PROJECT MANUAL

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

IFB for Contract No.600-21-24

GENERAL CONSTRUCTION

MECHANICAL CONSTRUCTION

ELECTRICAL CONSTRUCTION

Bids Due

September 6, 2024

10:00 am

Procurement Dept.
412 Boulevard of the .
Allies, 6th Floor
Pittsburgh, PA 15219

Attn:

Procurement Department

CONSULTANT: Tusick & Associates Architects, Inc.

Issued: August 5, 2024

Caster D. Binion
Executive Director

Housing Authority of the City of Pittsburgh

Point of Contact:Darnell.Walker@hacp.org
or 412-643-2806

HACP Development & Modernization

PROCUREMENT DEPARTMENT
412 Boulevards of the Allies, 6th Floor
Pittsburgh, PA 15219
412.456.5020
www.hacp.org

NOTICE TO PROSPECTIVE BIDDERS

July 24, 2024

INVITATION FOR BIDS (IFB)
Bedford Dwellings EnVision Center- New Dedicated Heating Plant AMP- 02

The **HOUSING AUTHORITY OF THE CITY OF PITTSBURGH** will receive separate sealed bids for the following contracts:

GENERAL CONSTRUCTION

ELECTRICAL CONSTRUCTION

MECHANICAL CONSTRUCTION

PLUMBING CONSTRUCTION

The estimated values of the project per contract noted above are in the following ranges:

GENERAL CONSTRUCTION	**$31,437.00**	**$46,107.60**
ELECTRICAL CONSTRUCTION	**$22,669.50**	**$33,248.60**
MECHANICAL CONSTRUCTION	**$74,088.00**	**$108,662.40**
PLUMBING CONSTRUCTION	**$47,055.00**	**$69,014.00**

Bid documents will be available on **August 5, 2024, AT 9:00 AM**

A Pre-Bid Conference will be held on **August 13, 2024, at 10:00 a.m.** at **2305 Bedford Ave, PA 15219.** After the Pre-Bid Conference, a site visit will be conducted thereafter. Bidders shall be prepared to review all aspects of the site necessary to prepare a bid. The last day for submission of written questions will be **August 20, 2024, at 10:00 a.m.**

In addition to electronic submission, The Housing Authority of the City of Pittsburgh will only be accepting physical bids dropped off in person from 8:30 AM until the bid opening time of **10:00 a.m.** on **September 6, 2024,** in the lobby of **412 Boulevard of the Allies, Pittsburgh, PA 15219**. Sealed bids may still be mailed via USPS at which time they will be Time and Date Stamped at **412 Boulevard of the Allies, Pittsburgh, PA 15219.** All bids must be received at the above address no later than **10:00 a.m. on September 6, 2024**, regardless of the selected delivery mechanism.

The work must be substantially complete within **180** calendar days of the Notice to Proceed.

Point of contact for the Housing Authority is Anna Jasim at (412) 643-2869.

Bid Documents, including the Bid Forms, Project Manual, and Drawings, may be obtained from the Business Opportunities Section of the HACP website, www.hacp.org. Prospective Bidders may register as a vendor on the website and download the documents free of charge. Electronic Versions of the Bid Documents may also be obtained in person**, Monday through Friday 8:30 a.m. to 4:30 p.m**. at the Housing Authority of the City of Pittsburgh located at **412 Boulevard of the Allies, Pittsburgh, PA 15219**.

HACP Development & Modernization

412 Boulevards of the Allies, 6th Floor
Pittsburgh, PA 15219
412.456.5020
www.hacp.org

PRE-BID SITE VISIT

The Pre-Bid Site visit will be held on **08/13/2024** at **10:00am** at the address of **2305 Bedford Ave, PA 15219**. Interested bidders may decide to attend.

PROPOSAL SUBMISSION

The Housing Authority of the City of Pittsburgh will be accepting physical proposals dropped off in person up until **September 6, 2024**, at the closing time of **10:00am**. Bids may also be submitted electronically at the following link (copy+paste):

https://www.dropbox.com/request/x5JzcGb9S4GkvftZl8RD?oref=e

Bids can still be mailed via USPS at which time they will be Time and Date Stamped at Procurement Department, 412 Boulevard of the Allies, 6th Floor, Pittsburgh, PA 15219. All Bids must be received at the above address no later than **September 6, 2024, at 10:00am**. Regardless of the selected delivery mechanism.

BID OPENING

The bid opening will be on September 6, 2024, at 10:00am and will be conducted virtually via Zoom.

Zoom Link:https://hacp-org.zoom.us/j/84722328838?pwd=1bYxNqLEpDlaZHndUELaQ804gu6Wmp.1
Meeting ID: 847 2232 8838
Passcode: 684522
One tap mobile
+13092053325,,84722328838#,,,,*684522# US
+13126266799,,84722328838#,,,,*684522# US (Chicago)

AWARD OF CONTRACT (S):

It is the intention of the Authority to award a contract to the lowest responsive and responsible bidder.

All bids shall remain open for the period specified in the IFB, which in no case shall be less than sixty (60) calendar days from the bid opening.

All bids of $10,000 or more must be accompanied by a negotiable bid guarantee that shall not be less than 5% of the amount of the bid. No bid guarantee is required for bids under $10,000. In accordance with 2 CFR 200.318(h) formerly 24 CFR Section 85.36(b)(8), the Authority is permitted to make awards only to responsible bidders possessing the ability to perform successfully under the terms and conditions of the proposed contract. Prior to award of any contract, the Authority shall conduct a pre-contract survey. Consideration will be given to such matters as bidder integrity, compliance with public policy, record of past performance, and financial and technical resources.

All bids must include a completed and signed Form of Agreement (Form 00500) as part of the bid. If the bid is successful and approved by HACP Board of Commissioners (if applicable), HACP will also sign the Form of Agreement thus creating a binding contract.

The successful bidder will be required to furnish an assurance of completion (performance and payment bond) each equal to 100% of the contract price.

The Authority reserves the right to reject any or all bids or to waive any informality in the bidding.

EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS:

The Contractor will be required to comply with all applicable Equal Employment Opportunity requirements for Federally-Assisted Construction Contracts. The Contractor must insure that employees and applicants for employment are not discriminated against because of race, color, religion, sexual preference, handicap or national origin.

A. Section 3 Participation

The work to be performed under this contract is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C 1701u and with HUD's regulations set forth at 24 CFR Part 135 ("Section 3"). The purpose of Section 3 is to ensure that employment and other economic opportunities generated by HUD assistance shall be directed to low and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

> Please describe ways the Bidder will assist HACP to comply with HUD's Section 3 requirements for hiring HACP residents and/or local disadvantaged individuals and businesses by reviewing the Section 3 Clause and by completing **Document 00433 – Section 3 Form.**

Section 3 of the Housing and Urban Development Act of 1968, as amended (12 U.S.C. 1701, et seq.) (the "Act") requires the Housing Authority of the City of Pittsburgh to ensure that employment and other economic and business opportunities generated by financial assistance from the Department of Housing and Urban Development ("HUD"), to the greatest extent feasible, are directed to public housing residents and other low income persons, particularly recipients of government housing assistance, and business concerns that provide economic opportunities to low and very low income persons.

To comply with the Act HACP requires its contractors to provide equal employment opportunity to all employees and applicants for employment without regard to race, color, religion, sex, national origin, disability, veteran's or marital status, or economic status and to take affirmative action to ensure that both job applicants and existing employees are given fair and equal treatment.

The goal of this policy is to obtain a reasonable level of success in the recruitment, employment, and utilization of HACP residents and other eligible persons and/or businesses by contractors working on contracts partially or wholly funded with HUD monies. HACP shall examine and consider a contractor's potential for success in providing employment and business opportunities to those covered under Section 3 prior to acting on any proposed contract award. In response to any RFP, RFQ or IFB HACP will require submission of the Section 3 Opportunities Plan and roster of current employees, and certification that the bidder will comply with the requirements of Section 3 either by hiring Section 3 employees to directly perform under the contract or by committing a dollar amount to HACP's Section 3 program in an amount consistent with the chart below. Below are the HACP Section 3 Guidelines as listed in the HACP Section 3 Program Manual:

RESIDENT HIRING REQUIREMENTS / RESIDENT HIRING SCALE

TOTAL LABOR DOLLARS USE TOTAL CONTRACT AMOUNT FOR SERVICE CONTRACTS	**RESIDENT LABOR AS A % OF TOTAL LABOR** **A.** DOLLARS
Labor dollars $25,000 but less than $100,000	10% of the labor dollars
$100,000, but less than $200,000	9% of the labor dollars
At least $200,000, but less than $300,000	8% of the labor dollars
At least $300,000, but less than $400,000	7% of the labor dollars
At least $400,000, but less than $500,000	6% of the labor dollars
At least $500,000, but less than $1 million	5% of the labor dollars
At least $1 million, but less than $2 million	4% of the labor dollars
At least $2 million, but less than $4 million	3% of the labor dollars
At least $4 million, but less than $7 million	2% of the labor dollars
$7 million or more	½ to 1 % of the labor dollars

***A copy of HACP's Section 3 Program Manual is available for download at www.hacp.org*

A copy of HUD's Section 3 requirement is provided herein. If you have any questions regarding the Section 3 Requirements or would like to discuss goals and planning for Section 3 Requirements please contact Mr. Lloyd Wilson, Resident Employment Manager/Section 3 Coordinator, by e-mail at lloyd.wilson@hacp.org or by contacting him at the Housing Authority of the City of Pittsburgh, Resident Employment Program located at the Bedford Hope Center, 2305 Bedford Ave, Pittsburgh PA 15219, telephone (412) 395-3950, ext. 1048. Proposals must demonstrate how the Offeror intends to meet or exceed the Authority's Section 3 requirements. Proposals submitted without a Section 3 plan may be deemed nonresponsive. Also, please complete **Section 3 Opportunities Plan** and include with your proposal.

Any bid or proposal received from a contractor that does not contain a Section 3 Opportunities Plan or certification and back-up documentation acceptable to HACP shall be deemed non-responsive by HACP.

B. MBE/WBE Participation Plan

HACP MBE and WBE Goals. It is the policy of HACP to ensure that Minority Business Enterprises (MBEs) and Women-owned Businesses (WBEs) are provided maximum opportunity to participate in contracts let by HACP. In accordance with Executive Order 11625, HACP has established a minimum threshold of eighteen percent (18%) of the total dollar amount for MBE utilization in this contract. HACP has established a seven percent (7%) minimum threshold for participation of WBEs, and, HACP strongly encourages and affirmatively promotes the use of MBEs and WBEs in all HACP contracts. For these purposes, an MBE is defined as "any legal entity other than a joint venture, organized to engage in commercial transactions, that is at least fifty-one percent (51%) owned and controlled by one or more minority persons." Also, a minority person is defined as a member of a socially or economically disadvantaged minority group, which includes African-Americans, Hispanic-Americans, Native-Americans, and Asian-Americans. A WBE/MBE is defined as "any legal entity other than a joint venture, organized to engage in commercial transactions, that is at least fifty-one percent (51%) owned and controlled by a female.

Bids or proposals submitted in response to this solicitation MUST include an MBE/WBE participation plan which, at a minimum demonstrates "Best Efforts" have been taken to achieve compliance with MBE/WBE goals. HACP's Procurement Policy defines "Best Efforts" in compliance with MBE/WBE goals to mean that the contractor must certify and document with its bid or proposal that it has contacted in writing at least ten (10) certified MBE and ten (10) certified WBE subcontractors to participate in the proposed contract with or lesser number if the contractor provides documentation that ten (10) certified MBE/WBE contractors could not be identified. Each contractor shall certify as to same under penalty of perjury and shall submit the back-up documentation with its bid or proposal. Any bid or proposal received from a contractor that does not contain such certification and back-up documentation acceptable to HACP may be deemed non-responsive by HACP.

If you have any questions regarding the HACP MBE/WBE goals please contact Renelda Colvin, MBE/WBE Compliance Specialist, by e-mail at Renelda.Colvin@hacp.org or by contacting her at the Procurement Department, Housing Authority of the City of Pittsburgh, 412 Boulevard of the Allies, 6th Floor, Pittsburgh PA 15219, telephone (412) 643-2768. Bids or proposals must demonstrate how the Offerer intends to meet or exceed these goals.

The Authority's Minority and Woman Business (MBE/WBE) participation goals are as follows:

-- MBE Goal: 18%
-- WBE Goal: 7%

Additionally, please be advised that participation credit will be applied in accordance with the following classifications, as follows:

-- Broker:	10% of contract face value
-- Supplier:	60% of contract face value
-- Bona Fide Contractor:	100% of contract face value
-- All Professional Service Firms:	100% of contract face value

Vendor definitions for the above classifications are to be referenced in either the respective vendor MBE/WBE certifications or as defined in 49 CFR Part 26.

Please describe ways the Bidder will utilize MBE/WBE businesses to meet the goals above by completing **Document 00434** – **MBE/WBE Solicitation & Commitment Record**.

Caster D. Binion
Executive Director
Housing Authority of the City of Pittsburgh

Housing Authority of the City of Pittsburgh

Development & Modernization
412 Boulevard of the Allies
6th Floor, Pittsburgh, PA
15219
(412) 456-5020
www.hacp.org

SPECIAL PROVISIONS

NOTICE TO ALL PROSPECTIVE BIDDERS

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

CONTRACT NO. 600-21-24

Each successful bidder(s) shall be required to comply with the following special provisions:

A. Required Documents/Information

After bid opening and determination of the responsive and responsible bidder, but prior to Notice to Proceed each successful bidder for this project shall provide the following documents/information to HACP within ten (10) business days of receiving written notice thereof:

(1) Insurance
(2) Payment and Performance Bonds
(3) Construction Schedule
(4) Submittal Log and Corresponding Submittals

Please accept these special provisions by completing the information requested below:

Signature of Authorized Officer: _____ Date: _____

Name of Contractor: _____

Address: _____

Telephone Number: _____

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

IFB CONTRACT NO. 600-21-24

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
DEVELOPMENT & MODERNIZATION DEPARTMENT
412 Boulevard of the Allies, 6th Floor
Pittsburgh, PA 15219
Phone: (412) 456-5020
Fax: (412) 456-5591

Issued: August 5, 2024

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP Contract No. 600-21-24

PROJECT MANUAL
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HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP CONTRACT NO. 600-21-24

INVITATION FOR BIDS
LIST OF DOCUMENTS

The HOUSING AUTHORITY OF THE CITY OF PITTSBURGH will receive separate sealed bids for Bedford Dwellings EnVision Center-New Dedicated Heating Plant, for the following contracts:

GENERAL CONSTRUCTION

MECHANICAL CONSTRUCTION

ELECTRICAL CONSTRUCTION

A complete **Invitation for Bids (IFB)** consists of the following documents:

THE PROJECT MANUAL, **dated** August 5, 2024 consisting of:

Bidding Requirements, Contract Forms, Conditions of the Contract, Wage Determination, and the Specifications.

