraneous materials. The products used shall inhibit corrosion of the various metals in the system and shall be safe to handle and use. Effectiveness of the product shall be such that the water need only be at ambient temperatures. Add recommended dosages of chemicals and circulate for 48 hours. System shall then be drained from the lowest point in the system with make-up water fed to the system. During the draining process, the circulating pumps shall be in continuous operation to prevent settling, and circulation and draining shall continue until the total alkalinity and pH of the water is equal to the makeup water. Contractor is cautioned to be sure temperature and pressure in system during flushing does not cause rupture disc on chiller or relief valves etc. to blow.

C. Install chemicals required for treatment of each system within 24 hours of completion of cleaning prior to start-up and operation of the system. Contractor shall measure water quantity required to fill system and provide this information to water treatment equipment supplier and tabulate this data in the operation and maintenance manuals.

D. After cleaning and filling the mechanical system, operate the system for a period of not less than 120 hours continuously during which time water treatment samples shall be taken at 4 hour intervals and the results plotted on a graph. Testing and sampling shall continue until the graph indicates the water treatment is maintaining the specified levels of 800 PPM to 1200 PPM of Nitrites and a maximum of 1 PPM of total iron levels of chemical within plus or minus 10% under all conditions of load.

E. After the system is flushed, pre-cleaned and chemically stabilized the Contractor shall:

1. Turn the test kits over to the owner.
2. Instruct the owner in proper maintenance procedures.
3. Fulfill all obligations for the specified period of 1 full year from the date of start up including four (4) service calls during the cooling season and two (2) service calls during the heating season.

F. Where the owner provides the chemicals for treatment, notify the owner well in advance of the cleaning process and when completed advise in writing that it is recommended that the chemicals be charged immediately to prevent damage to the system.

END OF SECTION 23 25 00

SECTION 23 51 00 - BREECHINGS, CHIMNEYS AND STACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Section 23 05 00 for requirements pertaining to Common Work Results for HVAC Systems.

1.2 WORK INCLUDED

A. The Contractor shall provide the flue gas breeching and stack in accordance with the specifications and as shown on the contract drawings, plus any modifications required by the Hot Water Generator Manufacturer.

B. The Contractor shall provide any required modifications to the building roof and roof support resulting from the stack penetration of the roof.

C. Condensing appliance vent listed to UL1738 shall have a limited lifetime warranty to begin at the date of installation. Any portion of the vent repaired or replaced under warranty shall be warranted for the remainder of the original warranty period.

1.3 SUBMITTALS

A. PRELIMINARY REVIEW

1. The Contractor shall submit shop drawings, manufacturer's catalog information, and other data as required, for the following items to the selected Hot Water Generator Manufacturer for review and comment.

    a. Breeching
    b. Access Doors
    c. Stacks
    d. Stack and Breeching Ports

2. The Hot Water Generator Manufacturer shall review the above submittals, and suggest size and configuration changes as deemed necessary, to provide a stack and breeching arrangement which will be suitable for use with the selected hot water generator.
3. The Hot Water Generator Manufacturer shall provide the Contractor with a Letter of Certification attesting the suitability of the proposed stack and breeching arrangement for use with the selected hot water generator.

B. FINAL SUBMITTAL

1. The Contractor shall submit shop drawings, manufacturer's catalog information, the Hot Water Generator Manufacturer's Letter of Certification, and other data as required, for the following items in accordance with Division 23 requirements.

    a. Breeching
    b. Access Doors
    c. Stacks
    d. Stack and Breeching Ports.

PART 2 - PRODUCTS

2.1 BREECHING

A. Breeching shall be fabricated from steel plate 3/16 inch thick braced with 2 inch by 2 inch by 3/16 inch structural steel angles. Provide structural steel angles on the outside to prevent buckling. Interior corners shall have continuous steel angles welded to the plates. Angles shall also be welded to the plates around the exterior of the breeching for stiffening and to prevent buckling. Stiffener and flange angles shall be welded to the plate and welded to each other.

B. Breeching section shall have 2 inch by 2 inch by 3/16 inch steel flanges drilled for bolted and gasketed connection to the outlet of the boiler.

C. Provide bolts and ceramic fiber gaskets for joining breeching sections. Bolt spacing shall not exceed 4 inches center to center. Gaskets shall be minimum 1 1/2 inches wide by 1/8 inch thick.

D. Insulation Clips: Provide insulation studs on the breeching to be insulated as specified on the drawings.

2.2 ACCESS DOORS

A. Provide steel fabricated access doors at points where indicated. The doors shall be fabricated as detailed on the contract drawings. The door shall be gasketed with ceramic fiber gaskets 1 1/2 inches wide by 1/8 inch thick.

2.3 STACK

A. Stack shall be fabricated from 3/16 inch steel plate as detailed on the contact drawings. All seams shall be welded gas tight. Provide 2 inch by 2 inch by 1/4 inch angle flange around top of stack. Bottom of stack shall be welded to breeching.

B. Stack shall be guided at roof as detailed on the contract drawings.

C. Provide rain cap as detailed on the contract drawings.

2.4 STACK AND BREECHING PORTS

A. Provide pipe nipples or other openings in breeching and stack as required for instrumentation, draft sensing connections, and smoke density measuring equipment. Provide 4 inch flanged test ports at the location shown on the drawings for use with portable test instrumentation.

2.5 DOUBLE WALL METAL VENTS:

A. Category 4 Gas Vents (AL-29-4C):
   1. Available Manufacturers: Subject to compliance with requirements, provide Category 4 double wall gas vents of one of the following:

      a. AmeriVent (American Metal Products)
      b. AMPCO.
      c. General Products Co., Inc.
      d. Hart & Cooley

e. Metal-Fab, Inc.
f. Selkirk

2. Description: Double wall gas vents, UL listed for Category 4, consisting of an inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, with the following minimum thicknesses.

Size	Inner Pipe	Outer Pipe
Round, up to 6"	0.012"	28 gage
Round, 7" to 18"	0.014"	28 gage
Round, 20" to 24"	0.018"	26 gage
Oval, up to 4"	0.012"	28 gage
Oval, 5" to 6"	0.014"	28 gage

B. Accessories: UL-labeled tees, elbows, increasers, draft hood connectors, metal cap with bird barrier, adjustable roof flashing, storm collar, support assembly, thimbles, fire stop spacers, and fasteners, fabricated of similar materials and designs as vent pipe straight sections.

2.6 ALL STEEL, POSITIVE PRESSURE, DOUBLE WALL VENTS:

A. Manufacturers: Subject to compliance with requirements, provide all steel, positive pressure double wall vents of one of the following:

1. AMPCO
2. CIX Secure Stack
3. Metal-Fab, Inc.
4. Selkirk.
5. Schebler
6. Stacks, Inc., Div of Air Management, Inc.
7. Van Packer.

B. Description: UL-labeled double wall metal stacks for use with building heating equipment burning gas, solid, or liquid fuels as described in NFPA 211.

C. Construction: 1" minimum air space between walls; inner jacket of Type (316 or 304) stainless steel, 0.035" thick; outer jacket of aluminum coated steel of the following thickness:

1. Size 10" to 24": 0.025" thick
2. Size 28" to 48": 0.034" thick.

D. Accessories: UL-labeled tees, elbows, increases, draft hood connectors, metal cap with bird barrier, adjustable roof flashing, storm collar, support assembly, thimbles, fire stop spacers, and fasteners fabricated of similar materials and designs as vent pipe straight sections.

PART 3 – EXECUTION

3.1 INSTALLATION OF DOUBLE WALL CONNECTORS, BREECHINGS, AND VENTS:

A. Atmospheric burner appliances:

1. Install Category 4 gas vents in accordance with manufacturer's installation instructions and UL listing. Maintain minimum clearances from combustibles specified in UL listing.
2. Support vents at intervals recommended by the manufacturer to support the weight of the vent and all accessories, without exceeding loading of appliances.

B. Forced draft appliances:

1. Install all steel, positive pressure vents in accordance with manufacturer's installation instructions and UL listing. Maintain minimum clearances from combustibles specified in UL listing.
2. Support vents at intervals recommended by the manufacturer to support the weight of the vent and all accessories, without exceeding loading of appliances.

3.2 PROTECTION:

A. Temporary Closure: At ends of breechings and chimneys which are not completed or connected to equipment, provide temporary closure which will prevent entrance of dust and debris until installations are completed.

3.3 INSTALLATION OF DAMPERS:

A. Install barometric and thermostatically operated dampers in accordance with manufacturer's instruction. Locate as close to draft hood collar as possible.

END OF SECTION 23 51 00

FLORIDA SCHOOL FOR THE DEAF AND BLIND
HEATING HOT WATER PRIMARY SYSTEM REPLACEMENT

NOTE: THIS SECTION IS INCLUDED FOR THE CONTROLS AND GENERAL CONTRACTORS REFERENCE ONLY. THE BOILERS ARE OWNER PURCHASED AND CONTRACTOR INSTALLED. CONTROLS CONTRACTOR SHALL MAKE ALL POINTS INDICATED IN THIS SPECIFICATION VISIBLE ON THE EXISTING HONEYWELL EBI SYSTEM.

SECTION 23 52 00 - HEATING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

A. Hot Water, Gas Fired Indoor and Outdoor Boilers

1.3 QUALITY ASSURANCE

A. All boilers and burner combinations shall have a minimum efficiency of 85%.

B. All electrical components shall be UL listed and or labeled.

C. All wiring shall conform to the NEC.

D. All pressure vessels shall be ASME rated and bear the ASME label stating compliance.

E. All boilers shall be factory assembled and tested for operation, construction and function of controls, if disassembly is required for shipment, dissembled sections should be as large as possible to minimize field reassembly labor.

F. After boiler installation is completed the Owner shall be provided with service for starting the unit and training the attendant.

G. After installation the manufacturer's representative of all equipment provided in this section shall certify in writing to the Owner's representative that the equipment has been installed within the guidelines of the manufacturer's written installation instructions and that its performance meets and/or exceeds the operating characteristics specified and/or scheduled.

H. Installing Contractor report is required in accordance with paragraph CG-500 of ASME CSD-1 Code 1998 Edition, 1999 Addenda. This report along with the Pressure Vessel Test, by the manufacturer, is required to be submitted to the “Florida Department of Financial Services Division of State Fire Marshal”, the engineer and the Owner’s Representative.

1.4 SUBMITTALS

A. Submit dimension drawing performance and product data for acceptance.

B. Submit letter of certification as described in 1.3 Quality Assurance.

C. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

D. Refer to Section 23 05 00 for submittal requirements.

1.5 WARRANTY

A. Limited twenty-five-year thermal shock warranty.

B. Limited ten-year closed-system heat exchanger warranty.

C. Limited 5 year pars and labor warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hot Water, Gas Fired Boiler

1. Raypak, Inc. (Product: MVB® copper finned-tube hydronic boiler(s))
2. Parker Boiler
3. Aerco

2.2 BOILERS

A. General

1. The boiler(s) shall be fired with natural gas at a rated input as indicated in the schedules.
2. The boiler(s) shall be CSA tested and certified with a minimum thermal efficiency of 85 percent at full fire.
3. The boiler(s) shall be ASME inspected and stamped and National Board registered for 160 PSIG working pressure and 250°F maximum allowable temperature, complete with a Manufacturer's Data Report.
4. The boiler(s) shall have a floor loading of 124 lbs./square foot or less respectively.

B. Heat Exchanger

1. The heat exchanger shall be of a single-bank, vertical multi-pass design and shall completely enclose the combustion chamber for maximum efficiency. The tubes shall be set vertically and shall be rolled into a powder coated, ASME boiler quality, carbon steel tube sheet.
2. The heat exchanger shall be sealed to 160 PSIG rated bronze headers with high temperature silicone "O" rings. The heat exchanger shall be cupro nickel.
3. The low water volume heat exchanger shall be explosion-proof on the water side and shall carry a twenty five-year warranty against thermal shock.

4. The headers shall be secured to the tube sheet by stud bolts with flange nuts to permit inspection and maintenance without removal of external piping connections. A heavy gauge stainless steel slotted heat exchanger wrap shall ensure proper combustion gas flow across the copper-finned tubes.
5. The boiler(s) shall be capable of operating at inlet water temperatures as low as 120°F without harmful condensation.
6. The boiler(s) flue connection, combustion air opening, gas connection, water connections and electrical connections shall be located on the rear.
7. The primary heat exchanger shall have accessible boiler drain valves with hose bibs to drain the water section of the primary heat exchanger.

C. Burners

1. The combustion chamber shall be of the sealed combustion type employing the Raypak high temperature radially fired knit burner, mounted in a vertical orientation.
2. The burner must be capable of firing at both a complete blue flame with maximum gas and air input as well as firing infrared when gas and air are reduced. The burner must be capable of firing at 100% of rated input when supplied with 4.0” WC of inlet gas pressure, so as to maintain service under heavy demand conditions; no exceptions .
3. The burner shall use a combustion air blower to precisely control the fuel/air mixture for maximum efficiency throughout the entire range of modulation. The combustion air blower shall operate for a pre-purge period before burner ignition and a post-purge period after burner operation to clear the combustion chamber.
4. The blower shall infinitely vary its output in response to a Pulse Width Modulation (PWM) signal supplied directly from the Versa IC® modulating temperature controller, thereby electronically and precisely adjusting the volume of air and gas supplied for combustion. Minimum fire shall be 14 percent of rated input (natural gas).

D. Ignition Control System

1. The boiler(s) shall be equipped with a 100 percent safety shutdown system.
2. The ignition shall be Hot Surface Ignition type with full flame rectification by remote sensing separate from the ignition source, with a three-try-for-ignition sequence, to ensure consistent operation.
3. The igniter will be located away from the water inlet to protect the device from condensation during startup.
4. The ignition control module shall include an LED that indicates fifteen (15) individual diagnostic flash codes and transmits any fault codes to the LCD display.
5. Two external viewing ports shall be provided, permitting visual observation of burner operation.

E. Gas Train

1. The boiler(s) shall have a firing/leak test valve and pressure test valve as required by CSD-1.
2. The boiler(s) shall have dual-seated main gas valve(s).
3. Gas control trains shall have a redundant safety shut-off feature, main gas

regulator, shut-off cock and plugged pressure tapping to meet the requirements of ANSI Z21.13/CSA 4.9.

4. High gas pressure safety switch.

F. Boiler Control

1. The following safety controls shall be provided:

   a. High limit control with manual reset
   b. Flow switch, mounted and wired
   c. 125 PSIG ASME pressure relief valve, piped by the installer to an approved drain
   d. Temperature and pressure gauge (shipped loose)

2. The boiler(s) shall be equipped with the Versa IC® modulating temperature controller with LCD display that incorporates an adjustable energy-saving pump control relay and freeze protection and is factory mounted and wired to improve system efficiency; eight water sensors included (system sensor is loose).

G. Firing Mode

1. Provide electronic modulating control of the gas input to the boiler.

H. Boiler Diagnostics

1. Provide external LED panel displaying the following boiler status/faults:

   a. Power on – Green
   b. Call for heat – Amber
   c. Flow – Green
   d. Stages 1 and 2 – Green
   e. Fan 1 proven – Green
   f. Ignition fault – Red
   g. Safety fault – Red
   h. Burner firing - Blue

2. Provide internal circuit board indicating the following safety faults, internal/external interlocks with fault display by a LCD display:

   a. System status
   b. Ignition Failure
   c. Condensate Blockage
   d. Blower Speed Error
   e. Low 24 VAC
   f. Manual reset high limit
   g. Auto reset high limit
   h. Blocked vent
   i. Flow switch fault
   j. Sensor failure
   k. Air pressure
   l. Factory option

m. External interlock
n. Ignition lock-out
o. Low water cut-off
p. Low gas pressure switch
q. High gas pressure switch
r. Controller alarm
s. Cold Water Start/Cold Water Run

3. Provide the following:
    a. Inlet sensor (open or short)
    b. Outlet sensor (open or short)
    c. System sensor (open or short)
    d. Air sensor (open or short)
    e. Indirect DHW sensor (open or short)
    f. Cold water protection sensor (open or short)
        a. Internal control fault
        b. ID card fault
    g. Cascade communications error
        a. Auto reset high limit
        b. Low water cut-off
        c. Low gas pressure switch

4. A Central Point Wiring board with diagnostic LED's indicating the status of each relay.
5. Provide ignition module indicating the following flash codes by LED signal and displayed on LCD display:

    a. 1 flash – low air pressure
    b. 2 flashes – flame in the combustion chamber w/o CFH
    c. 3 flashes – ignition lock-out (flame failure)
    d. 4 flashes – low hot surface igniter current
    e. 5 flashes – low 24VAC
    f. 6 flashes – internal fault (replace module)

I. Combustion Chamber: The lightweight, high-temperature, multi-piece, interlocking ceramic fiber combustion chamber liner shall be sealed to reduce standby radiation losses, reducing jacket losses and increasing unit efficiency.

J. Venting

1. When routed vertically, the boiler's flue material and size shall be in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA54 latest edition (Category IV).
2. When routed horizontally, the boiler(s) flue material and size shall meet or exceed the requirements as specified for Category IV in the National Fuel Gas Code, ANSI Z223.1/NFPA 54 latest edition.
3. The boiler(s) shall be ducted combustion air ready.
4. Venting material shall be metal as per the manufacturers recommendations.

K. Cabinet

1. The corrosion-resistant galvanized steel jackets shall be finished with a baked-on epoxy powder coat which is suitable for outdoor installation, applied prior to assembly for complete coverage, and shall incorporate louvers in the outer panels to divert air past heated surfaces.
2. The boiler(s), if located on a combustible floor, shall not require a separate combustible floor base.
3. The boiler(s) shall have the option of venting the flue products either through the top or the back of the unit.
4. Combustion air intake shall be on the left side of the cabinet, right side optional.
5. The boilers shall have as standard an internal, high capacity combustion air filter rated to MERV 8 (>95% arrestance).

2.3 BOILER OPERATING CONTROLS

A. Each boiler shall have the ability to receive a 0 to 10 VDC signal from the Central Energy Management and Direct Digital Control System (EMCS) to vary the setpoint control or firing rate. Each boiler shall have an alarm contact for connection to the central EMCS system.

B. Each boiler shall be equipped with Modbus communications compatibility with up to 146 points of data available.

1. B-85 Gateway – BACnet MS/TP, BACnet IP, N2 Metasys or Modbus TCP

B. Boiler(s) shall feature an integrated Versa IC® modulating digital controller, mounted and wired.

C. The control shall have the ability to provide cascade control of up to 5 boilers as a single system via 2-wire communication.

D. System sensor shall be shipped loose for field installation by installing contractor. Inlet/Outlet sensors are factory-installed.

2.4 DIRECT VENT

A. Boilers(s) shall meet safety standards for direct vent equipment as noted by the 2006 Uniform Mechanical Code, section 1107.6, and ASHRAE 15-1994, Section 8.13.6.

B. Boiler shall be capable of combined combustion air duct and vent lengths not to exceed 200 equivalent feet.

2.5 SOURCE QUALITY CONTROL

A. The boiler(s) shall be completely assembled, wired, and fire-tested prior to shipment from the factory.

B. The boiler(s) shall be furnished with the sales order, ASME Manufacturer's Data Report, inspection sheet, wiring diagram, rating plate and Installation and Operating Manual.

PART 3 – EXECUTION

3.1 GENERAL

A. All equipment shall be installed in accordance with manufacturer's written instruction.

B. Provide adequate clearance for service and code requirements.

C. Mount boilers on 6" housekeeping pad.

D. Install fuel gas boilers per 2010 Florida Building Code – Fuel Gas.

3.2 INSTALLATION

A. Must comply with:

1. Local, state, provincial, and national codes, laws, regulations and ordinances, CSD-1
2. National Fuel Gas Code, ANSI Z223.1/NFPA 54 – Latest Edition
3. National Electrical Code, ANSI/NFPA 70 – latest edition
4. Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1, when required
5. Manufacturer's installation instructions, including required service clearances and venting guidelines

B. Manufacturer's representative to verify proper and complete installation.

3.3 START-UP

A. Shall be performed by Raypak factory-trained personnel.

B. The pre-startup shall consist of at least one project site visit prior to the startup to provide informational assistance to the installing contractor.

C. Startup shall consist of the complete startup and checkout of the boilers, their control system, and to insure the system is operating as intended.

D. In addition the boiler representative shall insure the boiler supplied gateway is functional and has the ability to communicate with the building management system (EBI) in this case, BACnet. The boiler representative shall insure the communication among all the boilers is functional.