THE PROJECT DRAWINGS, as prepared by **Tusick & Associates Architects, Inc.**, **dated June 27, 2023**.

THE BID PACKAGE, **dated** August 5, 2024 consisting of a single three-ring binder containing:

Blank bid document forms to be completed by the bidder;

Divider tabs to separate the original bid documents from the copies;

A pre-printed, pre-addressed envelope in which to deliver the bid.

ADDENDA will be issued as required.

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

IDENTIFICATION OF OWNER

The Owner of this project is the Housing Authority of the City of Pittsburgh, a body corporate and politic and created pursuant to the "Housing Authorities Law," an Act passed by the 1937 session of the Legislature of the Commonwealth of Pennsylvania, P.L. 955, approved May 28, 1937, hereinafter variously called the "Housing Authority of the City of Pittsburgh" (HACP), "The Authority," the "Local Housing Authority" (LHA), the "Public Housing Authority" (PHA), or the "Public Housing Authority/Indian Housing Authority" (PHA/IHA).

Caster D. Binion
Executive Director
Housing Authority of the City of Pittsburgh

James D. Harris, Esquire
General Counsel
Housing Authority of the City of Pittsburgh

Procurement Department
Housing Authority of the City of Pittsburgh

U.S. Department of Housing and Urban Development
Office of Public and Indian Housing

Instructions to Bidders for Contracts Public and Indian Housing Programs

Instructions to Bidders for Contracts

Public and Indian Housing Programs

Table of Contents

1. Bid Preparation and Submission

(a) Bidders are expected to examine the specifications, drawings, all instructions, and, if applicable, the construction site (see also the contract clause entitled **Site Investigation and Conditions Affecting the Work** of the *General Conditions of the Contract for Construction*). Failure to do so will be at the bidders' risk.

(b) All bids must be submitted on the forms provided by the Public Housing Agency/Indian Housing Authority (PHA/IHA). Bidders shall furnish all the information required by the solicitation. Bids must be signed and the bidder's name typed or printed on the bid sheet and each continuation sheet which requires the entry of information by the bidder. Erasures or other changes must be initialed by the person signing the bid. Bids signed by an agent shall be accompanied by evidence of that agent's authority. (Bidders should retain a copy of their bid for their records.)

(c) Bidders must submit as part of their bid a completed form HUD-5369-A, "Representations, Certifications, and Other Statements of Bidders."

(d) All bid documents shall be sealed in an envelope which shall be clearly marked with the words "Bid Documents," the Invitation for Bids (IFB) number, any project or other identifying number, the bidder's name, and the date and time for receipt of bids.

(e) If this solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "No Bid" in the space provided for any item on which no price is submitted.

(f) Unless expressly authorized elsewhere in this solicitation, alternate bids will not be considered.

(g) Unless expressly authorized elsewhere in this solicitation, bids submitted by telegraph or facsimile (fax) machines will not be considered.

(h) If the proposed contract is for a Mutual Help project (as described in 24 CFR Part 905, Subpart E) that involves Mutual Help contributions of work, material, or equipment, supplemental information regarding the bid advertisement is provided as an attachment to this solicitation.

2. Explanations and Interpretations to Prospective Bidders

(a) Any prospective bidder desiring an explanation or interpretation of the solicitation, specifications, drawings, etc., must request it at least 7 days before the scheduled time for bid opening. Requests may be oral or written. Oral requests must be confirmed in writing. The only oral clarifications that will be provided will be those clearly related to solicitation procedures, i.e., not substantive technical information. No other oral explanation or interpretation will be provided. Any information given a prospective bidder concerning this solicitation will be furnished promptly to all other prospective bidders as a written amendment to the solicitation, if that information is necessary in submitting bids, or if the lack of it would be prejudicial to other prospective bidders.

(b) Any information obtained by, or provided to, a bidder other than by formal amendment to the solicitation shall not constitute a change to the solicitation.

3. Amendments to Invitations for Bids

(a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.

(b) Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date on the bid form, or (3) by letter, telegram, or facsimile, if those methods are authorized in the solicitation. The PHA/IHA must receive acknowledgement by the time and at the place specified for receipt of bids. Bids which fail to acknowledge the bidder's receipt of any amendment will result in the rejection of the bid if the amendment(s) contained information which substantively changed the PHA's/IHA's requirements.

(c) Amendments will be on file in the offices of the PHA/IHA and the Architect at least 7 days before bid opening.

4. Responsibility of Prospective Contractor

(a) The PHA/IHA will award contracts only to responsible prospective contractors who have the ability to perform successfully under the terms and conditions of the proposed contract. In determining the responsibility of a bidder, the PHA/IHA will consider such matters as the bidder's:

(1) Integrity;

(2) Compliance with public policy;

(3) Record of past performance; and

(4) Financial and technical resources (including construction and technical equipment).

(b) Before a bid is considered for award, the bidder may be requested by the PHA/IHA to submit a statement or other documentation regarding any of the items in paragraph (a) above. Failure by the bidder to provide such additional information shall render the bidder nonresponsible and ineligible for award.

5. Late Submissions, Modifications, and Withdrawal of Bids

(a) Any bid received at the place designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made and it:

(1) Was sent by registered or certified mail not later than the fifth calendar day before the date specified for receipt of offers (e.g., an offer submitted in response to a solicitation requiring receipt of offers by the 20th of the month must have been mailed by the 15th);

(2) Was sent by mail, or if authorized by the solicitation, was sent by telegram or via facsimile, and it is determined by the PHA/IHA that the late receipt was due solely to mishandling by the PHA/IHA after receipt at the PHA/IHA; or

(3) Was sent by U.S. Postal Service Express Mail Next Day Service - Post Office to Addressee, not later than 5:00 p.m. at the place of mailing two working days prior to the date specified for receipt of proposals. The term "working days" excludes weekends and observed holidays.

(b) Any modification or withdrawal of a bid is subject to the same conditions as in paragraph (a) of this provision.

(c) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent either by registered or certified mail is the U.S. or Canadian Postal Service postmark both on the envelope or wrapper and on the original receipt from the U.S. or Canadian Postal Service. Both postmarks must show a legible date or the bid, modification, or withdrawal shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, bidders should request the postal clerk to place a hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

(d) The only acceptable evidence to establish the time of receipt at the PHA/IHA is the time/date stamp of PHA/IHA on the proposal wrapper or other documentary evidence of receipt maintained by the PHA/IHA.

(e) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent by Express Mail Next Day Service-Post Office to Addressee is the date entered by the post office receiving clerk on the "Express Mail Next Day Service-Post Office to Addressee" label and the postmark on both the envelope or wrapper and on the original receipt from the U.S. Postal Service. "Postmark" has the same meaning as defined in paragraph (c) of this provision, excluding postmarks of the Canadian Postal Service. Therefore, bidders should request the postal clerk to place a legible hand cancellation bull's eye postmark on both the receipt and Failure by a bidder to acknowledge receipt of the envelope or wrapper.

(f) Notwithstanding paragraph (a) of this provision, a late modification of an otherwise successful bid that makes its terms more favorable to the PHA/IHA will be considered at any time it is received and may be accepted.

(g) Bids may be withdrawn by written notice, or if authorized by this solicitation, by telegram (including mailgram) or facsimile machine transmission received at any time before the exact time set for opening of bids; provided that written confirmation of telegraphic or facsimile withdrawals over the signature of the bidder is mailed and postmarked prior to the specified bid opening time. A bid may be withdrawn in person by a bidder or its authorized representative if, before the exact time set for opening of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid.

6. Bid Opening

All bids received by the date and time of receipt specified in the solicitation will be publicly opened and read. The time and place of opening will be as specified in the solicitation. Bidders and other interested persons may be present.

7. Service of Protest

(a) Definitions. As used in this provision:

"Interested party" means an actual or prospective bidder whose direct economic interest would be affected by the award of the contract.

"Protest" means a written objection by an interested party to this solicitation or to a proposed or actual award of a contract pursuant to this solicitation.

(b) Protests shall be served on the Contracting Officer by obtaining written and dated acknowledgement from —

Contracting Officer
Legal Department
Housing Authority of the City of Pittsburgh
200 Ross Street, 7th Floor
Pittsburgh, PA 15219

[Contracting Officer designate the official or location where a protest may be served on the Contracting Officer]

(c) All protests shall be resolved in accordance with the PHA's/IHA's protest policy and procedures, copies of which are maintained at the PHA/IHA.

8. Contract Award

(a) The PHA/IHA will evaluate bids in response to this solicitation without discussions and will award a contract to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the PHA/IHA considering only price and any price-related factors specified in the solicitation.

(b) If the apparent low bid received in response to this solicitation exceeds the PHA's/IHA's available funding for the proposed contract work, the PHA/IHA may either accept separately priced items (see 8(e) below) or use the following procedure to determine contract award. The PHA/IHA shall apply in turn to each bid (proceeding in order from the apparent low bid to the high bid) each of the separately priced bid deductible items, if any, in their priority order set forth in this solicitation. If upon the application of the first deductible item to all initial bids, a new low bid is within the PHA's/IHA's available funding, then award shall be made to that bidder. If no bid is within the available funding amount, then the PHA/IHA shall apply the second deductible item. The PHA/IHA shall continue this process until an evaluated low bid, if any, is within the PHA's/IHA's available funding. If upon the application of all deductibles, no bid is within the PHA's/IHA's available funding, or if the solicitation does not request separately priced deductibles, the PHA/IHA shall follow its written policy and procedures in making any award under this solicitation.

(c) In the case of tie low bids, award shall be made in accordance with the PHA's/IHA's written policy and procedures.

(d) The PHA/IHA may reject any and all bids, accept other than the lowest bid (e.g., the apparent low bid is unreasonably low), and waive informalities or minor irregularities in bids received, in accordance with the PHA's/IHA's written policy and procedures.

(e) Unless precluded elsewhere in the solicitation, the PHA/IHA may accept any item or combination of items bid.

(f) The PHA/IHA may reject any bid as nonresponsive if it is materially unbalanced as to the prices for the various items of work to be performed. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated for other work.

(g) A written award shall be furnished to the successful bidder within the period for acceptance specified in the bid and shall result in a binding contract without further action by either party.

9. Bid Guarantee (applicable to construction and equipment contracts exceeding $25,000)

All bids must be accompanied by a negotiable bid guarantee which shall not be less than five percent (5%) of the amount of the bid. The bid guarantee may be a certified check, bank draft, U.S. Government Bonds at par value, or a bid bond secured by a surety company acceptable to the U.S. Government and authorized to do business in the state where the work is to be performed. In the case where the work under the contract will be performed on an Indian reservation area, the bid guarantee may also be an irrevocable Letter of Credit (see provision 10, Assurance of Completion, below). Certified checks and bank drafts must be made payable to the order of the PHA/IHA. The bid guarantee shall insure the execution of the contract and the furnishing of a method of assurance of completion by the successful bidder as required by the solicitation. Failure to submit a bid guarantee with the bid shall result in the rejection of the bid. Bid guarantees submitted by unsuccessful bidders will be returned as soon as practicable after bid opening.

10. Assurance of Completion

(a) Unless otherwise provided in State law, the successful bidder shall furnish an assurance of completion prior to the execution of any contract under this solicitation. This assurance may be [Contracting Officer check applicable items] —

[X] (1) a performance and payment bond in a penal sum of 100 percent of the contract price; or, as may be required or permitted by State law;

[ ] (2) separate performance and payment bonds, each for 50 percent or more of the contract price;

[ ] (3) a 20 percent cash escrow;

[ ] (4) a 25 percent irrevocable letter of credit; or,

[ ] (5) an irrevocable letter of credit for 10 percent of the total contract price with a monitoring and disbursements agreement with the IHA (applicable only to contracts awarded by an IHA under the Indian Housing Program).

(b) Bonds must be obtained from guarantee or surety companies acceptable to the U.S. Government and authorized to do business in the state where the work is to be performed. Individual sureties will not be considered. U.S. Treasury Circular Number 570, published annually in the Federal Register, lists companies approved to act as sureties on bonds securing Government contracts, the maximum underwriting limits on each contract bonded, and the States in which the company is licensed to do business. Use of companies listed in this circular is mandatory. Copies of the circular may be downloaded on the U.S. Department of Treasury website **http://www.fms.treas.gov/c570/index.html**, or ordered for a minimum fee by contacting the Government Printing Office at (202) 512-2168.

(c) Each bond shall clearly state the rate of premium and the total amount of premium charged. The current power of attorney for the person who signs for the surety company must be attached to the bond. The effective date of the power of attorney shall not precede the date of the bond. The effective date of the bond shall be on or after the execution date of the contract.

(d) Failure by the successful bidder to obtain the required assurance of completion within the time specified, or within such extended period as the PHA/IHA may grant based upon reasons determined adequate by the PHA/IHA, shall render the bidder ineligible for award. The PHA/IHA may then either award the contract to the next lowest responsible bidder or solicit new bids. The PHA/IHA may retain the ineligible bidder's bid guarantee.

11. Preconstruction Conference (applicable to construction contracts)

After award of a contract under this solicitation and prior to the start of work, the successful bidder will be required to attend a preconstruction conference with representatives of the PHA/IHA and its architect/engineer, and other interested parties convened by the PHA/IHA. The conference will serve to acquaint the participants with the general plan of the construction operation and all other requirements of the contract (e.g., Equal Employment Opportunity, Labor Standards). The PHA/IHA will provide the successful bidder with the date, time, and place of the conference.

12. Indian Preference Requirements (applicable only if this solicitation is for a contract to be performed on a project for an Indian Housing Authority)

(a) HUD has determined that the contract awarded under this solicitation is subject to the requirements of section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e(b)). Section 7(b) requires that any contract or subcontract entered into for the benefit of Indians shall require that, to the greatest extent feasible

(1) Preferences and opportunities for training and employment (other than core crew positions; see paragraph (h) below) in connection with the administration of such contracts or subcontracts be given to qualified "Indians." The Act defines "Indians" to mean persons who are members of an Indian tribe and defines "Indian tribe" to mean any Indian tribe, band, nation, or other organized group or community, including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act, which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians; and,

(2) Preference in the award of contracts or subcontracts in connection with the administration of contracts be given to Indian organizations and to Indian-owned economic enterprises, as defined in section 3 of the Indian Financing Act of 1974 (25 U.S.C. 1452). That Act defines "economic enterprise" to mean any Indian-owned commercial, industrial, or business activity established or organized for the purpose of profit, except that the Indian ownership must constitute not less than 51 percent of the enterprise; "Indian organization" to mean the governing body of any Indian tribe or entity established or recognized by such governing body; "Indian" to mean any person who is a member of any tribe, band, group, pueblo, or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs and any "Native" as defined in the Alaska Native Claims Settlement Act; and Indian "tribe" to mean any Indian tribe, band, group, pueblo, or community including Native villages and Native groups (including

corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs.