E. A stack mounted analyzer shall be utilized to insure proper combustion across the entire firing range of the boilers.

F. The boiler manufacturer shall provide 8 hours of training to the owner for the operation of the boiler system.

B. Test during operation at a minimum must include the following::

1. Safeties (2.2 - F)
2. Operating Controls (2.3)
3. Static and full load gas supply pressure

4. Gas manifold and blower air pressure
5. Bacnet function

C. Submit copy of start-up report to Architect and Engineer.

3.4 TRAINING

A. Provide factory-authorized service representative to train maintenance personnel on procedures and schedules related to start-up, shut-down, trouble shooting, servicing, and preventive maintenance.

B. Schedule training at least seven days in advance.

END OF SECTION 23 52 00

Florida School for the Deaf & the Blind

Do More. Be More. Achieve More.

FLORIDA SCHOOL FOR THE DEAF & THE BLIND BOILER REPLACEMENT PHASE 2 PACKAGE

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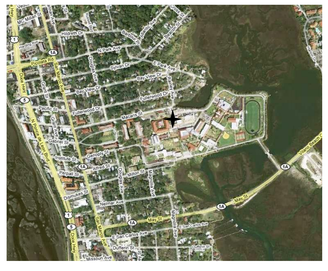
LOCATION MAP



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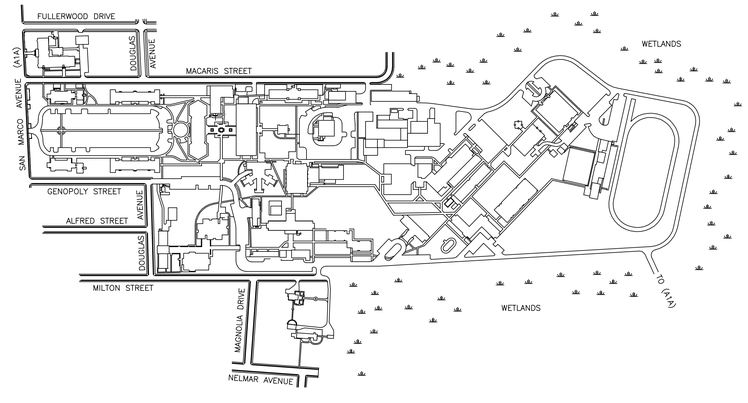

CAMPUS MAP

100 % CONSTRUCTION DOCS
JULY 06, 2015

MECHANICAL ABBREVIATIONS

A	AMPERES	EVAP	EVAPORATOR	MCA	MAXIMUM CIRCUIT AMPS
AC	AIR CONDITIONING	EWB	ENTERING WET BULB TEMPERATURE	MOCP	MAXIMUM OVERCURRENT PROTECTION
AD	ACCESS DOOR	EWT	ENTERING WATER TEMPERATURE	LRA	LOCK ROTOR AMPS
AFF	ABOVE FINISHED FLOOR	EXIST	EXISTING	RLA	RATED LOAD AMPS
AHU	AIR HANDLING UNIT	EXP	EXPANSION	PC	PLUMBING CONTRACTOR
APPROX	APPROXIMATELY	F	FIRE SPRINKLER PIPING	PCHWP	PRIMARY CHILLED WATER PUMP
AP	ACCESS PANEL	°F	DEGREES FAHRENHEIT	PD	PRESSURE DROP
ARCH	ARCHITECTURAL	FA	FREE AREA (SQ. FT.) OR FACE AREA	PHC	PREHEAT COIL
AS	AIR SEPARATOR	FBP	FIELD BUILT PLENUM	PSI	POUNDS PER SQUARE INCH
AUTO	AUTOMATIC	FCO	FLOOR CLEANOUT	PSIA	PSI ABSOLUTE
AUX	AUXILLIARY	FCU	FAN COIL UNIT	PSIG	PSI GAUGE
BCS	BUILDING CONTROL SYSTEM	FD	FLOOR DRAIN	PRESS	PRESSURE
BHP	BRAKE HORSEPOWER	FDPR	FIRE DAMPER	PVC	POLYVINYL CHLORIDE
BLDG	BUILDING	FLA	FULL LOAD AMPERES	RA	RETURN AIR
BOD	BOTTOM OF DUCT	FLEX	FLEXIBLE	RAF	RETURN AIR FAN
BTU	BRITISH THERMAL UNIT	FPI	FINS PER INCH	REQ'D	REQUIRED
BTUH	BRITISH THERMAL UNITS PER HOUR	FPM	FEET PER MINUTE	RF	RELIEF FAN
CC	COOLING COIL	FPS	FEET PER SECOND	RH	RELATIVE HUMIDITY
CD	CONDENSATE DRAIN	FTB	FAN POWERED TERMINAL BOX	RHC	REHEAT COIL
CFM	CUBIC FEET PER MINUTE	FV	FACE VELOCITY	RHG	*REFRIGERANT HOT GAS DISCHARGE
CH	CHILLER	GA	GAUGE	RLL	*REFRIGERANT LIQUID LINE
CHR	CHILLED WATER RETURN	GAL	GALLONS	RM	ROOM
CHS	CHILLED WATER SUPPLY	GPH	GALLONS PER HOUR	RPM	REVOLUTIONS PER MINUTE
CHWP	CHILLED WATER PUMP	GPM	GALLONS PER MINUTE	RSL	*REFRIGERANT SUCTION LINE
CLG	CEILING	HB	HOSE BIBB	RV	RELIEF VALVE
CMU	CONCRETE MASONARY UNIT	H20	WATER	S/FDPR	COMBINED SMOKE AND FIRE DAMPER
CO	CLEAN–OUT	HC	HEATING COIL	SA	SUPPLY AIR
COMB	COMBINATION	HD	HEAD	SAF	SUPPLY AIR FAN
COMPR	COMPRESSOR	HORIZ	HORIZONTAL	SAN	SANITARY
COND	CONDENSATE OR CONDENSER	HP	HORSEPOWER OR HEAT PUMP	SAU	SOUND ATTENUATION UNIT
CONN	CONNECTION	HW	HOT WATER	SCHWP	SECONDARY CHILLED WATER PUMP
CONT	CONTINUATION	HR	HOUR	SGCHS	SECONDARY GLYCOL CHILLED WATER SUPPLY
CU	CONDENSING UNIT	HT	HEIGHT	SGCHR	SECONDARY GLYCOL CHILLED WATER RETURN
CU FT	CUBIC FEET	HZ	FREQUENCY (HERTZ)	SDPR	SMOKE DAMPER
CUH	CABINET UNIT HEATER	ID	INSIDE DIAMETER	SP	STATIC PRESSURE
CU IN	CUBIC INCHES	IN	INCH OR INCHES	SPEC	SPECIFICATION
CW	COLD WATER (CITY)	INSUL	INSULATION	TAO	TRANSFER AIR OPENING
CWP	CONDENSER WATER PUMP	KW	KILOWATT	TD	TRENCH DRAIN
CWR	CONDENSER WATER RETURN	LAT	LEAVING AIR TEMPERTURE	TDH	TOTAL DYNAMIC HEAD
CWS	CONDENSER WATER SUPPLY	LB/HR	POUNDS PER HOUR	TEMP	TEMPERATURE
D	DRAIN LINE	LBS	POUNDS	TS	TIPSPEED
DB	DRY BULB	LDB	LEAVING DRY BULB TEMPERATURE	TYP	TYPICAL
DG	DOOR GRILLE	LIN FT	LINEAR FEET	UG	UNDERGROUND
DHW	DOMESTIC HOT WATER	LWB	LEAVING WET BULB	UH	UNIT HEATER
DIAM	DIAMETER	LWT	LEAVING WATER TEMPERATURE	VAV	VARIABLE AIR VOLUME UNIT
DN	DOWN	MAX	MAXIMUM	VD	VOLUME DAMPER
DWG	DRAWING	MB	MIXING BOX	W	WATT
DX	DIRECT EXPANSION	MBH	BTUH, THOUSANDS	W/	WITH
EA	EXHAUST AIR	MC	MECHANICAL CONTRACTOR	W/O	WITHOUT
EAT	ENTERING AIR TEMPERATURE	MIN	MINIMUM	WB	WET BULB
EDB	ENTERING DRY BULB TEMPERATURE	NC	NORMALLY CLOSED	WC	WATER COLUMN
EDH	ELECTRIC DUCT HEATER	NIC	NOT IN CONTRACT	WCO	WALL CLEANOUT
EF	EXHAUST FAN	NO	NORMALLY OPEN	WG	WATER GAUGE
EH	ELECTRIC HEATER	NO.	NUMBER	WP	WORKING PRESSURE
EL	ELEVATION	NTS	NOT TO SCALE	WMS	WIRE MESH SCREEN
ELEC	ELECTRICAL	OA	OUTSIDE AIR	ZD	ZONE DAMPER
EQ	EQUAL	OD	OUTSIDE DIAMETER		
ET	EXPANSION TANK	OV	OUTLET VELOCITY		

GENERAL LEGEND

- PIPE SECTION–SUPPLY
- PIPE SECTION–RETURN
- DIRECTION OF FLOW IN PIPE
- PITCH PIPE DOWN IN DIRECTION OF ARROW
- PIPE UP
- PIPE DOWN
- A — PIPE ANCHOR
- G — PIPE GUIDE
- EJ — EXPANSION JOINT
- FLEXIBLE PIPE CONNECTOR
- BALL VALVE
- CHECK VALVE, HORIZONTAL SWING
- CHECK VALVE, VERTICAL SPRING LOADED
- GATE VALVE
- GLOBE VALVE
- BC — BALANCING COCK
- BUTTERFLY VALVE TAPPED LUG WAFER
- STRAINER, Y–TYPEAND BLOWOFF VALVE
- SV — STRAINER/SHUT–OFF VALVE & PRESSURE TAP
- PTV — SHUT–OFF VALVE & PRESSURE TAP
- AUTOMATIC CONTROL VALVE (2–WAY, 3–WAY)
- NEEDLE VALVE
- MAV — MANUAL AIR VENT
- AAV — AUTOMATIC AIR VENT
- PP — TEMPERATURE & PRESSURE TAP (PETE'S PLUG)
- PG — PRESSURE GAUGE W/BALL VL. (WATER)
- PTW — PRESSURE GAUGE TAPPING (WATER)
- SOLENOID VALVE
- CAPPED LINE
- CHS–UG — CHILLED WATER SUPPLY (BELOW GRADE)
- CHS — CHILLED WATER SUPPLY (ABOVE GRADE)
- CHR–UG — CHILLED WATER RETURN (BELOW GRADE)
- CHR — CHILLED WATER RETURN (ABOVE GRADE)
- CF — CHEMICAL FEED PIPING
- CD–UG — CONDENSATE DRAIN (BELOW GRADE)
- CD — CONDENSATE DRAIN (ABOVE GRADE)
- CWS–UG — CONDENSER WATER SUPPLY (BELOW GRADE)
- CWS — CONDENSER WATER SUPPLY (ABOVE GRADE)
- CWR–UG — CONDENSER WATER RETURN (BELOW GRADE)
- CWR — CONDENSER WATER RETURN (ABOVE GRADE)