(b) (1) The successful Contractor under this solicitation shall comply with the requirements of this provision in awarding all subcontracts under the contract and in providing training and employment opportunities.

(2) A finding by the IHA that the contractor, either (i) awarded a subcontract without using the procedure required by the IHA, (ii) falsely represented that subcontracts would be awarded to Indian enterprises or organizations; or, (iii) failed to comply with the contractor's employment and training preference bid statement shall be grounds for termination of the contract or for the assessment of penalties or other remedies.

(c) If specified elsewhere in this solicitation, the IHA may restrict the solicitation to qualified Indian-owned enterprises and Indian organizations. If two or more (or a greater number as specified elsewhere in the solicitation) qualified Indian-owned enterprises or organizations submit responsive bids, award shall be made to the qualified enterprise or organization with the lowest responsive bid. If fewer than the minimum required number of qualified Indian-owned enterprises or organizations submit responsive bids, the IHA shall reject all bids and readvertise the solicitation in accordance with paragraph (d) below.

(d) If the IHA prefers not to restrict the solicitation as described in paragraph (c) above, or if after having restricted a solicitation an insufficient number of qualified Indian enterprises or organizations submit bids, the IHA may advertise for bids from non-Indian as well as Indian-owned enterprises and Indian organizations. Award shall be made to the qualified Indian enterprise or organization with the lowest responsive bid if that bid is -

(1) Within the maximum HUD-approved budget amount established for the specific project or activity for which bids are being solicited; and

(2) No more than the percentage specified in 24 CFR 905.175(c) higher than the total bid price of the lowest responsive bid from any qualified bidder. If no responsive bid by a qualified Indian-owned economic enterprise or organization is within the stated range of the total bid price of the lowest responsive bid from any qualified enterprise, award shall be made to the bidder with the lowest bid.

(e) Bidders seeking to qualify for preference in contracting or subcontracting shall submit proof of Indian ownership with their bids. Proof of Indian ownership shall include but not be limited to:

(1) Certification by a tribe or other evidence that the bidder is an Indian. The IHA shall accept the certification of a tribe that an individual is a member.

(2) Evidence such as stock ownership, structure, management, control, financing and salary or profit sharing arrangements of the enterprise.

(f) (1) All bidders must submit with their bids a statement describing how they will provide Indian preference in the award of subcontracts. The specific requirements of that statement and the factors to used by the IHA in determining the statement's adequacy are included as an attachment to this solicitation. Any bid that fails to include the required statement shall be rejected as nonresponsive. The IHA may require that comparable statements be provided by subcontractors to the successful Contractor, and may require the Contractor to reject any bid or proposal by a subcontractor that fails to include the statement.

(2) Bidders and prospective subcontractors shall submit a certification (supported by credible evidence) to the IHA in any instance where the bidder or subcontractor believes it is infeasible to provide Indian preference in subcontracting. The acceptance or rejection by the IHA of the certification shall be final. Rejection shall disqualify the bid from further consideration.

(g) All bidders must submit with their bids a statement detailing their employment and training opportunities and their plans to provide preference to Indians in implementing the contract; and the number or percentage of Indians anticipated to be employed and trained. Comparable statements from all proposed subcontractors must be submitted. The criteria to be used by the IHA in determining the statement(s)'s adequacy are included as an attachment to this solicitation. Any bid that fails to include the required statement(s), or that includes a statement that does not meet minimum standards required by the IHA shall be rejected as nonresponsive.

(h) Core crew employees. A core crew employee is an individual who is a bona fide employee of the contractor at the time the bid is submitted; or an individual who was not employed by the bidder at the time the bid was submitted, but who is regularly employed by the bidder in a supervisory or other key skilled position when work is available. Bidders shall submit with their bids a list of all core crew employees.

(i) Preference in contracting, subcontracting, employment, and training shall apply not only on-site, on the reservation, or within the IHA's jurisdiction, but also to contracts with firms that operate outside these areas (e.g., employment in modular or manufactured housing construction facilities).

(j) Bidders should contact the IHA to determine if any additional local preference requirements are applicable to this solicitation.

(k) The IHA [ ] does [X] does not [Contracting Officer check applicable box] maintain lists of Indian-owned economic enterprises and Indian organizations by specialty (e.g., plumbing, electrical, foundations), which are available to bidders to assist them in meeting their responsibility to provide preference in connection with the administration of contracts and subcontracts.

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP CONTRACT NO. 600-21-24

NOTICE OF PRE-BID CONFERENCE

A Pre-Bid Conference will be held on August 13, 2024

- A Pre-Bid Conference will be held on August 13, 2024 **at** 10:00 am, at the _____ _____. A site visit of the property will be conducted thereafter. Bidders shall be prepared to review all aspects of the site necessary to prepare a bid.

- Representatives of the Authority, the engineer and other interested parties will be in attendance.

All bidders are urged to attend.

- Bidders are responsible for examining the construction site. (Refer to "Instructions to Bidders for Contracts," Document HUD 5369, Clause 1, "Bid Preparation and Submission.") Notwithstanding the above, lack of attendance will not be a basis for rejecting a bid.

- Bidders are urged to examine the drawings and specifications prior to the Pre-Bid Conference.

- Nothing at the Pre-Bid Conference will change the terms of the IFB unless a subsequent Addendum is issued. (Refer to "Instructions to Bidders for Contracts," Document HUD 5369, Clause 2, "Explanations and Interpretations to Prospective Bidders.")

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP CONTRACT NO. 600-21-24

PROJECT SCHEDULE

NO LATER THAN	
August 5, 2024	Invitation for Bids issued
August 13, 2024 10:00 am	Pre-Bid Conference (On-Site)
August 20, 2024 10:00 am	Last day to submit written questions
September 6, 2024 10:00 am	Bids due
September 20, 2024 (estimated)	Notice of Award
September 30, 2024 (estimated)	Execution of Contracts
October 1, 2024 (estimated)	Pre-Construction Conference
October 1, 2024 (estimated)	Construction Start
180 calendar days from effective date of Notice to Proceed	All work required under this contract shall be complete

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP CONTRACT NO. 600-21-24

SCOPE OF WORK FOR GENERAL CONSTRUCTION

The Contract for General Construction shall consist of the following component parts:

1. THE AGREEMENT
(Bound in the Project Manual)

THE BID	Document 00310 - Scope of Work for General Construction Document 00311 - Form of Bid for General Construction
THE FORM OF AGREEMENT	Document 00500 - Form of Agreement Document 00590 - Contracting Officer Certification
CONDITIONS OF THE CONTRACT	Document HUD - 5370 General Conditions HACP Document - Supplemental General Conditions Document 00830 - Wage Determination Schedule

2. PRIMARY SPECIFICATIONS FOR THE GENERAL CONSTRUCTION CONTRACT
(Bound in the Project Manual)

All Work contained in the Primary Specifications listed below is the Work of the Contractor for this General Construction Contract unless specifically indicated otherwise.

Any Reference in the Primary Specifications to the "Contractor," the "Prime Contractor," or the "General Contractor" shall be interpreted as meaning the Contractor for this General Construction Contract.

The General Contractor shall coordinate the schedule and activities of work performed by this and all other Prime Contracts, as identified by (G)-General, (P)-Plumbing, (H)-HVAC, and (E)-Electrical.

It is the contractual responsibility of the Contractor for General Construction to familiarize himself with the work of the other prime contractors so that the Project as a whole can proceed in an orderly fashion. Failure to familiarize work by other trades would not be an excuse for corrective measures at no cost to the City of Pittsburgh Housing Authority.

For example, the General Contractor shall coordinate installation of general construction work with the requirements of the Plumbing, Mechanical, and Electrical Contractors.

Reference Standard for Incidental Work: Incidental work, as used in this paragraph, is work which is not a basic part of other Prime Contracts but which is required by reference.

For example, the General Contractor is required by his Primary Specifications to install and repair all general work. In the event that the Plumbing Contractor disturbs the general work, the patching, repair shall be done and follow the same Specification requirements of the appropriate Specification Section by the Plumbing Contractor even if that specification section may not be part of the Plumbing Contractor's Primary Specification. The same applies to all trades where incidental work occurs.

TECHNICAL SPECIFICATIONS MAY BE FOUND AT PART FOUR
OF THE PROJECT MANUAL

PLEASE ALSO REFER TO DRAWINGS

3. PRIMARY DRAWINGS FOR THE GENERAL CONSTRUCTION CONTRACT
(Contained in the set of Project Drawings issued simultaneously with this Project Manual)

All Work contained in the Primary Drawings listed below is the Work of this Contractor unless specifically indicated otherwise.

Any Reference to the "Contractor," the "Prime Contractor," or the "General Contractor" shall be interpreted as meaning the Contractor for this General Construction Contract.

The Primary Drawings for this contract consist of all Tusick & Associates Architects, Inc. construction documents drawings, **dated** June 27, 2023 and specifications contained in this project manual.

In case of drawing conflict with specifications, it is understood that the specification shall supersede the drawings.

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP Contract No. 600-21-24

FORM OF BID

GENERAL CONSTRUCTION

Contract No.: _____

TO: HOUSING AUTHORITY
CITY OF PITTSBURGH
(Hereinafter called the "Authority")
412 Boulevard of the Allies, 6th Floor,
Pittsburgh, PA 15219

BIDDER: _____
(Bidder Name)

_____
(Business Address)

_____

_____
(Telephone)

1. The undersigned Bidder, having visited the site, having become familiar with local conditions affecting the cost of the work**, including all City of Pittsburgh current code requirements**, and having become familiar with the Invitation for Bids (the IFB) issued by the Authority, which consists of the following:

   - Project Manual, dated August 5, 2024 containing Bidding Requirements, Contract Forms, Conditions of the Contract, and Specifications
   - Project Drawings, dated June 27, 2023
   - Addenda (if any) as enumerated in this Form of Bid

   hereby proposes to provide all supervision, technical personnel, labor, materials, machinery, tools, appurtenances, equipment and services required to construct and complete the General Construction Work as described in Document 00310 "Scope of Work for General Construction" and as indicated in the Drawings and Specifications, for the following Firm Fixed Price:

   _____Dollars ($ _____)
   (Insert Bid Price in words) *(Insert Bid Price in Figures)*

2. Bid security **[ ] is [ ] is not** submitted with this bid.
   (Check one)

   Bid Security is in amount of:

   _____% of the bid OR _____ Dollars ($_____)

Bid Security is in the form of:

[ ]	Certified Check	[ ]	Bank Draft
[ ]	U.S. Govt. Bond	[ ]	Bid Bond (Document 00410)

3. The Bidder hereby acknowledges receipt of the following Addenda, if any, as issued by the Authority:

Total number of Addenda _____ (if none, so state)

Addendum No. _____dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____

4. The Bidder attaches hereto the Special Provisions (Document 00021);

5. The Bidder attaches hereto the Statement of Bidder's Qualifications (Document 00420);

6. The Bidder attaches hereto the Section 3 Opportunities Plan (Document 00433), MBE/WBE Solicitation and Commitment Record (Document 00434), Bidder Manpower Plan (Document 00435), and Previous Related Experience (Document 00436);

7. The Bidder attaches hereto the Bidder's Representations, Certifications and Other Statements of Bidders (Document HUD 5369-A), Previous Participation Certificate (Document HUD-2530);

8. The Bidder attaches hereto the Bidder’s Special Provisions – Notice to All Prospective Bidders (Document 00437), Non-Collusion Affidavit (Document 00485);

9. The Bidder attaches hereto the completed Form of Agreement (Document 00500);

10. The Bidder attaches hereto the Supplemental General Conditions (HACP Document).

PROPRIETORSHIP SIGNATURE PAGE SHEET - FB-I

(To be used when the Bidder is an individual doing business as a Sole Proprietorship.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] An individual doing business in his/her own name
[ ] An individual doing business under a fictitious or assumed name
(Complete Proprietorship Fictitious Name Disclosure below)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Principal*	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

PROPRIETORSHIP FICTITIOUS NAME DISCLOSURE

(To be used when the Bidder is an individual doing business under a fictitious or assumed name.)

_____ is an individual trading under a fictitious or
(Proprietor's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Principal*	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

PARTNERSHIP SIGNATURE PAGE SHEET - FB-P-1

(To be used when the Bidder is an individual doing business as a Partnership.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] A General Partnership (Attach completed Sheet FB-P-3)
- [ ] Doing business under Partnership Name
- [ ] Doing business under a fictitious or assumed name
  (Complete Partnership Fictitious Name Disclosure Sheet FB-P-2)

[ ] A Limited Partnership (Attach completed Sheet FB-P-3)
- [ ] Doing business under Partnership Name
- [ ] Doing business under a fictitious or assumed name
  (Complete Partnership Fictitious Name Disclosure Sheet FB-P-2)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Partner **	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*
	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Partner **	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

* If the Bidder is a partnership, the Bid and Contract must be signed in the name of the partnership by at least two general partners, and the names and addresses of all the partners must be listed on the certificate on Sheet FB-P-3.

PARTNERSHIP FICTITIOUS NAME DISCLOSURE

SHEET FB-P-2

(To be used when the Bidder is a partnership doing business under a fictitious or assumed name.)

_____ is a partnership trading under a fictitious or
(Partnership's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

	_____		_____
	(Printed or Typed Name)		*(Printed or Typed Name)*
Witness		*Partner**	
{		{	
	_____		_____
	(Signature and Date)		*(Signature and Date)*

PARTNERSHIP CERTIFICATE SHEET FB-P-3

(To be used when the Bidder is a partnership.)

I, as partner of _____,
(Name of Partnership)
certify that the following are the names and addresses of all the partners of said partnership.

Name: _____ Name: _____

Address: _____ Address: _____

City: _____ City: _____

Name: _____ Name: _____

Address: _____ Address: _____

City: _____ City: _____

Name: _____ Name: _____

Address: _____ Address: _____

City: _____ City: _____

Name: _____ Name: _____

Address: _____ Address: _____

City: _____ City: _____

(Use additional sheets as required.)

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness {		*Partner** {	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

CORPORATION SIGNATURE PAGE SHEET FB-C-1

(To be used when the bidder is a corporation.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] A corporation doing business in its own name
[ ] A corporation doing business under a fictitious or assumed name
(Complete Corporation Fictitious Name Disclosure FB-C-2)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

(CORPORATE SEAL)

_____
(Corporate Name)

_____ _____
(Printed or Typed Name) *(Printed or Typed Name)*

Witness { *President* *V.P.*** {

_____ _____
(Signature and Date) *(Signature and Date)*

_____ _____
(Corporate Title) *(Corporate Title)*

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal (Doc. 00625) must be executed by the Secretary or Assistant Secretary.

CORPORATION FICTITIOUS NAME DISCLOSURE SHEET FB-C-2

(To be used when the Bidder is a corporation doing business under a fictitious or assumed name.)

_____ is a corporation trading under a fictitious or
(Corporation's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*President*	
{		*V.P. *****	{
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal (Doc. 00625) must be executed by the Secretary or Assistant Secretary.

CORPORATION CERTIFICATE SHEET FB-C-3

(To be used when the bidder is a corporation)

_____ is a corporation organized and existing
(Corporate name used as Bidder name)

under the laws of the state of _____ with its principal place of business at:

_____,_____,_____
(Street Address) *(City)* *(State)*

and, if a non-Pennsylvania corporation **[ ] has [ ] has not** *(check one)* been granted a certificate of authority to do business in Pennsylvania as required by the Pennsylvania Business Corporation Law, approved May 5, 1933, P.L. 364, as amended, 15 P.S. sec.2005 et seq.

I, _____, certify that I am the **[ ] Secretary [ ] Assistant Secretary** of the
(check one)
Corporation named a Bidder herein; that _____ who signed

this Bid on behalf of the Corporation was then _____ of said Corporation that
*(President/V.P.) ***

I know his signature and his signature thereto is genuine; and that said Bid was duly signed, sealed and attested in behalf of said Corporation by authority of its governing body.

(CORPORATE SEAL)

_____
(Signature and Date)

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the above Certificate must be executed by the Secretary or Assistant Secretary

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP CONTRACT NO. 600-21-24

SCOPE OF WORK FOR ELECTRICAL CONSTRUCTION

The Contract for Electrical Construction shall consist of the following component parts:

1. THE AGREEMENT
(Bound in the Project Manual)

THE BID	Document 00320 - Scope of Work for Electrical Construction Document 00321 - Form of Bid for Electrical Construction
THE FORM OF AGREEMENT	Document 00500 - Form of Agreement Document 00590 - Contracting Officer Certification
CONDITIONS OF THE CONTRACT	Document HUD - 5370 General Conditions HACP Document - Supplemental General Conditions Document 00830 - Wage Determination Schedule

2. PRIMARY SPECIFICATIONS FOR THE ELECTRICAL CONSTRUCTION CONTRACT
(Bound in the Project Manual)

All Work contained in the Primary Specifications listed below is the Work of the Contractor for this Electrical Construction Contract unless specifically indicated otherwise.

Any Reference in the Primary Specifications to the "Contractor," the "Prime Contractor," or the "Electrical Contractor" shall be interpreted as meaning the Contractor for this Electrical Construction Contract.

The Electrical Contractor shall coordinate the schedule and activities of work performed under this contract with that of those contracts identified as (G)-General, (P)-Plumbing, and (H)-HVAC.

It is the contractual responsibility of the Contractor for Electrical Construction to familiarize himself with the work of the other prime contractors so that the Project as a whole can proceed in an orderly fashion. Failure to familiarize work by other trades would not be an excuse for corrective measures at no cost to the City of Pittsburgh Housing Authority.

For example, the Electrical Contractor shall coordinate installation of electrical construction work with the requirements of the Plumbing, Mechanical, and General Contractors.

Reference Standard for Incidental Work: Incidental work, as used in this paragraph, is work which is not a basic part of other Prime Contracts but which is required by reference.

For example, the General Contractor is required by his Primary Specifications to install and repair all general work. In the event that the Plumbing Contractor disturbs the general work, the patching, repair shall be done and follow the same Specification requirements of the appropriate Specification Section by the Plumbing Contractor even if that specification section may not be part of the Plumbing Contractor's Primary Specification. The same applies to all trades where incidental work occurs.

TECHNICAL SPECIFICATIONS MAY BE FOUND AT PART FOUR
OF THE PROJECT MANUAL

PLEASE ALSO REFER TO DRAWINGS

3. PRIMARY DRAWINGS FOR THE ELECTRICAL CONSTRUCTION CONTRACT
(Contained in the set of Project Drawings issued simultaneously with this Project Manual)

All Work contained in the Primary Drawings listed below is the Work of this Contractor unless specifically indicated otherwise.

Any Reference to the "Contractor," the "Prime Contractor," or the "Electrical Contractor" shall be interpreted as meaning the Contractor for this Electrical Construction Contract.

The Primary Drawings for this contract consist of all Tusick & Associates Architects, Inc construction documents drawings, **dated** June 27, 2023 and specifications contained in this project manual.

In case of drawing conflict with specifications, it is understood that the specification shall supersede the drawings.

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP Contract No. 600-24-24

FORM OF BID

ELECTRICAL CONSTRUCTION

Contract No.: _____

TO: HOUSING AUTHORITY
CITY OF PITTSBURGH
(Hereinafter called the "Authority")
412 Boulevard of the Allies, 6th Floor, Pittsburgh, PA 15219

BIDDER: _____
(Bidder Name)

_____
(Business Address)

_____

_____
(Telephone)

1. The undersigned Bidder, having visited the site, having become familiar with local conditions affecting the cost of the work**, including all City of Pittsburgh current code requirements**, and having become familiar with the Invitation for Bids (the IFB) issued by the Authority, which consists of the following:

   - Project Manual, dated August 5, 2024 containing Bidding Requirements, Contract Forms, Conditions of the Contract, and Specifications
   - Project Drawings, dated June 27, 2023
   - Addenda (if any) as enumerated in this Form of Bid

   hereby proposes to provide all supervision, technical personnel, labor, materials, machinery, tools, appurtenances, equipment and services required to construct and complete the Electrical Construction Work as described in Document 00320 "Scope of Work for Electrical Construction" and as indicated in the Drawings and Specifications, for the following Firm Fixed Price:

   _____Dollars ($ _____)
   (Insert Bid Price in words) *(Insert Bid Price in Figures)*

2. Bid security **[ ] is [ ] is not** submitted with this bid.
   (Check one)

   Bid Security is in amount of:

   _____% of the bid OR _____ Dollars ($_____)

Bid Security is in the form of:

[ ]	Certified Check	[ ]	Bank Draft
[ ]	U.S. Govt. Bond	[ ]	Bid Bond (Document 00410)

3. The Bidder hereby acknowledges receipt of the following Addenda, if any, as issued by the Authority:

Total number of Addenda _____ (if none, so state)

Addendum No. _____dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____

4. The Bidder attaches hereto the Special Provisions (Document 00021);

5. The Bidder attaches hereto the Statement of Bidder's Qualifications (Document 00420);

6. The Bidder attaches hereto the Section 3 Opportunities Plan (Document 00433), MBE/WBE Solicitation and Commitment Record (Document 00434), Bidder Manpower Plan (Document 00435), and Previous Related Experience (Document 00436);

7. The Bidder attaches hereto the Bidder's Representations, Certifications and Other Statements of Bidders (Document HUD 5369-A), Previous Participation Certificate (Document HUD-2530);

8. The Bidder attaches hereto the Bidder’s Special Provisions – Notice to All Prospective Bidders (Document 00437), Non-Collusion Affidavit (Document 00485);

9. The Bidder attaches hereto the completed Form of Agreement (Document 00500);

10. The Bidder attaches hereto the Supplemental General Conditions (HACP Document).

PROPRIETORSHIP SIGNATURE PAGE SHEET - FB-I

(To be used when the Bidder is an individual doing business as a Sole Proprietorship.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] An individual doing business in his/her own name
[ ] An individual doing business under a fictitious or assumed name
(Complete Proprietorship Fictitious Name Disclosure below)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Principal*	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

PROPRIETORSHIP FICTITIOUS NAME DISCLOSURE

(To be used when the Bidder is an individual doing business under a fictitious or assumed name.)

_____ is an individual trading under a fictitious or
(Proprietor's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Principal*	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

PARTNERSHIP SIGNATURE PAGE SHEET - FB-P-1

(To be used when the Bidder is an individual doing business as a Partnership.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] A General Partnership (Attach completed Sheet FB-P-3)
- [ ] Doing business under Partnership Name
- [ ] Doing business under a fictitious or assumed name
  (Complete Partnership Fictitious Name Disclosure Sheet FB-P-2)

[ ] A Limited Partnership (Attach completed Sheet FB-P-3)
- [ ] Doing business under Partnership Name
- [ ] Doing business under a fictitious or assumed name
  (Complete Partnership Fictitious Name Disclosure Sheet FB-P-2)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Partner **	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*
	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Partner **	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

* If the Bidder is a partnership, the Bid and Contract must be signed in the name of the partnership by at least two general partners, and the names and addresses of all the partners must be listed on the certificate on Sheet FB-P-3.

PARTNERSHIP FICTITIOUS NAME DISCLOSURE

SHEET FB-P-2

(To be used when the Bidder is a partnership doing business under a fictitious or assumed name.)

_____ is a partnership trading under a fictitious or
(Partnership's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

_____	_____
(Printed or Typed Name)	*(Printed or Typed Name)*
Witness	*Partner**
{	{
_____	_____
(Signature and Date)	*(Signature and Date)*

PARTNERSHIP CERTIFICATE SHEET FB-P-3

(To be used when the Bidder is a partnership.)

I, as partner of _____,
(Name of Partnership)
certify that the following are the names and addresses of all the partners of said partnership.

Name: _____	Name: _____
Address: _____	Address: _____
City: _____	City: _____
Name: _____	Name: _____
Address: _____	Address: _____
City: _____	City: _____
Name: _____	Name: _____
Address: _____	Address: _____
City: _____	City: _____
Name: _____	Name: _____
Address: _____	Address: _____
City: _____	City: _____

(Use additional sheets as required.)

_____	_____
(Printed or Typed Name)	*(Printed or Typed Name)*
Witness {	*Partner** {
_____	_____
(Signature and Date)	*(Signature and Date)*

CORPORATION SIGNATURE PAGE SHEET FB-C-1

(To be used when the bidder is a corporation.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] A corporation doing business in its own name
[ ] A corporation doing business under a fictitious or assumed name
(Complete Corporation Fictitious Name Disclosure FB-C-2)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

(CORPORATE SEAL)

_____
(Corporate Name)

_____ _____
(Printed or Typed Name) *(Printed or Typed Name)*

Witness { *President V.P.*** {

_____ _____
(Signature and Date) *(Signature and Date)*

_____ _____
(Corporate Title) *(Corporate Title)*

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal (Doc. 00625) must be executed by the Secretary or Assistant Secretary.

CORPORATION FICTITIOUS NAME DISCLOSURE SHEET FB-C-2

(To be used when the Bidder is a corporation doing business under a fictitious or assumed name.)

_____ is a corporation trading under a fictitious or
(Corporation's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*President*	
{		*V.P. *****	{
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal (Doc. 00625) must be executed by the Secretary or Assistant Secretary.

CORPORATION CERTIFICATE SHEET FB-C-3

(To be used when the bidder is a corporation)

_____ is a corporation organized and existing
(Corporate name used as Bidder name)

under the laws of the state of _____ with its principal place of business at:

_____,_____,_____
(Street Address) *(City)* *(State)*

and, if a non-Pennsylvania corporation **[ ] has [ ] has not** *(check one)* been granted a certificate of authority to do business in Pennsylvania as required by the Pennsylvania Business Corporation Law, approved May 5, 1933, P.L. 364, as amended, 15 P.S. sec.2005 et seq.

I, _____, certify that I am the **[ ] Secretary [ ] Assistant Secretary** of the
(check one)
Corporation named a Bidder herein; that _____ who signed

this Bid on behalf of the Corporation was then _____ of said Corporation that
*(President/V.P.) ***

I know his signature and his signature thereto is genuine; and that said Bid was duly signed, sealed and attested in behalf of said Corporation by authority of its governing body.

(CORPORATE SEAL)

_____
(Signature and Date)

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the above Certificate must be executed by the Secretary or Assistant Secretary

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP CONTRACT NO. 600-21-24

SCOPE OF WORK FOR PLUMBING CONSTRUCTION

The Contract for Plumbing Construction shall consist of the following component parts:

1. THE AGREEMENT
(Bound in the Project Manual)

THE BID	Document 00330 - Scope of Work for Plumbing Construction Document 00331 - Form of Bid for Plumbing Construction
THE FORM OF AGREEMENT	Document 00500 - Form of Agreement Document 00590 - Contracting Officer Certification
CONDITIONS OF THE CONTRACT	Document HUD - 5370 General Conditions HACP Document - Supplemental General Conditions Document 00830 - Wage Determination Schedule

2. PRIMARY SPECIFICATIONS FOR THE PLUMBING CONSTRUCTION CONTRACT
(Bound in the Project Manual)

All Work contained in the Primary Specifications listed below is the Work of the Contractor for this Plumbing Construction Contract unless specifically indicated otherwise.

Any Reference in the Primary Specifications to the "Contractor," the "Prime Contractor," or the "Plumbing Contractor" shall be interpreted as meaning the Contractor for this Plumbing Construction Contract.

The Plumbing Contractor shall coordinate the schedule and activities of work performed under this contract with that of those contracts identified as (G)-General, (E)-Electrical, and (H)-HVAC.

It is the contractual responsibility of the Contractor for Plumbing Construction to familiarize himself with the work of the other prime contractors so that the Project as a whole can proceed in an orderly fashion. Failure to familiarize work by other trades would not be an excuse for corrective measures at no cost to the City of Pittsburgh Housing Authority.

For example, the Plumbing Contractor shall coordinate installation of plumbing construction work with the requirements of the Electrical, Mechanical, and General Contractors.

Reference Standard for Incidental Work: Incidental work, as used in this paragraph, is work which is not a basic part of other Prime Contracts but which is required by reference.

For example, the General Contractor is required by his Primary Specifications to install and repair all general work. In the event that the Plumbing Contractor disturbs the general work, the patching, repair shall be done and follow the same Specification requirements of the appropriate Specification Section by the Plumbing Contractor even if that specification section may not be part of the Plumbing Contractor's Primary Specification. The same applies to all trades where incidental work occurs.