- 4" 6" — PIPE REDUCTION
- T — THERMOMETER
- TW — THERMOMETER WELL
- ROUND DUCT
- FLAT OVAL DUCT
- 12x6, 8"ø,G–1 160 CFM — SIDEWALL SUPPLY SIZE, NECK SIZE,TYPE CAPACITY
- 8x8, 8"ø,G–2 110 CFM — SIDEWALL RETURN SIZE, NECK SIZE,TYPE CAPACITY
- 6X6,8"ø,G–3 150CFM — CEILING DIFFUSER SUPPLY SIZE, NECK SIZE, TYPE CAPACITY
- 6X6, 8"ø,G–3 150 CFM — CEILING RETURN OR EXHAUST SIZE, NECK SIZE, TYPE CAPACITY
- 6X6,8"ø,G–3 150CFM — FLOOR SUPPLY SIZE, NECK SIZE,TYPE CAPACITY
- 6X8, 8"ø,G–3 150 CFM — FLOOR RETURN OR EXHAUST SIZE, NECK SIZE,TYPE CAPACITY
- SUPPLY LINEAR – LENGTH,WIDTH,G#,PLENUM SIZE XXX CFM PER PLENUM; CONTINUOUS,2–SLOT,G–7,48" PLENUM 150 CFM PER PLENUM
- RETURN LINEAR – LENGTH,WIDTH,G#,PLENUM SIZE XXX CFM PER PLENUM; CONTINUOUS,2–SLOT,G–7,OPEN 150 CFM PER PLENUM
- UC CFM — DOOR UNDERCUT 3/4"MAX., CAPACITY
- ΔT — DELTA T (TEMPERATURE DIFFERENCE)
- ROUND DUCT SECTION–SUPPLY
- ROUND DUCT SECTION–RETURN
- DUCT SECTION–SUPPLY
- DUCT SECTION–RETURN OR EXHAUST
- FLEXIBLE DUCT CONNECTION
- FIRE DAMPER & ACCESS DOOR
- VOLUME DAMPER
- TURNING VANES
- SMOKE DAMPER & ACCESS DOOR
- FLEXIBLE ROUND DUCT
- A / M–1/M–2 — SECTION DESIGNATION; SHEET WHERE SECTION APPEARS; SHEET WHERE SECTION CUT
- T — THERMOSTAT
- SD — SMOKE DETECTOR
- SP — DOWN DUCT STATIC PRESSURE SENSOR
- CO_2 — INDOOR AIR QUALITY SENSOR
- M — MOTORIZED VALVE
- T — REMOTE TEMPERATURE SENSOR
- H — HUMIDISTAT
- M — MOTORIZED DAMPER
- CFM — AIR FLOW MEASURING STATION
- FM — FLOW METER
- POINT OF DISCONNECTION
- POINT OF CONNECTION