TECHNICAL SPECIFICATIONS MAY BE FOUND AT PART FOUR
OF THE PROJECT MANUAL

PLEASE ALSO REFER TO DRAWINGS

3. PRIMARY DRAWINGS FOR THE PLUMBING CONSTRUCTION CONTRACT
(Contained in the set of Project Drawings issued simultaneously with this Project Manual)

All Work contained in the Primary Drawings listed below is the Work of this Contractor unless specifically indicated otherwise.

Any Reference to the "Contractor," the "Prime Contractor," or the "Plumbing Contractor" shall be interpreted as meaning the Contractor for this Plumbing Construction Contract.

The Primary Drawings for this contract consist of all Tusick & Associates Architects, Inc construction documents drawings, **dated** June 27, 2023 and specifications contained in this project manual.

In case of drawing conflict with specifications, it is understood that the specification shall supersede the drawings.

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP Contract No. 600-21-24

FORM OF BID

PLUMBING CONSTRUCTION

Contract No.: _____

TO: HOUSING AUTHORITY
CITY OF PITTSBURGH
(Hereinafter called the "Authority")
100 Ross Street, Suite 200
Pittsburgh, PA 15219

BIDDER: _____
(Bidder Name)
_____
(Business Address)
_____

_____
(Telephone)

1. The undersigned Bidder, having visited the site, having become familiar with local conditions affecting the cost of the work**, including all City of Pittsburgh current code requirements**, and having become familiar with the Invitation for Bids (the IFB) issued by the Authority, which consists of the following:

   - Project Manual, dated August 5, 2024 containing Bidding Requirements, Contract Forms, Conditions of the Contract, and Specifications
   - Project Drawings, dated June 27, 2023
   - Addenda (if any) as enumerated in this Form of Bid

   hereby proposes to provide all supervision, technical personnel, labor, materials, machinery, tools, appurtenances, equipment and services required to construct and complete the Plumbing Construction Work as described in Document 00330 "Scope of Work for Plumbing Construction" and as indicated in the Drawings and Specifications, for the following Firm Fixed Price:

   _____Dollars ($ _____)
   (Insert Bid Price in words) *(Insert Bid Price in Figures)*

2. Bid security **[ ] is [ ] is not** submitted with this bid.
   (Check one)

   Bid Security is in amount of:

   _____% of the bid OR _____ Dollars ($_____)

Bid Security is in the form of:

[ ]	Certified Check	[ ]	Bank Draft
[ ]	U.S. Govt. Bond	[ ]	Bid Bond (Document 00410)

3. The Bidder hereby acknowledges receipt of the following Addenda, if any, as issued by the Authority:

Total number of Addenda _____ (if none, so state)

Addendum No. _____dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____

4. The Bidder attaches hereto the Special Provisions (Document 00021);

5. The Bidder attaches hereto the Statement of Bidder's Qualifications (Document 00420);

6. The Bidder attaches hereto the Section 3 Opportunities Plan (Document 00433), MBE/WBE Solicitation and Commitment Record (Document 00434), Bidder Manpower Plan (Document 00435), and Previous Related Experience (Document 00436);

7. The Bidder attaches hereto the Bidder's Representations, Certifications and Other Statements of Bidders (Document HUD 5369-A), Previous Participation Certificate (Document HUD-2530);

8. The Bidder attaches hereto the Bidder’s Special Provisions – Notice to All Prospective Bidders (Document 00437), Non-Collusion Affidavit (Document 00485);

9. The Bidder attaches hereto the completed Form of Agreement (Document 00500);

10. The Bidder attaches hereto the Supplemental General Conditions (HACP Document).

PROPRIETORSHIP SIGNATURE PAGE SHEET - FB-I

(To be used when the Bidder is an individual doing business as a Sole Proprietorship.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] An individual doing business in his/her own name
[ ] An individual doing business under a fictitious or assumed name
(Complete Proprietorship Fictitious Name Disclosure below)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Principal*	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

PROPRIETORSHIP FICTITIOUS NAME DISCLOSURE

(To be used when the Bidder is an individual doing business under a fictitious or assumed name.)

_____ is an individual trading under a fictitious or
(Proprietor's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Principal*	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

PARTNERSHIP SIGNATURE PAGE SHEET - FB-P-1

(To be used when the Bidder is an individual doing business as a Partnership.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] A General Partnership (Attach completed Sheet FB-P-3)
- [ ] Doing business under Partnership Name
- [ ] Doing business under a fictitious or assumed name
  (Complete Partnership Fictitious Name Disclosure Sheet FB-P-2)

[ ] A Limited Partnership (Attach completed Sheet FB-P-3)
- [ ] Doing business under Partnership Name
- [ ] Doing business under a fictitious or assumed name
  (Complete Partnership Fictitious Name Disclosure Sheet FB-P-2)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Partner **	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*
	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Partner **	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

* If the Bidder is a partnership, the Bid and Contract must be signed in the name of the partnership by at least two general partners, and the names and addresses of all the partners must be listed on the certificate on Sheet FB-P-3.

PARTNERSHIP FICTITIOUS NAME DISCLOSURE

SHEET FB-P-2

(To be used when the Bidder is a partnership doing business under a fictitious or assumed name.)

_____ is a partnership trading under a fictitious or
(Partnership's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

_____	_____
(Printed or Typed Name)	*(Printed or Typed Name)*
Witness	*Partner**
{	{
_____	_____
(Signature and Date)	*(Signature and Date)*

PARTNERSHIP CERTIFICATE SHEET FB-P-3

(To be used when the Bidder is a partnership.)

I, as partner of _____,
(Name of Partnership)
certify that the following are the names and addresses of all the partners of said partnership.

Name: _____ Name: _____

Address: _____ Address: _____

City: _____ City: _____

Name: _____ Name: _____

Address: _____ Address: _____

City: _____ City: _____

Name: _____ Name: _____

Address: _____ Address: _____

City: _____ City: _____

Name: _____ Name: _____

Address: _____ Address: _____

City: _____ City: _____

(Use additional sheets as required.)

_____ _____
(Printed or Typed Name) *(Printed or Typed Name)*

Witness *Partner**

{ {

_____ _____
(Signature and Date) *(Signature and Date)*

CORPORATION SIGNATURE PAGE SHEET FB-C-1

(To be used when the bidder is a corporation.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] A corporation doing business in its own name
[ ] A corporation doing business under a fictitious or assumed name
(Complete Corporation Fictitious Name Disclosure FB-C-2)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

(CORPORATE SEAL)

_____
(Corporate Name)

_____ _____
(Printed or Typed Name) *(Printed or Typed Name)*

Witness { *President V.P.*** {

_____ _____
(Signature and Date) *(Signature and Date)*

_____ _____
(Corporate Title) *(Corporate Title)*

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal (Doc. 00625) must be executed by the Secretary or Assistant Secretary.

CORPORATION FICTITIOUS NAME DISCLOSURE SHEET FB-C-2

(To be used when the Bidder is a corporation doing business under a fictitious or assumed name.)

_____ is a corporation trading under a fictitious or
(Corporation's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*President*	
{		*V.P. *****	{
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal (Doc. 00625) must be executed by the Secretary or Assistant Secretary.

CORPORATION CERTIFICATE SHEET FB-C-3

(To be used when the bidder is a corporation)

_____ is a corporation organized and existing
(Corporate name used as Bidder name)

under the laws of the state of _____ with its principal place of business at:

_____,_____,_____
(Street Address) *(City)* *(State)*

and, if a non-Pennsylvania corporation **[ ] has [ ] has not** *(check one)* been granted a certificate of authority to do business in Pennsylvania as required by the Pennsylvania Business Corporation Law, approved May 5, 1933, P.L. 364, as amended, 15 P.S. sec.2005 et seq.

I, _____, certify that I am the **[ ] Secretary [ ] Assistant Secretary** of the
(check one)
Corporation named a Bidder herein; that _____ who signed

this Bid on behalf of the Corporation was then _____ of said Corporation that
(President/V.P.) **

I know his signature and his signature thereto is genuine; and that said Bid was duly signed, sealed and attested in behalf of said Corporation by authority of its governing body.

(CORPORATE SEAL)

_____
(Signature and Date)

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the above Certificate must be executed by the Secretary or Assistant Secretary

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP CONTRACT NO. _____

SCOPE OF WORK FOR MECHANICAL CONSTRUCTION

The Contract for Mechanical Construction shall consist of the following component parts:

1. THE AGREEMENT
(Bound in the Project Manual)

THE BID	Document 00340 - Scope of Work for Mechanical Construction Document 00341 - Form of Bid for Mechanical Construction
THE FORM OF AGREEMENT	Document 00500 - Form of Agreement Document 00590 - Contracting Officer Certification
CONDITIONS OF THE CONTRACT	Document HUD - 5370 General Conditions HACP Document - Supplemental General Conditions Document 00830 - Wage Determination Schedule

2. PRIMARY SPECIFICATIONS FOR THE MECHANICAL CONSTRUCTION CONTRACT
(Bound in the Project Manual)

All Work contained in the Primary Specifications listed below is the Work of the Contractor for this Mechanical Construction Contract unless specifically indicated otherwise.

Any Reference in the Primary Specifications to the "Contractor," the "Prime Contractor," or the "Mechanical Contractor" shall be interpreted as meaning the Contractor for this Mechanical Construction Contract.

The Mechanical Contractor shall coordinate the schedule and activities of work performed under this contract with that of those contracts identified as (G)-General, (E)-Electrical, and (P)-Plumbing.

It is the contractual responsibility of the Contractor for Mechanical Construction to familiarize himself with the work of the other prime contractors so that the Project as a whole can proceed in an orderly fashion. Failure to familiarize work by other trades would not be an excuse for corrective measures at no cost to the City of Pittsburgh Housing Authority.

For example, the Mechanical Contractor shall coordinate installation of mechanical construction work with the requirements of the Electrical, Plumbing, and General Contractors.

Reference Standard for Incidental Work: Incidental work, as used in this paragraph, is work which is not a basic part of other Prime Contracts but which is required by reference.

For example, the General Contractor is required by his Primary Specifications to install and repair all general work. In the event that the Plumbing Contractor disturbs the general work, the patching, repair shall be done and follow the same Specification requirements of the appropriate Specification Section by the Plumbing Contractor even if that specification section may not be part of the Plumbing Contractor's Primary Specification. The same applies to all trades where incidental work occurs.

TECHNICAL SPECIFICATIONS MAY BE FOUND AT PART FOUR
OF THE PROJECT MANUAL

PLEASE ALSO REFER TO DRAWINGS

3. PRIMARY DRAWINGS FOR THE MECHANICAL CONSTRUCTION CONTRACT
(Contained in the set of Project Drawings issued simultaneously with this Project Manual)

All Work contained in the Primary Drawings listed below is the Work of this Contractor unless specifically indicated otherwise.

Any Reference to the "Contractor," the "Prime Contractor," or the "Mechanical Contractor" shall be interpreted as meaning the Contractor for this Mechanical Construction Contract.

The Primary Drawings for this contract consist of all Tusick & Associates Architects, Inc construction documents drawings, **dated** June 27, 2023 and specifications contained in this project manual.

In case of drawing conflict with specifications, it is understood that the specification shall supersede the drawings.

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP Contract No. 600-21-24

FORM OF BID

MECHANICAL CONSTRUCTION

Contract No.: _____

TO: HOUSING AUTHORITY
CITY OF PITTSBURGH
(Hereinafter called the "Authority")
412 Boulevard of the Allies, 6th Floor, Pittsburgh, PA 15219

BIDDER: _____
(Bidder Name)

_____
(Business Address)

_____

_____
(Telephone)

1. The undersigned Bidder, having visited the site, having become familiar with local conditions affecting the cost of the work**, including all City of Pittsburgh current code requirements**, and having become familiar with the Invitation for Bids (the IFB) issued by the Authority, which consists of the following:

   - Project Manual, dated August 5, 2024 containing Bidding Requirements, Contract Forms, Conditions of the Contract, and Specifications
   - Project Drawings, dated June 27, 2023
   - Addenda (if any) as enumerated in this Form of Bid

   hereby proposes to provide all supervision, technical personnel, labor, materials, machinery, tools, appurtenances, equipment and services required to construct and complete the Mechanical Construction Work as described in Document 00340 "Scope of Work for Mechanical Construction" and as indicated in the Drawings and Specifications, for the following Firm Fixed Price:

   _____Dollars ($ _____)
   (Insert Bid Price in words) *(Insert Bid Price in Figures)*

2. Bid security **[ ] is [ ] is not** submitted with this bid.
   (Check one)

   Bid Security is in amount of:

   _____% of the bid OR _____ Dollars ($_____)

Bid Security is in the form of:

[ ]	Certified Check	[ ]	Bank Draft
[ ]	U.S. Govt. Bond	[ ]	Bid Bond (Document 00410)

3. The Bidder hereby acknowledges receipt of the following Addenda, if any, as issued by the Authority:

Total number of Addenda _____ (if none, so state)

Addendum No. _____dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____
Addendum No. _____ dated _____	Addendum No. _____ dated _____

4. The Bidder attaches hereto the Special Provisions (Document 00021);

5. The Bidder attaches hereto the Statement of Bidder's Qualifications (Document 00420);

6. The Bidder attaches hereto the Section 3 Opportunities Plan (Document 00433), MBE/WBE Solicitation and Commitment Record (Document 00434), Bidder Manpower Plan (Document 00435), and Previous Related Experience (Document 00436);

7. The Bidder attaches hereto the Bidder's Representations, Certifications and Other Statements of Bidders (Document HUD 5369-A), Previous Participation Certificate (Document HUD-2530);

8. The Bidder attaches hereto the Bidder’s Special Provisions – Notice to All Prospective Bidders (Document 00437), Non-Collusion Affidavit (Document 00485);

9. The Bidder attaches hereto the completed Form of Agreement (Document 00500);

10. The Bidder attaches hereto the Supplemental General Conditions (HACP Document).

PROPRIETORSHIP SIGNATURE PAGE SHEET - FB-I

(To be used when the Bidder is an individual doing business as a Sole Proprietorship.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] An individual doing business in his/her own name
[ ] An individual doing business under a fictitious or assumed name
(Complete Proprietorship Fictitious Name Disclosure below)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Principal*	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

PROPRIETORSHIP FICTITIOUS NAME DISCLOSURE

(To be used when the Bidder is an individual doing business under a fictitious or assumed name.)

_____ is an individual trading under a fictitious or
(Proprietor's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Principal*	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

PARTNERSHIP SIGNATURE PAGE SHEET - FB-P-1

(To be used when the Bidder is an individual doing business as a Partnership.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] A General Partnership (Attach completed Sheet FB-P-3)
- [ ] Doing business under Partnership Name
- [ ] Doing business under a fictitious or assumed name
  (Complete Partnership Fictitious Name Disclosure Sheet FB-P-2)

[ ] A Limited Partnership (Attach completed Sheet FB-P-3)
- [ ] Doing business under Partnership Name
- [ ] Doing business under a fictitious or assumed name
  (Complete Partnership Fictitious Name Disclosure Sheet FB-P-2)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Partner **	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*
	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Partner **	
{		{	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

* If the Bidder is a partnership, the Bid and Contract must be signed in the name of the partnership by at least two general partners, and the names and addresses of all the partners must be listed on the certificate on Sheet FB-P-3.

PARTNERSHIP FICTITIOUS NAME DISCLOSURE

SHEET FB-P-2

(To be used when the Bidder is a partnership doing business under a fictitious or assumed name.)

_____ is a partnership trading under a fictitious or
(Partnership's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

_____	_____
(Printed or Typed Name)	*(Printed or Typed Name)*
Witness	*Partner**
{	{
_____	_____
(Signature and Date)	*(Signature and Date)*

PARTNERSHIP CERTIFICATE SHEET FB-P-3

(To be used when the Bidder is a partnership.)

I, as partner of _____,
(Name of Partnership)
certify that the following are the names and addresses of all the partners of said partnership.

Name: _____	Name: _____
Address: _____	Address: _____
City: _____	City: _____
Name: _____	Name: _____
Address: _____	Address: _____
City: _____	City: _____
Name: _____	Name: _____
Address: _____	Address: _____
City: _____	City: _____
Name: _____	Name: _____
Address: _____	Address: _____
City: _____	City: _____

(Use additional sheets as required.)

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness {		*Partner** {	
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

CORPORATION SIGNATURE PAGE SHEET FB-C-1

(To be used when the bidder is a corporation.)

THE BIDDER CERTIFIES THAT THE BIDDER IS:

[ ] A corporation doing business in its own name
[ ] A corporation doing business under a fictitious or assumed name
(Complete Corporation Fictitious Name Disclosure FB-C-2)

SIGNED, SEALED AND DELIVERED

this _____ day of _____ 20 _____.

(CORPORATE SEAL)

_____
(Corporate Name)

_____ _____
(Printed or Typed Name) *(Printed or Typed Name)*

Witness *President*
{ *V.P.*** {

_____ _____
(Signature and Date) *(Signature and Date)*

_____ _____
(Corporate Title) *(Corporate Title)*

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal (Doc. 00625) must be executed by the Secretary or Assistant Secretary.

CORPORATION FICTITIOUS NAME DISCLOSURE SHEET FB-C-2

(To be used when the Bidder is a corporation doing business under a fictitious or assumed name.)

_____ is a corporation trading under a fictitious or
(Corporation's Name)

assumed name of _____ and **[ ] has [ ] has not** registered under
(Fictitious or Assumed Name Used as Bidder's Name) *(Check one)*

the Fictitious Names Act of Pennsylvania, namely the Act of May 24, 1945,P.L.967, as amended, 54 P.S.sec.281.1 et seq.

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*President*	
{		*V.P. *****	{
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal (Doc. 00625) must be executed by the Secretary or Assistant Secretary.

CORPORATION CERTIFICATE SHEET FB-C-3

(To be used when the bidder is a corporation)

_____ is a corporation organized and existing
(Corporate name used as Bidder name)

under the laws of the state of _____ with its principal place of business at:

_____,_____,_____
(Street Address) *(City)* *(State)*

and, if a non-Pennsylvania corporation **[ ] has [ ] has not** *(check one)* been granted a certificate of authority to do business in Pennsylvania as required by the Pennsylvania Business Corporation Law, approved May 5, 1933, P.L. 364, as amended, 15 P.S. sec.2005 et seq.

I, _____, certify that I am the **[ ] Secretary [ ] Assistant Secretary** of the
(check one)
Corporation named a Bidder herein; that _____ who signed

this Bid on behalf of the Corporation was then _____ of said Corporation that
*(President/V.P.) ***

I know his signature and his signature thereto is genuine; and that said Bid was duly signed, sealed and attested in behalf of said Corporation by authority of its governing body.

(CORPORATE SEAL)

_____
(Signature and Date)

** If the bidder is a corporation, the Bid and the Contract must be executed in the Corporation's correct corporate name by its President or Vice President and its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the above Certificate must be executed by the Secretary or Assistant Secretary

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we,

_____, as Principal, and
(Insert name and address of Bidder exactly as it appears on Form of Bid)

_____, as Sureties, are
held and firmly bound unto the Housing Authority of the City of Pittsburgh, its certain attorney, successors, or assigns (the Obligee, hereinafter called the "Authority") in the penal sum of

_____Dollars ($_____)

lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, personal representatives, successors, and assigns, jointly and severally, firmly by these presents:

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas, the Principal simultaneously submits to the Authority the accompanying bid, dated

_____, 20_____ (the "Bid"), for construction of
(Insert date of bid)

_____
(Insert name of project exactly as it appears on Form of Bid)
pursuant to specifications, drawings and other related documents constituting the Invitation for Bids (the "IFB").

NOW, THEREFORE, if the Principal shall not withdraw said bid within the period specified therein after the opening of the same, or, if no period be specified, within sixty (60) days after the said opening, and shall within the period specified therefore, or, if no period be specified within ten (10) days after the prescribed forms are presented to him for signature, enter into a written contract with the Authority in accordance with the bid as accepted, and give bonds with good and sufficient surety or sureties, as may be required for the faithful performance and proper fulfillment of such contract and for the payment of labor and materialmen or in the event of the withdrawal of said bid within the period specified, or the failure to enter into such contract and give such bonds within the time specified, if the Principal shall pay the Authority the difference between the amount specified in said bid and the amount for which the Authority may procure the required work or supplies or both, if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

SIGNED, SEALED AND DELIVERED IN _____ ORIGINAL COUNTERPARTS

this _____ day of _____ 20_____.

IF THE PRINCIPAL IS AN INDIVIDUAL, SIGN HERE

_____ *(Printed or Typed Name)*	_____ *(Printed or Typed Name)*
Witness	*Principal*
{	{
_____ *(Signature and Date)*	_____ *(Signature and Date)*

SURETY SIGN HERE

(SURETY SEAL)

_____ *(Printed or Typed Name)*	_____ *(Printed or Typed Name)*
Attest	*Surety****
{	{
_____ *(Signature and Date)*	_____ *(Signature and Date)*

*** Power of attorney must be attached to this Bid Bond.

SIGNED, SEALED AND DELIVERED IN _____ ORIGINAL COUNTERPARTS

this _____ day of _____ 20_____.

IF THE PRINCIPAL IS A PARTNERSHIP, SIGN HERE

_____ *(Printed or Typed Name)*	_____ *(Printed or Typed Name)*
Witness {	*Partner** {
_____ *(Signature and Date)*	_____ *(Signature and Date)*
_____ *(Printed or Typed Name)*	_____ *(Printed or Typed Name)*
Witness {	*Partner** {
_____ *(Signature and Date)*	_____ *(Signature and Date)*

* If the Bidder is a partnership, the Bond must be signed in the name of the partnership by at least two general partners, whose names and addresses must be listed on the certificate on page BF-3-P of the Bid.

SURETY SIGN HERE

(SURETY SEAL)

_____ *(Printed or Typed Name)*	_____ *(Printed or Typed Name)*
Attest {	*Surety**** {
_____ *(Signature and Date)*	_____ *(Signature and Date)*

*** Power of attorney must be attached to this Bid Bond.

SIGNED, SEALED AND DELIVERED IN _____ ORIGINAL COUNTERPARTS

this _____ day of _____ 20_____.

IF THE PRINCIPAL IS A CORPORATION, SIGN HERE

(CORPORATE SEAL)

_____
(Corporate Name)

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Attest {	_____ *(Signature and Date)*	*President V.P.*** {	_____ *(Signature and Date)*
	_____ *(Corporate Title)*		_____ *(Corporate Title)*

** If the bidder is a corporation, the Bond must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal below must be executed by the Secretary or Assistant Secretary.

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the
[ ] Secretary [ ] Assistant Secretary of the Corporation named a Bidder herein; that
(check one)

_____ who signed this Bid on behalf of the

Corporation was then _____ of said Corporation that I know his signature and his signature thereto is genuine; and that said Bid was duly signed, sealed and attested in behalf of said Corporation by authority of its governing body.

(CORPORATE SEAL)

_____
(Signature and Date)

SURETY SIGN HERE

(SURETY SEAL)

_____ _____

(Printed or Typed Name) *(Printed or Typed Name)*

Attest *Surety****

{ {

_____ _____

(Signature and Date) *(Signature and Date)*

*** Power of attorney must be attached to this Bid Bond.

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

STATEMENT OF BIDDER'S QUALIFICATIONS

_____	Bedford Dwellings EnVision Center-New Dedicated Heating Plant
(Bidder's Name)	*(Project Name)*
_____	_____
(Address)	
_____	_____
	(HACP Project No.)

Names of not more than two principals to contact:

Name:_____	Name:_____
Title:_____	Title:_____
Telephone:_____	Telephone:_____

AUTHORIZATION:

Excerpt from HUD 7460.8-REV-1 AND 24 CFR 85.36(b)(8) & 24 CFR 905.160(a)(3):

"The evaluation of a contractor's ability to perform a contract is known as determining the contractor's responsibility. Has **shall** make awards only to **responsible** contractors possessing the ability to perform successfully under the terms and conditions of a proposed contract. Consideration **shall** be given to such matters as **contractor integrity, compliance with public policy, record of past performance, and financial and technical resources**.

"The award of a contract to an offeror **shall** not be made solely on the basis of the lowest evaluated price without considering the firm's ability to perform the required work. Some of the specific factors to consider include (1) whether the contractor performed satisfactorily on other HA Contracts, (2) is the contractor suspended or debarred from Federal Contracts, and (3) have other HAs has satisfactory performance from this contractor.

"A pre-award survey may entail an on-site inspection of the offeror's facilities, including a review of financial statements, record keeping, production capacity, or similar factors that impact on the ability to perform the contract.

"Recent unsatisfactory performance regarding either quality or timeliness of delivery is an example of a problem which the Contracting Officer **shall** consider and resolve as to its impact on the current procurement prior to making an affirmative determination of responsibility.

ORGANIZATION

THE BIDDER IS:

[ ] An individual doing business in his/her own name
[ ] An individual doing business under a fictitious or assumed name

[ ] A General Partnership
  [ ] Doing business under Partnership Name
  [ ] Doing business under a fictitious or assumed name

[ ] A Limited Partnership
  [ ] Doing business under Partnership Name
  [ ] Doing business under a fictitious or assumed name

[ ] A corporation doing business in its own name
[ ] A corporation doing business under a fictitious or assumed name

How many years has the bidder been in business as a Contractor? _____

How many years has the bidder been in business under its present business name? _____

Under what other or former names has the bidder operated?

PAST PERFORMANCE

CLAIMS AND SUITS. (If the answer to any of the questions below is yes, please attach explanation.)

[ ] Yes [ ] No Has the Bidder ever failed to complete any work awarded to it?

[ ] Yes [ ] No Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against the bidder or its officers?

[ ] Yes [ ] No Has the bidder filed any law suits or requested arbitration with regard to construction contracts within the last five years?

[ ] Yes [ ] No Within the last five years, has any officer or principal of the bidder ever been an officer or principal of another organization when it failed to complete a construction contract? (If answer is yes, please attach details.)

State average annual amount of construction work performed during the past five years: $_____

State total worth of work in progress and under contract: $_____

On a separate sheet, list major construction projects the bidder has in progress, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.

On a separate sheet, list the major projects the bidder has completed in the past five years, giving the name of project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.

FINANCIAL RESOURCES

Financial Statement.

Attach a financial statement (audited if available), including the bidder's latest balance sheet and income statement showing the following items:

Current Assets (e.g. cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);
Net Fixed Assets;
Other Assets;
Current Liabilities (e.g. accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes);
Other Liabilities (e.g. capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

Name and address of firm preparing attached financial statement, and date thereof:

[ ] Yes [ ] No Is the attached financial statement for the identical organization named on page one?

If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary).

[ ] Yes [ ] No Will the organization whose financial statement is attached act as guarantor of the contract for construction?

TECHNICAL RESOURCES

Licensing:
List jurisdictions and trade categories in which the bidder is legally qualified to do business, and indicate registration or license numbers, if applicable.

Experiences:
List the categories of work that the bidder normally performs with its own forces.

On a separate sheet, list the construction experience and present commitments of the key individuals of the bidder.

REFERENCES

List Trade References (use separate sheet if necessary):

List Bank References (use separate sheet if necessary):

List previous HUD/USDA-FmHA projects and Section 8 Contracts (formerly Schedule A on HUD-2530). Applicable to construction contracts exceeding $50,000. List each principals name, previous project, principal's participation role and interest, and disclose defaults, mortgage relief, assignments and foreclosures. **Note that having a Master Schedule on file with HUD will not meet this requirement.**

Certifications: I (meaning the individual who signs as well as the corporations, partnerships or other parties listed above who certify) hereby apply to HUD or USDA-FmHA, as the case may be, for approval to participate as a principal in the role and project listed above based upon my following previous participation record of this Certification.

I certify that all the statements made by me are true, complete and correct to the best of my knowledge and belief and are made in good faith, including the data contained in Schedule A and Exhibits, signed by me and attached to this form.
Warning: HUD and/or the Authority will prosecute false claims and statements. Conviction may result in criminal and/or civil penalties. (18 U.S.C. 1001, 1012;31 U.S.C. 3729, 3802)

I further certify that:

1. The list of previous HUD/USDA-FmHA projects and Section 8 Contracts contains a listing of every assisted or insured project of HUD, which I have been or am now a principal.