GENERAL NOTES

1. REFER TO THE DIVISION 23 SPECIFICATIONS.
2. THE CONTRACTOR SHALL DEMONSTRATE EACH HVAC SYSTEMS PERFORMANCE IN THE PRESENCE OF THE ARCHITECT AND THE OWNER'S PROJECT MANAGER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COST OF ANY ADDITIONAL SYSTEM TEST REQUIRED IF IN THE OPINION OF THE ARCHITECT AND THE OWNER'S PROJECT MANAGER THE SYSTEMS DO NOT PERFORM AS SPECIFIED.
3. VISIT AND CAREFULLY EXAMINE THOSE PORTIONS OF THE BUILDING AND SITE AFFECTED BY THIS WORK BEFORE SUBMITTING PROPOSALS, SO AS TO BECOME FAMILIAR WITH EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT EXECUTION OF THE WORK. SUBMISSION OF A PROPOSAL WILL BE CONSTRUED AS EVIDENCE THAT SUCH EXAMINATION HAS BEEN MADE AND LATER CLAIMS FOR LABOR, EQUIPMENT OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED WILL NOT BE RECOGNIZED.
4. REFER TO DRAWINGS FOR ALL AIR HANDLING UNITS UTILIZING A FULLY DUCTED RETURN AIR SYSTEM.
5. ALL GRILLES, REGISTERS OR DIFFUSERS SHOWN IN THE CEILING SHALL BE 24X24 UNLESS OTHERWISE NOTED.
6. PROVIDE A DUCT ACCESS DOOR FOR ALL S/FDPR, SDPR AND/OR FDPR SHOWN ON CONSTRUCTION DOCUMENTS. ACCESS DOORS MAY NOT BE SHOWN FOR CLARITY OF THE DOCUMENTS.
7. PROVIDE A VOLUME DAMPER AT EVERY BRANCH DUCT AND AS SHOWN ON THE DOCUMENTS FOR ALL DUCTWORK SYSTEMS. ALL DAMPERS MAY NOT BE SHOWN ON THE DOCUMENTS FOR CLARITY.
8. FULLY COORDINATE ALL CEILING MOUNTED AIR DISTRIBUTION DEVICES WITH ARCHITECTURAL CEILING GRID.
9. VERIFY EXACT LOCATION OF ALL ELECTRICAL EQUIPMENT INCLUDING WALL SWITCHES, FIRE ALARM DEVICES, ETC. WITH ELECTRICAL CONTRACTOR AND ELECTRICAL DRAWINGS.
10. INSTALL A SMOKE DETECTOR IN THE SUPPLY AND RETURN DUCTWORK AS SHOWN. DETECTOR SHALL DE–ENERGIZE THE SUPPLY FAN WHEN SMOKE IS DETECTED. CONNECT TO THE FIRE ALARM SYSTEM, SO THAT THE ALARM ENUNCIATED AT THE FIRE ALARM PANEL CORRESPONDS TO THE AREA IN ALARM.
11. ALL DUCT SIZES INDICATED ON THE DOCUMENTS ARE NET FREE AREA DIMENSIONS.
12. UNFORESEEN CONDITIONS MAY EXIST AND WORK MAY NOT BE FIELD LOCATED EXACTLY AS SHOWN ON THE DRAWINGS. COOPERATION WITH OTHER TRADES IN ROUTING AS DETERMINED DURING CONSTRUCTION AND AS DIRECTED BY THE ARCHITECT/ENGINEER MAY BE NECESSARY. IT IS INTENDED THAT SUCH DEVIATIONS SHALL BE CONSIDERED AS PART OF THIS CONTRACT. SUCH DEVIATIONS MAY NOT BE CONSIDERED AS PART OF THIS CONTRACT WHEN PROPERLY DOCUMENTED IN WRITING. THE PLANS ARE NOT COMPLETELY TO SCALE. THIS CONTRACTOR IS TO FIELD VERIFY DIMENSIONS OF ALL SITE UTILITIES, ETC., PRIOR TO BID AND INCLUDE ANY DEVIATIONS IN THE CONTRACT.
13. ALL PIPING AND DUCT IS TO BE CONCEALED ABOVE CEILING OR IN NEW WALLS, UNLESS SPECIFICALLY NOTED AS EXPOSED OR SURFACE MOUNTED.
14. WORK SHALL BE PERFORMED, IN STRICT COMPLIANCE WITH THE ESTABLISHED WORK SCHEDULE BEING SET FORTH BY THE OWNER. COORDINATE ALL WORK WITH GENERAL CONTRACTOR. THIS CONTRACTOR SHALL FURNISH ADEQUATE FORCES, CONSTRUCTION PLANT AND EQUIPMENT, AND SHALL WORK SUCH HOURS, INCLUDING NIGHT SHIFTS, OVERTIME OPERATIONS, SUNDAYS AND HOLIDAYS IN ACCORDANCE WITH THE OWNER'S OPERATIONAL SCHEDULE AS LISTED IN DIVISION 1 OF THE SPECIFICATIONS. IF THE CONTRACTOR DOES NOT MAINTAIN THE CONSTRUCTION SCHEDULE BECAUSE OF INADEQUATE FORCES, SUPERVISION OR ANY OTHER REASON UNDER THE CONTRACTOR'S CONTROL, THE OWNER MAY REQUIRE THE CONTRACTOR TO INCREASE THE NUMBER OF SHIFTS AND/OR OVERTIME OPERATIONS, DAY OF WORK AND/OR THE AMOUNT OF CONSTRUCTION PLANT, AT NO ADDITIONAL COST TO THE OWNER UNDER THIS CONTRACT. FAILURE TO MAINTAIN THE CONSTRUCTION SCHEDULE DUE TO OWNER'S OPERATIONAL INTERFERENCES, WHICH WERE NOT IDENTIFIED IN OR PRIOR TO THE PRE–BID CONFERENCE, SHALL NOT BE THE CONTRACTOR'S LIABILITY.
15. ALL CONCRETE, WALL PATCHING, CEILING REPAIR, FENCE WORK AND OTHER GENERAL CONSTRUCTION WORK REQUIRED FOR INSTALLING MECHANICAL/PLUMBING OR FIRE PROTECTION SYSTEMS SHALL BE PROVIDED BY MECHANICAL CONTRACTOR AND FULLY COORDINATED WITH GENERAL CONTRACTOR USING THE APPROPRIATE CONSTRUCTION TRADES.
16. ALL MATERIALS AND EQUIPMENT SHALL BE NEW AND SHALL BE UL LISTED WHERE APPLICABLE.
17. DUCTWORK SHALL NOT BE SUPPORTED BY THE CEILING SUSPENSION SYSTEM. COORDINATE LOCATIONS OF GRILLES, DIFFUSERS AND LOUVERS WITH ELECTRICAL, ARCHITECTURAL AND PLUMBING WORK.
18. THE ROOF DECK SHALL NOT SUPPORT DUCTWORK, PIPING, EQUIPMENT OR ANY OTHER DEVICES. ALL SUPPORTS SHALL BE SPAN BETWEEN THE STRUCTURAL BEAMS TO SUPPORT THE MECHANICAL EQUIPMENT. PENETRATION OF THE ROOF DECK WILL NOT BE ACCEPTED.
19. IN GENERAL, PLANS AND DIAGRAMS ARE SCHEMATIC ONLY AND SHOULD NOT BE SCALED. CONTRACTOR SHALL COORDINATE ALL PLUMBING, HEATING AND ELECTRICAL WORK AT THE SITE, SO AS NOT TO CONFLICT IN LOCATION WITH OTHER WORK UNDER THE CONTRACT. ALL PIPING SHOWN ON A SITE PLAN SHALL BE VERIFIED AND COORDINATED WITH THE CIVIL DOCUMENTS PRIOR TO THE BID.
20. ANY CONFLICT WITH DOORS, WINDOWS, CABINETS OR ANY OTHER EQUIPMENT SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT/ENGINEER.
21. THE MECHANICAL CONTRACTOR IS DIRECTED TO COMPLY WITH DIVISION 26 OF THE CONTRACT SPECIFICATIONS REFERRING TO MOTORS, STARTERS, ETC.
22. ALL DOOR GRILLES, OUTSIDE AIR LOUVERS, DISCHARGE LOUVERS, SHOWN ON THE MECHANICAL DRAWINGS, SHALL BE FURNISHED AND INSTALLED BY THE MECHANICAL CONTRACTOR. THE SIZE AND LOCATION OF EQUIPMENT INSTALLED UNDER DIVISION 23 – MECHANICAL SHALL BE COORDINATED WITH OTHER TRADES. THE MECHANICAL CONTRACTOR SHALL VERIFY ALL COLORS AND FINISHES OF THESE DEVICES, WITH THE ARCHITECT, PRIOR TO ORDERING OF THE EQUIPMENT.
23. WHENEVER A REFERENCE IS MADE TO STANDARD, INSTALLATION AND MATERIALS SHALL COMPLY WITH THE LATEST PUBLISHED EDITION AT THE TIME THE PROJECT IS BID UNLESS OTHERWISE SPECIFIED.
24. ALL MATERIAL STORED ON SITE SHALL BE PROPERLY PROTECTED FROM INJURY OR DETERIORATION. MATERIAL SHALL NOT BE STORED IN CONTACT WITH THE GROUND OR FLOOR. ALL DUCTWORK AND EQUIPMENT STORED SHALL BE SEALED AT ANY OPENING TO PREVENT ANY DEBRIS OR DIRT ENTERING THE INSIDE OF THE DUCTWORK AND EQUIPMENT. IF DEBRIS OR DIRT IS FOUND INSIDE THE DUCTWORK DURING ANY INSPECTION, THE CONTRACTOR WILL BE RESPONSIBLE FOR ALL COSTS INCURRED TO CLEAN THE DUCTWORK TO THE SATISFACTION OF THE OWNER AND ENGINEER.
25. ALL SUPPLY AIR DUCT BENDS FROM THE VERTICAL TO THE HORIZONTAL AND ANGLED TURNS OF DUCTWORK SHALL HAVE LONG RADIUS ELBOWS. TURNING VANES WILL ONLY BE ACCEPTED WHERE SHOWN ON THE DOCUMENTS.
26. VOLUME DAMPERS SHALL BE INSTALLED IN ALL BRANCH DUCTS LEADING FROM MAIN TRUNK LINES.
27. ALL EXTERNAL FIBROUS GLASS WRAPPED INSULATION JOINTS, SEAMS AND CONNECTIONS SHALL BE CONSTRUCTED WITH FAB AND STAPLES AND THEN SEALED WITH MASTIC. HEAT AND PRESSURE SENSITIVE TAPE ARE NOT ACCEPTABLE AS A FINAL CLOSURE.
28. PROVIDE FIRE DAMPERS AT EACH FIRE RATED WALL PENETRATION OF ALL AIR SUPPLY, RETURN, EXHAUST AND VENTILATION DUCTS. IF NOT SHOWN ON THE DOCUMENTS THIS MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO BID.
29. ACCESS DOORS IN WALLS, CEILING AND DUCTS SHALL BE PROVIDED FOR INSPECTION OF ALL FIRE, SMOKE AND FIRE/SMOKE DAMPERS. ACCESS DOORS SHALL BE OF A SIZE ADEQUATE FOR THE PURPOSE AND SHALL MAINTAIN ANY NECESSARY FIRE RATING. SIZE PER SCHEDULE IN SPECIFICATION SECTION 23 33 00.
30. DUCTWORK SHALL BE SHEET METAL, EXTERNALLY WRAPPED UNLESS OTHERWISE NOTED, MIN. 26 GA. AND CONSTRUCTED IN STRICT ACCORDANCE WITH SMACNA STANDARDS.
31. CONTRACTOR SHALL COORDINATE WORK WITH ALL OTHER TRADES.
32. MECHANICAL CONTRACTOR TO TEST AND BALANCE HVAC SYSTEMS TO PROVIDE MAXIMUM PERFORMANCE WITH REGARDS TO CFM, TEMPERATURE AND STATIC PRESSURE. REFER TO SPECIFICATIONS FOR TEST AND BALANCE REQUIREMENTS.
33. ALL INSULATION USED FOR DUCTWORK SHALL BE INSTALLED THICKNESS RECOMMENDED BY THE ASHRAE GUIDE AND DATA BOOKS. INSULATION MATERIAL SHALL MEET NFPA 90A REQUIREMENTS AND SHALL HAVE COMPOSITE FIRE AND SMOKE HAZARD RATING AS TESTED IN ACCORDANCE WITH NFPA 225 OR UL 723 NOT EXCEEDING FLAME SPREAD OF MORE THAN 25 AND SMOKE DEVELOPED 50. REFER TO SPECIFICATIONS.
34. ALL DUCTWORK AND PIPING SHALL TRANSITION UP INTO JOIST SPACE TO GIVE MAXIMUM CLEARANCES TO CEILING AND LIGHTING DEVICES.
35. ALL WORK SHALL BE INSTALLED IN ACCORDANCE WITH THE 2010 FLORIDA BUILDING CODE, 2010 FLORIDA BUILDING CODE – PLUMBING AND 2010 FLORIDA BUILDING CODE – MECHANICAL, 2010 FLORIDA FIRE PREVENTION CODE & STANDARDS AS REFERENCED IN DIVISION 1 AND THROUGHOUT THE SPECIFICATIONS.
36. ALL PLENUMS SHALL BE DOUBLE WALL MADE BY AHU MANUFACTURER. FIELD BUILT PLENUMS ARE NOT ACCEPTABLE. REFER TO SPECIFICATION SECTION 23 73 00 FOR PLENUM REQUIREMENTS.
37. THE MECHANICAL CONTRACTOR SHALL PROVIDE A LOG OF ALL MECHANICAL EQUIPMENT THAT HAS BEEN REPAIRED OR REPLACED PRIOR TO SUBSTANTIAL COMPLETION TO THE ENGINEER TO REVIEW.
38. THE CONTRACTOR SHALL FULLY COMPLY WITH THE FBC 2010 SECTION 1816.2 FOR SLEEVING PIPES THROUGH A SLAB–ON–GRADE CONCRETE SLAB.
39. PIPING CARRYING REFRIGERANTS SHALL BE TYPE ACR HARD–DRAWN COPPER TUBING, ASTM B88, ANSI H23.1. FITTINGS SHALL BE WROUGHT COPPER: ASTM B16.22, ANSI B16.22. ALL 90 ELBOWS SHALL BE THE LONG RADIUS TYPE. REFER TO SPECIFICATION SECTION 23 21 13 FOR BRAZING OPTIONS.

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ENG. BUS. No. EB-0005096 CERT. OF AUTH. No. 5096

FLORIDA SCHOOL OF THE DEAF AND BLIND BOILER REPLACEMENT PHASE 1 DESIGN

Revisions

No.	Date	Description

MPE PROJ#: 2014–150A

Designed By: SG

Drawn By: AG/SG

Checked By: SG

Issue Date: 07/06/15

Drawing Scale: 1/8"=1'–0"

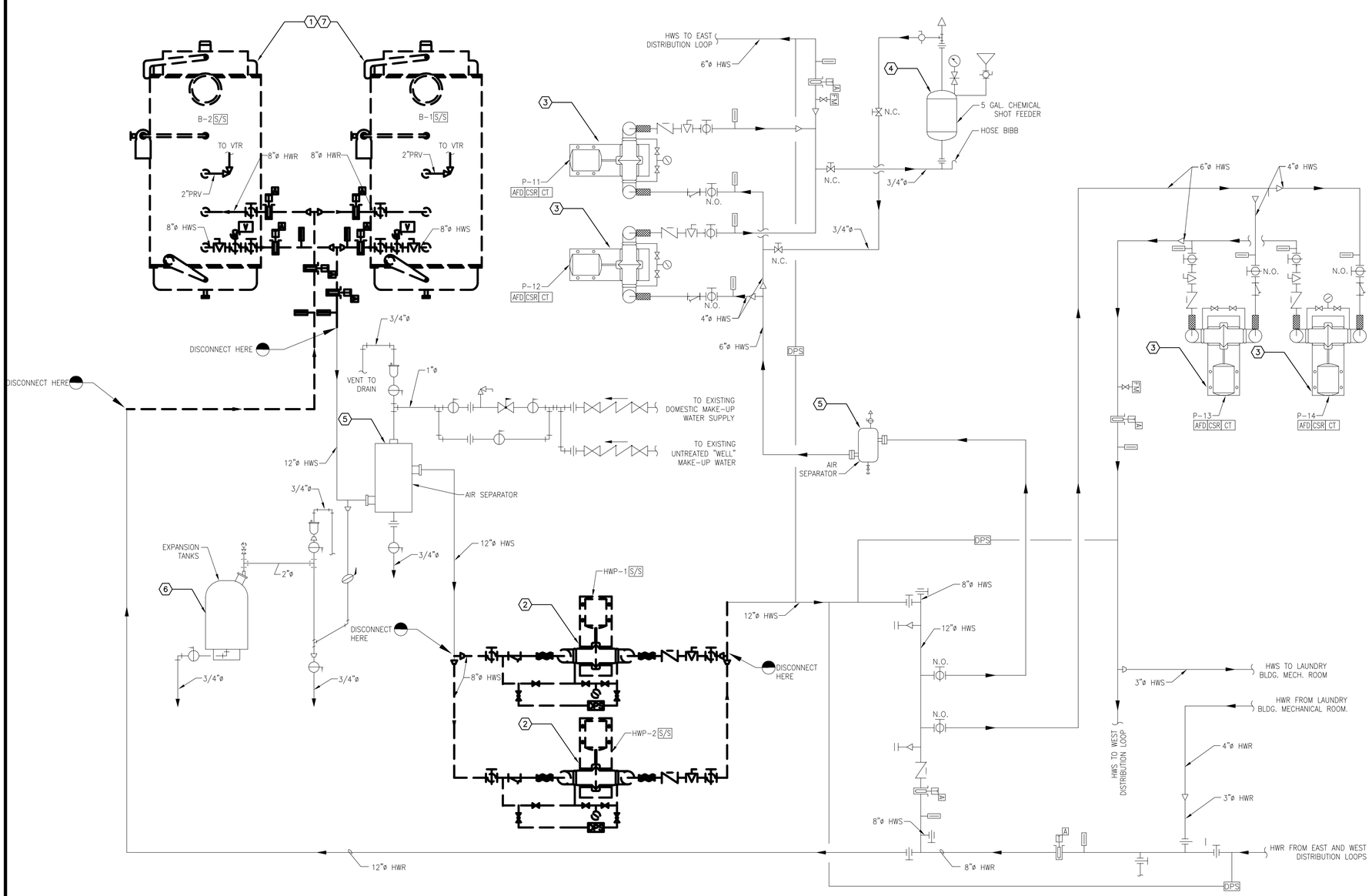
Drawing Title:

MECHANICAL LEGEND

CONSTRUCTION DOCUMENTS

Drawing No.