2. For the period beginning 10 years prior to the date of this certification, and except as shown by me on the certification.
   a. No mortgage on a project listed by me has ever been in default, assigned to the Government or foreclosed, nor has mortgage relief by the mortgagee been given;
   b. I have not experienced default or noncompliance under any Conventional Contract or Turnkey Contract of Sale in connection with a public housing project;
   c. To the best of my knowledge, there are no unresolved findings raised as a result of HUD audits, management reviews or other Governmental investigations concerning me or my projects;
   d. There has not been a suspension or termination of payments under any HUD assistance contract in which I have had a legal or beneficial interest;
   e. I have not been convicted of a felony and am not presently, to my knowledge, the subject of a complaint or indictment charging a felony. (A felony is defined as any offense punishable by imprisonment for a term exceeding one year, but does not include any offense classified as a misdemeanor under the laws of a State and punishable by imprisonment of two years or less);
   f. I have not been suspended, debarred or otherwise restricted by any Department or Agency of the Federal Government or of a State Government from doing business with such Department or Agency.

g. I have not defaulted on an obligation covered by a surety or performance bond and have not been the subject of a claim under an employee fidelity bond.

3. All the names of the parties, known to me to be principals in this project(s) in which I propose to participate, are listed above.

4. I am not a HUD/FmHA employee or a member of a HUD/FmHA employee's immediate household as defined in Standards of Ethical Conduct for Employees of the Executive Branch in 5 C.F.R. Part 2635 (57 FR 35006) and HUD's Standard of Conduct in 24 C.F.r. Part O and USDA's Standard of Conduct in 7 C.F.R. Part 9 Subpart B.

5. I am not a Housing Authority of the City of Pittsburgh employee or a member of an Authority employee's immediate family.

6. I am not a principal participant in an assisted or insured project as of this date on which construction has stopped for a period in excess of 20 days or which has been substantially completed for more than 90 days and documents for closing, including final cost certification have not been filed with HUD or FmHA.

7. To my knowledge I have not been found by HUD or FmHA to be in noncompliance with any applicable civil rights law.

8. I am not a Member of Congress or a Resident Commissioner nor otherwise prohibited or limited by law from contracting with the Government of the United States of America.

9. Statements above (if any) to which I cannot certify have been deleted by striking through the words with a pen. I have initialed each deletion (if any) and have attached a true and accurate signed statement (if applicable) to explain the facts and circumstances which I think helps to qualify me as a responsible principal for participation in this project.

(Signature and Date)

(Typed or Printed Name)

(Title)

(Company Name)

Subscribed and sworn to before me

this_____ day of _____, 20

My Commission expires _____, 20

All section 3 covered contracts shall include the following clause (referred to as the section 3 clause):

A. The work to be performed under this contract is subject to the requirements of section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3). The purpose of section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

B. The parties to this contract agree to comply with HUD's regulations in 24 CFR part 135, which implement section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the part 135 regulations.

C. The contractor agrees to send to each labor organization or representative of workers with which the contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

D. The contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 135. The contractor will not subcontract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 135.

E. The contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR part 135 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR part 135.

F. Noncompliance with HUD's regulations in 24 CFR part 135 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts.

G. With respect to work performed in connection with section 3 covered Indian housing assistance, section 7(b) of the Indian Self- Determination and Education Assistance Act (25 U.S.C. 450e) also applies to the work to be performed under this contract. Section 7(b) requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties to this contract that are subject to the provisions of section 3 and section 7(b) agree to comply with section 3 to the maximum extent feasible, but not in derogation of compliance with section 7(b).

Housing Authority City of Pittsburgh

Development and Modernization Department

Bidder's Section 3 Participation Form

A. Bidder's Section 3 Hiring Plan

Job Category	Total Estimated Positions Needed for Project	No. Positions Occupied by Permanent Employees*	Number of Positions Not Occupied	Number of Positions Available for Section 3 Residents
Trade:				
Journeyman				
Helper				
Apprentices				
Trainees				
Laborer				
Others				

*** Please submit a list of current employees to be assigned to this project including Dates of Hire**

B. Bidder's Section 3 Subcontracting Plan

SUB - CONTRACTOR'S NAME**	SUB - CONTRACTORS ADDRESS	PHONE NUMBER	FEDERAL TAX ID NO./ SS#	DESCRIPTION OF WORK	Sub - Contract Amount

**** If the Bidder has not identified a Section 3 subcontractor, please indicate if there will be any Section 3 subcontracting opportunity and describe scope of work**_____

_____
Company Name

_____
Project Name

_____
Project Number

_____
Name and Title of Person Completing this Form

_____
Signature and Date

PLACE HOLDER FOR

ROSTER OF CURRENT EMPLOYEES

Pursuant to Housing Authority of the City of Pittsburgh Section 3 Program Manual, Part I, Section A - Section 3 Policy Statement (in part):

"HACP shall examine and consider a contractor's potential for success in providing employment and business opportunities to those covered under Section 3 prior to acting on any proposed contract award. In response to any RFP, RFQ or IFB HACP will require submission of the Section 3 Opportunities Plan and roster of current employees, and certification that the bidder will comply with the requirements of Section 3."

Section 3 Participation

With respect to work performed in connection with Section 3 covered Indian housing assistance, Section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e) also applies to the work to be performed under this contract. Section 7(b) requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties to this contract that are subject to the provisions of Section 3 and Section 7(b) agree to comply with Section 3 to the maximum extent feasible, but not in derogation of compliance with Section 7(b).

RESIDENT HIRING REQUIREMENTS / RESIDENT HIRING SCALE

TOTAL LABOR DOLLARS USE TOTAL CONTRACT AMOUNT FOR SERVICE CONTRACTS	RESIDENT LABOR AS A % OF TOTAL LABOR DOLLARS
Labor dollars $25,000 but less than $100,000	10% of the labor dollars
$100,000, but less than $200,000	9% of the labor dollars
At least $200,000, but less than $300,000	8% of the labor dollars
At least $300,000, but less than $400,000	7% of the labor dollars
At least $400,000, but less than $500,000	6% of the labor dollars
At least $500,000, but less than $1 million	5% of the labor dollars
At least $1 million, but less than $2 million	4% of the labor dollars
At least $2 million, but less than $4 million	3% of the labor dollars
At least $4 million, but less than $7 million	2% of the labor dollars
$7 million or more	½ to 1 % of the labor dollars

A copy of HACP's Section 3 Program Manual is available for download at www.HACP.org.

SECTION 3 OPPORTUNITIES PLAN

Business Opportunities and Employment Training for Housing Authority of the City of Pittsburgh Low Income Public Housing Residents (LIPH) and Area Residents of Low and Very Low Income Status (ARLIS)

PRIME CONTRACTOR'S NAME: _____
SPECIFICATION OR RFP/IFB/RFQ NUMBER: _____
SPECIFICATION OR RFP/IFB/RFQ TITLE: _____

The Contractor hereby agrees to comply with all the provisions of Section 3 as set forth in 24 CFR 135.1 et seq. and the HACP Section 3 Policy and Program requirements. The Contractor hereby submits this document to identify employment opportunities for HACP residents (LIPH) and **Area Residents of Low and Very Low Income Status (ARLIS**) during the term of the contract between the Contractor and the HACP.

The preference of HACP is to ensure that as many HACP residents as possible are employed. In an effort to further that requirement, HACP has created a preference tier structure as outlined in the HACP Section 3 Policy and Program Manual which can be reviewed by visiting the "Vendor Services" section of www.hacp.org. Contractors are required to comply with Section 3 by first considering Tier I – Hiring. If the Contractor cannot meet its Section 3 requirement in Tier I and needs to move to Tier II or Tier III, that Contractor must document this inability to comply with the preference and the need to move to a lower tier. (Such inability **must** be documented for moves within tiers). The Contractor agrees to meet its Section 3 requirement following the Preferential Tier Structure as indicated by the selection below (check one or more tiers below):

[ ] Tier I – HIRING

The Contractor affirms that the jobs identified shall be for meaningful employment that may or may not be related to the scope of services covered under Contract/Purchase Order # _____. The Contractor has committed to employ _____ resident(s) in order to comply with its Section 3 requirements. A prime contractor may satisfy the HACP Resident Hiring Requirements through his/her subcontractors. **Contact the HACP Resident Employment Program for resident referrals at 412-395-3950, Ext 1048.**

When Tier I is selected, the Contractor shall complete the following table as instructed below:

(1) Indicate each job title for all phases of this contract
(2) The number of positions that will be needed in each category
(3) How many of those positions are currently filled
(4) The number currently filled by low and very low-income HACP residents
(5) The number currently filled by City of Pittsburgh neighborhood area residents
(6) How many positions need to be filled

Indicate your requirement for the number of positions you intend to fill with:

(7) Low income HACP Residents (LIPH) and/or
(8) Low and very low income City of Pittsburgh Neighborhood Area Residents (ARLIS)

SECTION 3 OPPORTUNITIES PLAN

Section 3 Labor Utilization Assessment and Plan							
SPEC or RFP TITLE:				SPEC or RFP NUMBER:			
JOB TITLE (1)	NUMBER OF POSITIONS					HIRING REQUIREMENT	
	# NEEDED (2)	CURRENTLY FILLED			TO BE FILLED (6)	LIPH (7)	ARLIS (8)
		TOTAL (3)	LIPH (4)	ARLIS (5)			

LIPH – HACP low income public housing resident
ARLIS - Area Residents of Low/Very Low Income Status – (Area is the Pittsburgh metropolitan area)

In the event the value of Section 3 resident hiring is less than the amount identified in the Resident Hiring Scale, vendors must contribute to the HACP Education Fund an amount not less than the difference between the value of Section 3 hiring and the amount identified in the Resident Hiring Scale, which funds shall be used to provide other economic opportunities.
Therefore, if it is anticipated that any position listed above shall be for less than the full term of the contract period, you must indicate on the lines below, the anticipated term for each position:

_____

_____

SECTION 3 OPPORTUNITIES PLAN

[ ] Tier II – CONTRACTING

The contractor has identified _____ HACP resident-owned business(es) or _____ Section 3 business(es) which is/are 51 percent or more owned by Section 3 residents or 30 percent or more of their permanent full-time workforce are Section 3 residents. This will satisfy the contractor's Section 3 requirement covered under Contract/Purchase Order # _____.

In a one (1) page letter on your firm's letterhead:

1) Indicate the requirements, expressed in terms of percentage, of planned contracting dollars for the use of Section 3 business concerns as subcontractors.

2) A statement of the total dollar amount to be contracted, total dollar amount to be contracted to Section 3 business concerns for building trades, and total dollar amount to be contracted to Section 3 business concerns for other than building trades work (maintenance, repair, modernization, and development).

3) A description of the method used to develop the requirements above and the efforts to be undertaken by the contractor to meet those requirements.

[ ] Tier III - OTHER ECONOMIC OPPORTUNITIES

Firms may provide other economic opportunities to train and employ Section 3 residents or make a direct cash contribution to the HACP Education Fund. HACP has established the following minimum threshold requirements for provision of training or contribution to the HACP fund that provides other economic opportunities:

a) Contractor incurs the cost of providing skilled training for residents in an amount commensurate with the sliding scale set forth in the Resident Hiring Scale; or,

b) Contractor makes a contribution to the HACP Education Fund at Clean Slate E3 to provide assistance to residents to obtain training. The level of contribution would be commensurate with the sliding scale set forth in the Resident Hiring Scale.
Contractor shall provide, in a letter on firm letterhead:

1) Indication of the skilled training to be provided, the number of persons to be trained, the training provider, the cost of training, and the trainee recruitment plan; or,
2) Provide the amount of planned contribution to be made in relation to percentage of the contract labor hours costs. (Contribution checks should be made payable to: Clean Slate E3 Education Fund and mailed to Clean Slate E3, C/O Housing Authority of the City of Pittsburgh, Finance Department, 412 Boulevard of the Allies, 7th Floor, Pittsburgh, PA 15219.

[ ] Tier IV – No New Hire Opportunity

If awarded this contract, the contractor will be able to fulfill the requirements of the IFB/RFP/RFQ with the existing work force. No new hires will be employed as a result of this award. If this position changes and hiring opportunities become necessary, the HACP Resident Employment Program will be notified.

SECTION 3 OPPORTUNITIES PLAN

By signing below, the Contractor hereby agrees to comply with the selected Section 3 requirements indicated above. To the extent that the completion of this form is contingent upon future information, for example price negotiations, request for specific services, etc., the undersigned hereby affirms and agrees to fully adhere to the spirit and intent of the HACP Section 3 Policy.

Furthermore, the undersigned acknowledges and affirms responsibility for completion and submission of this form as part of the response documentation for this Invitation for Bid or Request for Proposal. Failure to submit this form may jeopardize the responsiveness of your submission.

Company Name:_____

Name:_____

Title:_____

Signature:_____Date:_____

Witness Name:_____

Witness Signature:_____Date:_____

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
MBE/WBE SOLICITATION AND COMMITMENT RECORD

SOLICITATION AND COMMITMENT STATEMENT
MINORITY (MBE) AND FEMALE (WBE) OWNED BUSINESS ENTERPRISES

BID NUMBER	NAME OF BIDDER	ADDRESS	PHONE

List below All MBE/WBE's that were solicited - whether or not a commitment was obtained -- Copy this form as necessary

_____MBE _____WBE	TYPE OF SUBCONTRACT WORK OR MATERIALS	DATE SOLICITED		COMMITMENT MADE		GIVE REASON(S) IF NO COMMITMENT MADE
		BY PHONE	BY MAIL	**YES** (IF YES, GIVE DATE)	**NO**	
COMPANY NAME						
ADDRESS		QUOTE RECEIVED		AMOUNT COMMITTED		
CONTACT PERSON PHONE		YES	NO	DOLLAR AMOUNT $		
				PERCENT OF TOTAL BID %		

_____MBE _____WBE	TYPE OF SUBCONTRACT WORK OR MATERIALS	DATE SOLICITED		COMMITMENT MADE		GIVE REASON(S) IF NO COMMITMENT MADE
		BY PHONE	BY MAIL	**YES** (IF YES, GIVE DATE)	**NO**	
COMPANY NAME						
ADDRESS		QUOTE RECEIVED		AMOUNT COMMITTED		
CONTACT PERSON PHONE		YES	NO	DOLLAR AMOUNT $		
				PERCENT OF TOTAL BID %		

_____MBE _____WBE	TYPE OF SUBCONTRACT WORK OR MATERIALS	DATE SOLICITED		COMMITMENT MADE		GIVE REASON(S) IF NO COMMITMENT MADE
		BY PHONE	BY MAIL	**YES** (IF YES, GIVE DATE)	**NO**	
COMPANY NAME						
ADDRESS		QUOTE RECEIVED		AMOUNT COMMITTED		
CONTACT PERSON PHONE		YES	NO	DOLLAR AMOUNT $		
				PERCENT OF TOTAL BID %		

Prepared by: Title: Phone:

NOTE: Certification and letters of intent for each MBE/WBE commitment must accompany this document.