M–1.0



DEMOLITION BOILER PLANT SCHEMATIC

RENOVATION GENERAL NOTES

A. THE FOLLOWING PLANS ARE INTENDED TO PROVIDE THE CONTRACTOR WITH A GENERAL KNOWLEDGE OF THE EXISTING CONDITIONS WITHIN THE PROJECT AREA. EXISTING EQUIPMENT, STRUCTURE, DUCTWORK, ETC. LOCATED ON DRAWING WERE DERIVED FROM LIMITED FIELD OBSERVATIONS AND THE EXISTING AS-BUILTS WHICH MAY NOT BE UP TO DATE. THIS DRAWING MAY NOT BE ALL INCLUSIVE OF SERVICES THAT EXIST IN THE PROJECT AREA. CONTRACTOR SHALL VERIFY SERVICES AND LOCATIONS PRIOR TO ANY DEMOLITION WORK COMMENCING. ANY DEVIATIONS IMPACTING WORK SHOWN ON THESE DOCUMENTS SHALL BE REPORTED TO THE ARCHITECT AND ENGINEER PRIOR TO BEGINNING DEMOLITION. BEGINNING OF DEMOLITION SHALL SIGNIFY CONTRACTORS ACCEPTANCE OF EXISTING CONDITIONS AND THE COST OF REROUTING DUCTWORK AND/OR THE PIPING DUE TO CONFLICTS WITH EXISTING CONDITIONS SHALL BE PAID BY CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE FOR ALL REQUIRED DEMOLITION WHETHER SHOWN ON THE PLANS OR NOT.

B. GENERAL CONTRACTOR SHALL REPLACE ANY DAMAGED CEILING TILES THAT RESULT FROM WORK ABOVE CEILING.

C. RECORD EXISTING SUPPLY, RETURN, & EXHAUST FLOWS ASSOCIATED WITH OUTSIDE AIR PRIOR TO DEMOLITION, REBALANCE AIR FLOWS IN AREAS TO QUANTITIES MEASURED BEFORE COMMENCEMENT OF DEMOLITION, UNLESS INDICATED OTHERWISE.

D. CONTRACTOR SHALL FIELD VERIFY AIR QUANTITIES OF ALL AIR DEVICES AND EQUIPMENT PRIOR TO DEMOLITION. CONTRACTOR SHALL VISIT THE SITE TO BECOME FAMILIAR WITH SCOPE OF THE PROJECT. ALL EXISTING CONDITIONS MUST BE VERIFIED PRIOR TO INITIATION OF WORK.

E. EXISTING SYSTEMS TO REMAIN IN SERVICE WHILE NEW SYSTEMS ARE MADE OPERATIONAL, DUCTWORK, PIPING AND ASSOCIATED INSULATION WHICH TO REMAIN IN SERVICE SHALL NOT BE DISTURBED. IF BROKEN DURING CONSTRUCTION OR DEMOLITION, CONTRACTOR SHALL REPLACED WITH NEW DUCT, PIPING AND INSULATION OF SAME SIZE AND MATERIALS. REPAIR ALL DAMAGE CAUSED BY MOVING, RIGGING OR SETTING IN PLACE ANY SYSTEMS ASSOCIATED WITH THIS PROJECT AS REQUIRED. PATCH, REPAIR AND RETURN ALL FINISHED TO ORIGINAL CONDITION. CONSTRUCTION ZONES EXCLUDED.

F. REFER TO ARCHITECTURAL FOR ADDITIONAL DEMO REQUIREMENTS.

G. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER DISPOSAL OF ALL MATERIALS BEING REMOVED.

HEX NOTES

1. REMOVE EXISTING BOILER AND ALL ASSOCIATED VALVES, BREECHING, CONDUIT, WIRING, CONTROLLERS, PIPING (TO POINT INDICATED), SENSORS, NATURAL GAS PIPING, DRAINAGE PIPING, ETC.
2. REMOVE EXISTING PRIMARY PUMPS AND ALL ASSOCIATED VALVES, CONDUIT, WIRING, CONTROLLERS, PIPING (TO POINT INDICATED), SENSORS, CONCRETE PADS, ETC.
3. EXISTING SECONDARY DISTRIBUTION PUMP TO REMAIN.
4. EXISTING CHEMICAL POT FEEDER TO REMAIN.
5. EXISTING AIR SEPARATOR TO REMAIN.
6. EXISTING EXPANSION TANKS TO REMAIN.
7. EXISTING BOILER PADS TO REMAIN IN PLACE.

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Revisions

No.	Date	Description

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Issue Date: 07/06/15

Drawing Scale: NTS

Drawing Title:
MECHANICAL DEMOLITION PIPING SCHEMATIC

CONSTRUCTION DOCUMENTS

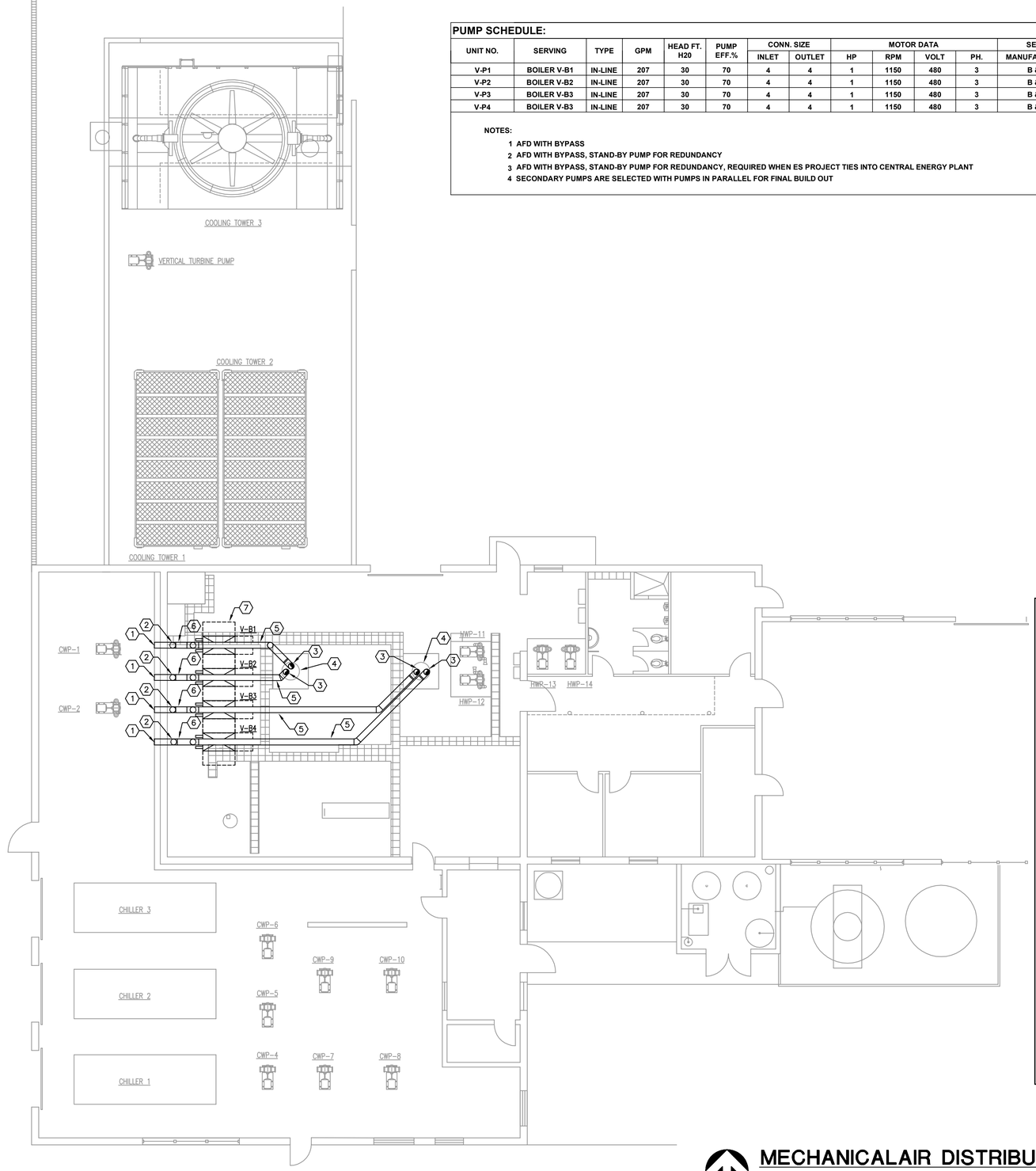
Drawing No.
M-2.0

PUMP SCHEDULE:

UNIT NO.	SERVING	TYPE	GPM	HEAD FT. H20	PUMP EFF.%	CONN. SIZE		MOTOR DATA				SELECTION BASED ON:		REMARKS
						INLET	OUTLET	HP	RPM	VOLT	PH.	MANUFACTURER	MODEL	
V-P1	BOILER V-B1	IN-LINE	207	30	70	4	4	1	1150	480	3	B & G	4x4x7	SERIES 80
V-P2	BOILER V-B2	IN-LINE	207	30	70	4	4	1	1150	480	3	B & G	4x4x7	SERIES 80
V-P3	BOILER V-B3	IN-LINE	207	30	70	4	4	1	1150	480	3	B & G	4x4x7	SERIES 80
V-P4	BOILER V-B3	IN-LINE	207	30	70	4	4	1	1150	480	3	B & G	4x4x7	SERIES 80

NOTES:

1 AFD WITH BYPASS
2 AFD WITH BYPASS, STAND-BY PUMP FOR REDUNDANCY
3 AFD WITH BYPASS, STAND-BY PUMP FOR REDUNDANCY, REQUIRED WHEN ES PROJECT TIES INTO CENTRAL ENERGY PLANT
4 SECONDARY PUMPS ARE SELECTED WITH PUMPS IN PARALLEL FOR FINAL BUILD OUT



MECHANICALAIR DISTRIBUTION PLAN

1/8"=1'-0"

0 4' 8' 16'

RENOVATION GENERAL NOTES

A. THE FOLLOWING PLANS ARE INTENDED TO PROVIDE THE CONTRACTOR WITH A GENERAL KNOWLEDGE OF THE EXISTING CONDITIONS WITHIN THE PROJECT AREA. EXISTING EQUIPMENT, STRUCTURE, DUCTWORK, ETC. LOCATED ON DRAWING WERE DERIVED FROM LIMITED FIELD OBSERVATIONS AND THE EXISTING AS-BUILTS WHICH MAY NOT BE UP TO DATE. THIS DRAWING MAY NOT BE ALL INCLUSIVE OF SERVICES THAT EXIST IN THE PROJECT AREA. CONTRACTOR SHALL VERIFY SERVICES AND LOCATIONS PRIOR TO ANY DEMOLITION WORK COMMENCING. ANY DEVIATIONS IMPACTING WORK SHOWN ON THESE DOCUMENTS SHALL BE REPORTED TO THE ARCHITECT AND ENGINEER PRIOR TO BEGINNING DEMOLITION. BEGINNING OF DEMOLITION SHALL SIGNIFY CONTRACTORS ACCEPTANCE OF EXISTING CONDITIONS AND THE COST OF REROUTING DUCTWORK AND/OR THE PIPING DUE TO CONFLICTS WITH EXISTING CONDITIONS SHALL BE PAID BY CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE FOR ALL REQUIRED DEMOLITION WHETHER SHOWN ON THE PLANS OR NOT.

B. GENERAL CONTRACTOR SHALL REPLACE ANY DAMAGED CEILING TILES THAT RESULT FROM WORK ABOVE CEILING.

C. RECORD EXISTING SUPPLY, RETURN, & EXHAUST FLOWS ASSOCIATED WITH OUTSIDE AIR PRIOR TO DEMOLITION, REBALANCE AIR FLOWS IN AREAS TO QUANTITIES MEASURED BEFORE COMMENCEMENT OF DEMOLITION, UNLESS INDICATED OTHERWISE.

D. CONTRACTOR SHALL FIELD VERIFY AIR QUANTITIES OF ALL AIR DEVICES AND EQUIPMENT PRIOR TO DEMOLITION. CONTRACTOR SHALL VISIT THE SITE TO BECOME FAMILIAR WITH SCOPE OF THE PROJECT. ALL EXISTING CONDITIONS MUST BE VERIFIED PRIOR TO INITIATION OF WORK.

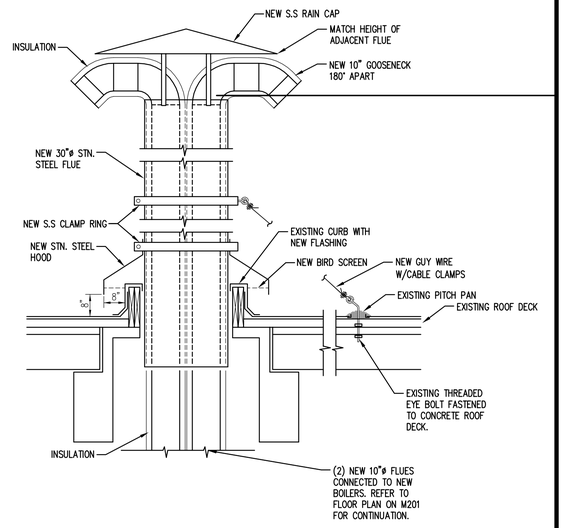
E. EXISTING SYSTEMS TO REMAIN IN SERVICE WHILE NEW SYSTEMS ARE MADE OPERATIONAL, DUCTWORK, PIPING AND ASSOCIATED INSULATION WHICH TO REMAIN IN SERVICE SHALL NOT BE DISTURBED. IF BROKEN DURING CONSTRUCTION OR DEMOLITION, CONTRACTOR SHALL REPLACED WITH NEW DUCT, PIPING AND INSULATION OF SAME SIZE AND MATERIALS. REPAIR ALL DAMAGE CAUSED BY MOVING, RIGGING OR SETTING IN PLACE ANY SYSTEMS ASSOCIATED WITH THIS PROJECT AS REQUIRED. PATCH, REPAIR AND RETURN ALL FINISHED TO ORIGINAL CONDITION. CONSTRUCTION ZONES EXCLUDED.

F. REFER TO ARCHITECTURAL FOR ADDITIONAL DEMO REQUIREMENTS.

G. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER DISPOSAL OF ALL MATERIALS BEING REMOVED.

HEX NOTES

1. COMBUSTION AIR INTAKE. MOUNT INTAKE A MINIMUM OF 30" ABOVE THE FINISHED ROOF.
2. MOUNT INTAKE DUCTWORK PARALLEL TO WALL. PROVIDE WALL BRACKET FOR INTAKE DUCTWORK EVERY 5 FEET.
3. 12"ø EXHAUST FLUE DUCTWORK UP THROUGH ROOF. PROVIDE 25' OF VERTICAL DUCTWORK THROUGH EXISTING FLUE OPENING. PROVIDE DRAIN PORT AT THE LOWEST DUCTWORK ELBOW.
4. 2-12"ø EXHAUST FLUES THROUGH EXISTING ROOF OPENING. REFER TO DETAIL THIS SHEET.
5. 12" EXHAUST FLUE DUCTWORK. TYP.
6. 12" COMBUSTION AIR DUCTWORK TO BE RACKED ALONG WALL.
7. DASHED AREA AROUND THE BOILER INDICATES THE MAINTENANCE CLEARANCE. TYP. PROVIDE 4" HIGH CONCRETE PAD. PROVIDE 6 FEET BY 21 FEET CONCRETE PAD FOR BOILERS. EXTEND EXISTING BOILER CONCRETE PAD AS REQUIRED.



TWO FLUE BOILER BREECHING DETAIL

N.T.S.

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ENG. BUS. No. EB-0005096 CERT. OF AUTH. No. 5096

FLORIDA SCHOOL OF THE DEAF AND BLIND BOILER REPLACEMENT PHASE 1 DESIGN

Revisions

No.	Date	Description

MPE PROJ#: 2014-150A

Designed By: SG

Drawn By: AG/SG

Checked By: SG

Issue Date: 07/06/15

Drawing Scale: 1/8"=1'-0"

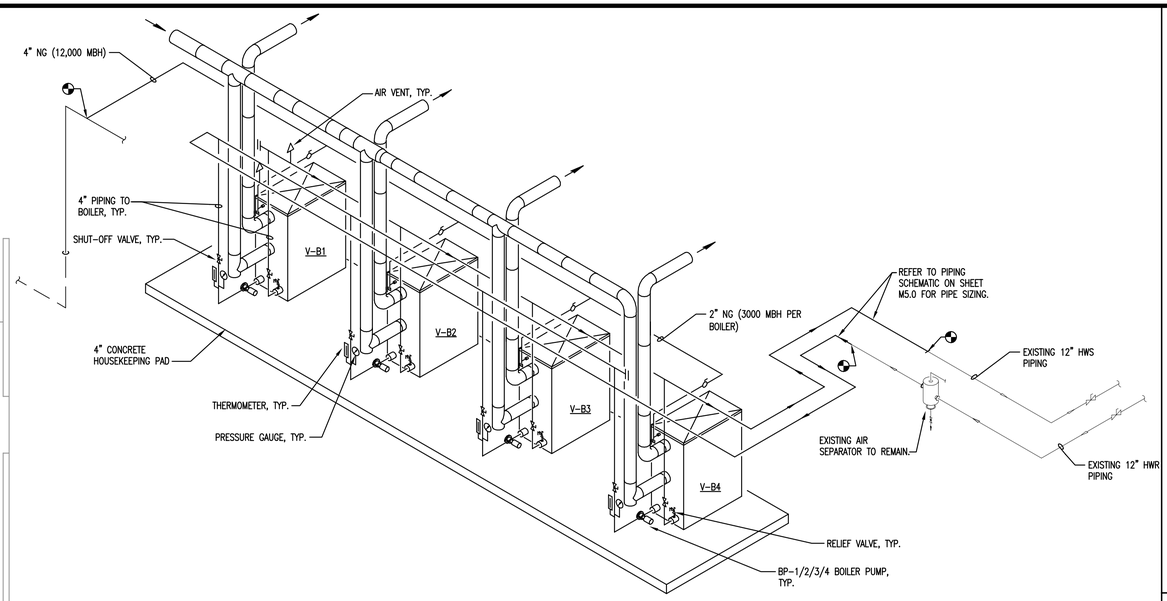
Drawing Title:

MECHANICAL AIR DISTRIBUTION PLAN

CONSTRUCTION DOCUMENTS

Drawing No.

M-3.0



HVAC BOILER SYSTEM ISOMETRIC

NOT TO SCALE

MECHANICAL NEW WORK PLAN

1/8"=1'-0"

0 4' 8' 16'

RENOVATION GENERAL NOTES

A. THE FOLLOWING PLANS ARE INTENDED TO PROVIDE THE CONTRACTOR WITH A GENERAL KNOWLEDGE OF THE EXISTING CONDITIONS WITHIN THE PROJECT AREA. EXISTING EQUIPMENT, STRUCTURE, DUCTWORK, ETC. LOCATED ON DRAWING WERE DERIVED FROM LIMITED FIELD OBSERVATIONS AND THE EXISTING AS-BUILTS WHICH MAY NOT BE UP TO DATE. THIS DRAWING MAY NOT BE ALL INCLUSIVE OF SERVICES THAT EXIST IN THE PROJECT AREA. CONTRACTOR SHALL VERIFY SERVICES AND LOCATIONS PRIOR TO ANY DEMOLITION WORK COMMENCING. ANY DEVIATIONS IMPACTING WORK SHOWN ON THESE DOCUMENTS SHALL BE REPORTED TO THE ARCHITECT AND ENGINEER PRIOR TO BEGINNING DEMOLITION. BEGINNING OF DEMOLITION SHALL SIGNIFY CONTRACTORS ACCEPTANCE OF EXISTING CONDITIONS AND THE COST OF REROUTING DUCTWORK AND/OR THE PIPING DUE TO CONFLICTS WITH EXISTING CONDITIONS SHALL BE PAID BY CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE FOR ALL REQUIRED DEMOLITION WHETHER SHOWN ON THE PLANS OR NOT.

B. GENERAL CONTRACTOR SHALL REPLACE ANY DAMAGED CEILING TILES THAT RESULT FROM WORK ABOVE CEILING.

C. RECORD EXISTING SUPPLY, RETURN, & EXHAUST FLOWS ASSOCIATED WITH OUTSIDE AIR PRIOR TO DEMOLITION, REBALANCE AIR FLOWS IN AREAS TO QUANTITIES MEASURED BEFORE COMMENCEMENT OF DEMOLITION, UNLESS INDICATED OTHERWISE.

D. CONTRACTOR SHALL FIELD VERIFY AIR QUANTITIES OF ALL AIR DEVICES AND EQUIPMENT PRIOR TO DEMOLITION. CONTRACTOR SHALL VISIT THE SITE TO BECOME FAMILIAR WITH SCOPE OF THE PROJECT. ALL EXISTING CONDITIONS MUST BE VERIFIED PRIOR TO INITIATION OF WORK.

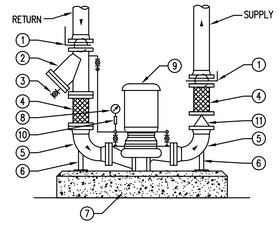
E. EXISTING SYSTEMS TO REMAIN IN SERVICE WHILE NEW SYSTEMS ARE MADE OPERATIONAL. DUCTWORK, PIPING AND ASSOCIATED INSULATION WHICH TO REMAIN IN SERVICE SHALL NOT BE DISTURBED. IF BROKEN DURING CONSTRUCTION OR DEMOLITION, CONTRACTOR SHALL REPLACED WITH NEW DUCT, PIPING AND INSULATION OF SAME SIZE AND MATERIALS. REPAIR ALL DAMAGE CAUSED BY MOVING, RIGGING OR SETTING IN PLACE ANY SYSTEMS ASSOCIATED WITH THIS PROJECT AS REQUIRED. PATCH, REPAIR AND RETURN ALL FINISHED TO ORIGINAL CONDITION. CONSTRUCTION ZONES EXCLUDED.

F. REFER TO ARCHITECTURAL FOR ADDITIONAL DEMO REQUIREMENTS.

G. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER DISPOSAL OF ALL MATERIALS BEING REMOVED.

HEX NOTES

1. REFER TO PIPING SCHEMATIC ON SHEET M5.0 FOR PIPE SIZING.
2. EXISTING AIR SEPARATOR TO REMAIN.
3. PROVIDE NEW 4" CONCRETE HOUSEKEEPING PAD WITH NEOPRENE ISOLATION PAD BELOW BOILERS FOR VIBRATION CONTROL.
4. NEW BOILERS TO BE OWNER PROVIDED AND CONTRACTOR INSTALLED. PROVIDE CONTROL WIRING AND INTERFACE TO EXISTING HONEYWELL EBI SYSTEM. BOILER CONTROL POINTS TO BE PROVIDED AS SPECIFIED.
5. PROVIDE FLOW METER AND BTUH METER ON HWS PIPING. CONNECT METERS TO EXISTING HONEYWELL EBI SYSTEM.
6. PROVIDE HWS AND HWR TEMPERATURE SENSORS ON 12" MAINS. CONNECT TO EXISTING HONEYWELL EBI SYSTEM.
7. PROVIDE REGULATOR, DRIP LEGS, AND SHUT OFF VALVE ON 4" NATURAL GAS MAIN. SET REGULATOR PER BOILER MANUFACTURERS SPECIFICATIONS.
8. EXISTING PORTION OF TRENCH DRAIN TO REMAIN. RUN 4" SANITARY PIPING TO EXISTING SANITARY TAP CONNECTION IN LOCATION SHOWN. SLOPE PIPING PER CODE.
9. FILL EXISTING TRENCH DRAIN WITH HEAVY WEIGHT CONCRETE.
10. EXISTING PORTION OF TRENCH DRAIN TO REMAIN. RUN 2" SANITARY PIPING FROM SINK AND 4" SANITARY PIPING FROM TRENCH DRAIN TO EXISTING SANITARY TAP CONNECTION IN LOCATION SHOWN. SLOPE PIPING PER CODE.
11. EXISTING SANITARY TAP LOCATION.



1. BUTTERFLY VALVE
2. Y-STRAINER
3. BALL VALVE DRAIN W/HOSE END & CAP
4. FLEXIBLE CONNECTOR
5. REDUCING ELBOW
6. PIPE SUPPORT
7. CONCRETE HOUSEKEEPING PAD
8. PRESSURE GAUGE W/MANIFOLD PIPE
9. PUMP AND MOTOR
10. PISTON SNUBBER
11. VERTICAL SPRING LOADED CHECK VALVE

VERTICAL MOUNTED INLINE PUMP

N.T.S.

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Issue Date: 07/06/15

Drawing Scale: 1/8"=1'-0"

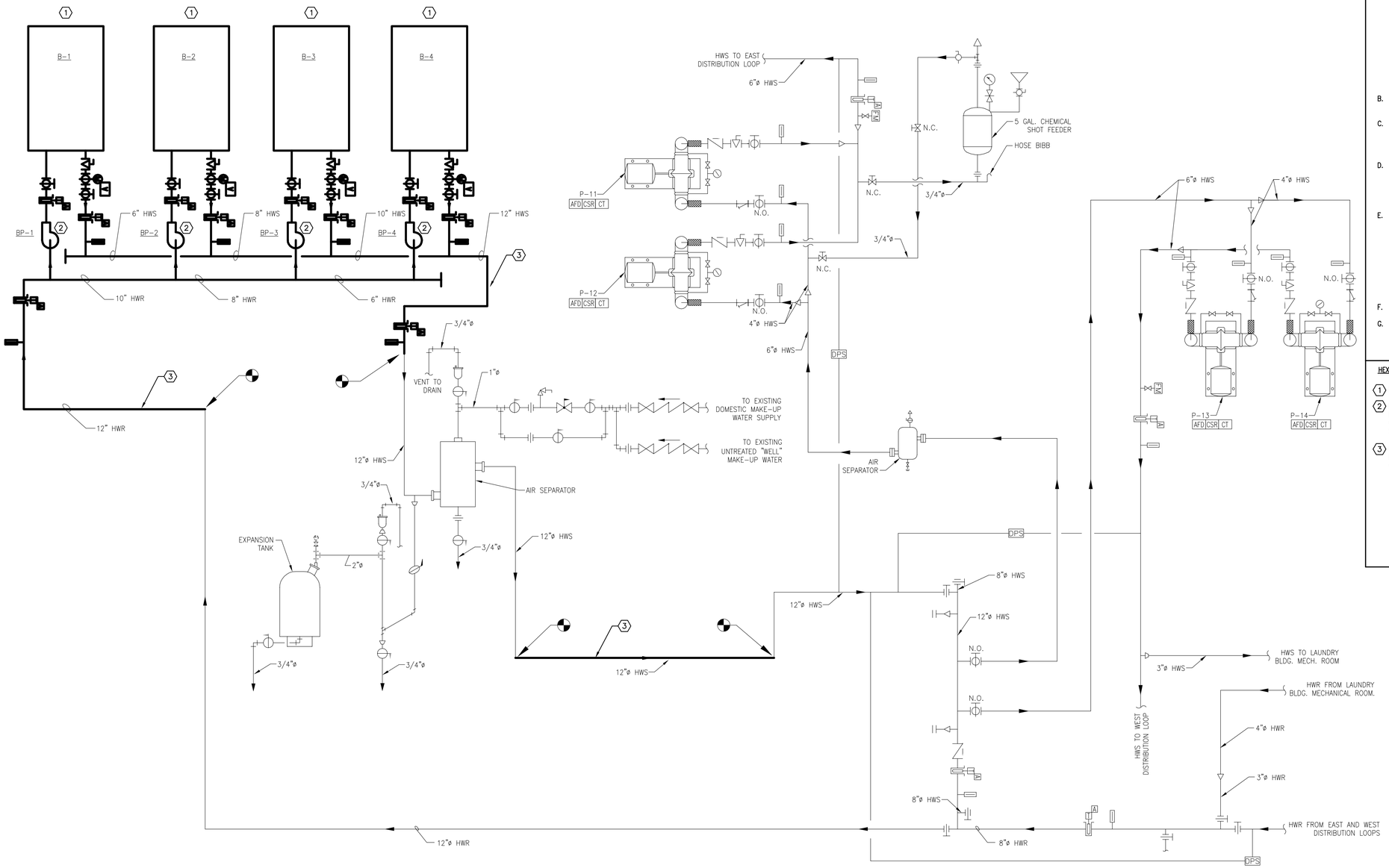
Drawing Title:

MECHANICAL PIPING PLAN

CONSTRUCTION DOCUMENTS

Drawing No.

M-4.0



BOILER PLANT NEW WORK SCHEMATIC

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G. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER DISPOSAL OF ALL MATERIALS BEING REMOVED.

HEX NOTES

(1) NEW BOILERS PROVIDED IN A PREVIOUS BID PACAKGE BY OWNER.

(2) PROVIDE NEW PRIMARY PUMP WITH SUPPLY SIDE CHECK VALVE, BUTTERFLY VALVE, PRESSURE SENSOR, TEMPERATURE SENSOR, UNION, CONTROL VALVE; AND RETURN SIDE BUTTERFLY VAVLE, PRESSURE SENSOR, TEMPERATURE SENSOR AND UNION.

(3) PROVIDE 12" PIPING AND INSULATION WITH COLOR CODED PVC JACKET PER OWNERS REQUIREMENTS. COORDINATE COLOR SELECTION WITH OWNER.

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MECHANICAL
NEW WORK
PIPING SCHEMATIC

CONSTRUCTION DOCUMENTS

Drawing No.
M-5.0