MBE/WBE Participation Plan

I. SMALL BUSINESS PARTICIPATION
Is the Bidder a Small Business as defined by the size and standards in 13 CFR 121?

Yes _____ No _____

II. MINORITY BUSINESS PARTICIPATION
Is the Bidder classified as a Minority Business Enterprise?

Yes _____ No _____

If "No", are any Subcontractors classified as Minority Business enterprises?

Yes _____ No _____

If "Yes", please fill in the following chart:

Consulting Firm(s) (MBE)	$ Value Contract	% of Fee

III. WOMEN-OWNED BUSINESS PARTICIPATION
Is the Bidder classified as a Woman-Owned Business Enterprise?

Yes _____ No _____

If "No", area any Subcontractors classified as Women-Owned Business Enterprises?

Yes _____ No _____

If "Yes", please fill in the following chart:

Consulting Firm(s) (WBE)	$ Value Contract	% of Fee

****All MBE/WBE firms must be certified.**
In order for the MBE/WBE participation plan to be complete, copies of MBE/WBE certification must be included for all firms listed.

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
MBE/WBE RECORD
MBE/WBE SOLICITATION AND COMMITMENT STATEMENT
MBE/WBE 3-YEAR RECORD

BIDDERS NAME: _____
ADDRESS: _____
TELEPHONE: _____
CONTACT PERSON: _____
PROPOSAL AND BID FOR: _____

List below all contracts with the Housing Authority of the City of Pittsburgh during the past three years and the MBE and WBE participation obtained.					
CONTRACT TITLE	CONTRACT DATE	AMOUNT	% PARTICIPATION MBE	WBE	COMMENTS

Prepared by: Title: Phone:

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
MBE/WBE SOLICITATION AND COMMITMENT STATEMENT
ADDITIONAL INFORMATION SHEET

The bidder presents the following as additional and supplemental information to its MBE/WBE Solicitation and Commitment Statement.

Prepared by: Title: Phone:

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH
MBE/WBE EXHIBIT

MBE/WBE COMMITMENT WAIVER REQUEST FORM

BIDDER'S FIRM:_____
ADDRESS:_____
TELEPHONE:_____
CONTACT PERSON:_____
PROPOSAL AND BID FOR:_____

Waiver of the MBE/WBE participation requirement is requested for the following reasons:

Prepared by: Title: Phone:

NOTE: The fully completed MBE/WBE Solicitation and Commitment Statement must accompany this waiver request.

Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11625)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

2. The goals for minority and female participation at the Housing Authority of the City of Pittsburgh are pursuant to the Mayor's promulgated Executive Order, and the action of the Housing Authority Board. Expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, these goals are seventeen percent (18%) of the total cost of the contract to be expended for minority participation and six percent (7%) for women participation. These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

   The Contractor's compliance with the Executive Order and the regulations in Section 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in Section 41 CFR Part 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in Section 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification, within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation, to:

   LaVaris Ross, Labor Relations Specialist
   U.S. Department of Housing and Urban Development
   Office of Labor Relations
   City Crescent Building
   10 S. Howard Street, 5th Floor
   Baltimore, MD 21201

   The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is within the Commonwealth of Pennsylvania, County of Allegheny, City of Pittsburgh.

Housing Authority of the City of Pittsburgh

Development & Modernization
412 Boulevard of the Allies, 6th Floor,
Pittsburgh, PA 15219
(412) 456-5020
www.hacp.org

NOTICE TO ALL PROSPECTIVE BIDDERS

REQUEST FOR MANPOWER PLAN

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP CONTRACT NO. 600-21-24

Each bid must include a separate Manpower Plan and Major Equipment List for this Invitation for Bids. The Manpower Plan must include (1) the names of the bidder's personnel to be assigned to the Project, (2) trade/position, (3) Social Security Number or Driver's License Number and (4) Employee Date of Hire.

In the event you are bidding on multiple HACP construction work, each bid must include a separate Manpower Plan and Major Equipment List that clearly demonstrates that the bidder has the capacity and will not use the same personnel and equipment on more than one HACP construction work that are being executed simultaneously within the next 180 days.

HACP will use this information to determine whether the bidder has the capacity to perform the work.

Please acknowledge receipt of this Notice by completing the information below and the attached and including copies in your bid.

Bidder's Name: _____

Name of the Person Signing the Bid: _____

Signature of the Person Signing the Bid: _____

Bid Due Date: _____

Housing Authority of the City of Pittsburgh

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www.hacp.org

Bidder's Planned Manpower

Provide Employee Name, Trade/Position, Social Security Number or Driver's License Number and Date of Hire for each employee:
(use additional sheets if necessary).

Name	Position	Social Security No. or Driver's License No.		Date of Hire

Housing Authority of the City of Pittsburgh

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SPECIAL PROVISIONS
FOR INVITATION FOR BIDS (IFB)

REQUEST FOR INFORMATION

Each bidder must submit the following information to assist the Owner to determine if the Bidder has the capacity to perform the required work under this **Project Name:_____ IFB No. _____.**

Bidder's Capacity

Provide information demonstrating the Bidder's ability to provide the resources necessary for the timely and efficient implementation of the construction work. Due to the nature of this procurement, capacity will also be evaluated based on the Bidder's ability to complete the work on time and within budget, therefore, please describe the Bidder's Capacity as follows:

1. Manpower Plan and Major Equipment List (Please complete **Form 00435-1 & 2**).
2. List a maximum of three-(3) current or completed ***Housing Authority of the City of Pittsburgh*** related projects, the **Initial Contract Value, Change Orders, if any, and Final Contract Value**. If the project was not completed within budget and on time, please explain the circumstances and/or justification for the change order(s): Please attach a separate sheet if you do not have sufficient space.

Project #	Initial Contract Value	Change Order(s)	Final Contract Value
a.			
b.			
c.			

Justification for Change Orders/Schedule:_____
_____

3. List at least three-(3) other Owners including one current or completed project plus the following information:

Vendor's Name & Contact #	Initial Contract Value	Change Order(s)	Final Contract Value
a.			
b.			
c.			

Justification for Change Orders/Schedule:_____
_____

The Bidder hereby certifies that the information provided above is accurate/correct and provision of false information can be a basis for the rejection of this bid:

Bidder's Name:_____ Bidder's Signature:_____
Date:_____

Housing Authority of the City of Pittsburgh

Development & Modernization
412 Boulevard of the Allies, 6th Floor, Pittsburgh, PA 15219
(412) 456-5020
www.hacp.org

NOTICE TO ALL PROSPECTIVE BIDDERS

Previous Related Experience
for

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP CONTRACT NO. 600-21-24

The bidder shall list three (3) firms, governmental units, or persons for whom the bidder has previously performed work of the nature requested under this IFB. Bidder shall list as references all housing authorities, including HACP, for whom the bidder has previously performed work of the nature requested under this IFB. HACP reserves the right to contact such persons at anytime prior to award and the bidder agrees that HACP may rely on information provided by such persons to determine the bidder's responsibility.

In addition to the references, all bidders will provide the last three jobs they performed, contact information from the job and all change orders related to the job and the reason for each.

All bidders will provide information on the most recet HACP job to include all change order information and the reason for each. The most recent HACP job can be one of the 3 last jobs performed if that is the case.

Reference 1			
Project:			
Contact:			
Contact Telephone Number:			
Contract Amount:			
Change Orders			
Number	**Total $ Value per Change**	**Description of Change**	**Reason for Change**
1			
2			
3			
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Housing Authority of the City of Pittsburgh

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All bidders will provide information on the most recet HACP job to include all change order information and the reason for each. The most recent HACP job can be one of the 3 last jobs performed if that is the case.

Reference 2			
Project:			
Contact:			
Contact Telephone Number:			
Contract Amount:			
Change Orders			
Number	**Total $ Value per Change**	**Description of Change**	**Reason for Change**
1			
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for

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HACP CONTRACT NO. 600-21-24

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All bidders will provide information on the most recet HACP job to include all change order information and the reason for each. The most recent HACP job can be one of the 3 last jobs performed if that is the case.

Reference 3			
Project:			
Contact:			
Contact Telephone Number:			
Contract Amount:			
Change Orders			
Number	**Total $ Value per Change**	**Description of Change**	**Reason for Change**
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All bidders will provide information on the most recet HACP job to include all change order information and the reason for each. The most recent HACP job can be one of the 3 last jobs performed if that is the case.

Reference 4			
Project:			
Contact:			
Contact Telephone Number:			
Contract Amount:			
Change Orders			
Number	**Total $ Value per Change**	**Description of Change**	**Reason for Change**
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All bidders will provide information on the most recet HACP job to include all change order information and the reason for each. The most recent HACP job can be one of the 3 last jobs performed if that is the case.

Reference 5			
Project:			
Contact:			
Contact Telephone Number:			
Contract Amount:			
Change Orders			
Number	**Total $ Value per Change**	**Description of Change**	**Reason for Change**
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HACP CONTRACT NO. 600-21-24

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In addition to the references, all bidders will provide the last three jobs they performed, contact information from the job and all change orders related to the job and the reason for each.

All bidders will provide information on the most recet HACP job to include all change order information and the reason for each. The most recent HACP job can be one of the 3 last jobs performed if that is the case.

Reference 6			
Project:			
Contact:			
Contact Telephone Number:			
Contract Amount:			
Change Orders			
Number	**Total $ Value per Change**	**Description of Change**	**Reason for Change**
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Housing Authority of the City of Pittsburgh

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In addition to the references, all bidders will provide the last three jobs they performed, contact information from the job and all change orders related to the job and the reason for each.

All bidders will provide information on the most recet HACP job to include all change order information and the reason for each. The most recent HACP job can be one of the 3 last jobs performed if that is the case.

Reference 7			
Project:			
Contact:			
Contact Telephone Number:			
Contract Amount:			
Change Orders			
Number	**Total $ Value per Change**	**Description of Change**	**Reason for Change**
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***All contractors MUST submit 3 references and most recent HACP Job if applicable.**

U.S. Department of Housing and Urban Development

Office of Public and Indian Housing

Representations, Certifications, and Other Statements of Bidders

Public and Indian Housing Programs

Representations, Certifications, and Other Statements of Bidders

Public and Indian Housing Programs

Table of Contents

1. Certificate of Independent Price Determination

(a) The bidder certifies that--

(1) The prices in this bid have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other bidder or competitor relating to (i) those prices, (ii) the intention to submit a bid, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this bid have not been and will not be knowingly disclosed by the bidder, directly or indirectly, to any other bidder or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a competitive proposal solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the bidder to induce any other concern to submit or not to submit a bid for the purpose of restricting competition.

(b) Each signature on the bid is considered to be a certification by the signatory that the signatory--

(1) Is the person in the bidder's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(l) through (a)(3) above; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(l) through (a)(3) above.

_____ [insert full name of person(s) in the bidder's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the bidder's organization];

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the bidder deletes or modifies subparagraph (a)2 above, the bidder must furnish with its bid a signed statement setting forth in detail the circumstances of the disclosure.

☑ [Contracting Officer check if following paragraph is applicable]

(d) Non-collusive affidavit. (applicable to contracts for construction and equipment exceeding $50,000)

(1) Each bidder shall execute, in the form provided by the PHA/IHA, an affidavit to the effect that he/she has not colluded with any other person, firm or corporation in regard to any bid submitted in response to this solicitation. If the successful bidder did not submit the affidavit with his/her bid, he/she must submit it within three (3) working days of bid opening. Failure to submit the affidavit by that date may render the bid nonresponsive. No contract award will be made without a properly executed affidavit.

(2) A fully executed "Non-collusive Affidavit" [ ] is, [ ] is not included with the bid.

2. Contingent Fee Representation and Agreement

(a) Definitions. As used in this provision:

"Bona fide employee" means a person, employed by a bidder and subject to the bidder's supervision and control as to time, place, and manner of performance, who neither exerts, nor proposes to exert improper influence to solicit or obtain contracts nor holds out as being able to obtain any contract(s) through improper influence.

"Improper influence" means any influence that induces or tends to induce a PHA/IHA employee or officer to give consideration or to act regarding a PHA/IHA contract on any basis other than the merits of the matter.

(b) The bidder represents and certifies as part of its bid that, except for full-time bona fide employees working solely for the bidder, the bidder:

(1) [ ] has, [ ] has not employed or retained any person or company to solicit or obtain this contract; and

(2) [ ] has, [ ] has not paid or agreed to pay to any person or company employed or retained to solicit or obtain this contract any commission, percentage, brokerage, or other fee contingent upon or resulting from the award of this contract.

(c) If the answer to either (a)(1) or (a)(2) above is affirmative, the bidder shall make an immediate and full written disclosure to the PHA/IHA Contracting Officer.

(d) Any misrepresentation by the bidder shall give the PHA/IHA the right to (1) terminate the contract; (2) at its discretion, deduct from contract payments the amount of any commission, percentage, brokerage, or other contingent fee; or (3) take other remedy pursuant to the contract.

3. Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions (applicable to contracts exceeding $100,000)

(a) The definitions and prohibitions contained in Section 1352 of title 31, United States Code, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The bidder, by signing its bid, hereby certifies to the best of his or her knowledge and belief as of December 23, 1989 that:

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of a contract resulting from this solicitation;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the bidder shall complete and submit, with its bid, OMB standard form LLL, "Disclosure of Lobbying Activities;" and

(3) He or she will include the language of this certification in all subcontracts at any tier and require that all recipients of subcontract awards in excess of $100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than $10,000, and not more than $100,000, for each such failure.

(d) Indian tribes (except those chartered by States) and Indian organizations as defined in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) are exempt from the requirements of this provision.

4. Organizational Conflicts of Interest Certification

The bidder certifies that to the best of its knowledge and belief and except as otherwise disclosed, he or she does not have any organizational conflict of interest which is defined as a situation in which the nature of work to be performed under this proposed contract and the bidder's organizational, financial, contractual, or other interests may, without some restriction on future activities:

(a) Result in an unfair competitive advantage to the bidder; or,

(b) Impair the bidder's objectivity in performing the contract work.

[ ] In the absence of any actual or apparent conflict, I hereby certify that to the best of my knowledge and belief, no actual or apparent conflict of interest exists with regard to my possible performance of this procurement.

5. Bidder's Certification of Eligibility

(a) By the submission of this bid, the bidder certifies that to the best of its knowledge and belief, neither it, nor any person or firm which has an interest in the bidder's firm, nor any of the bidder's subcontractors, is ineligible to:

(1) Be awarded contracts by any agency of the United States Government, HUD, or the State in which this contract is to be performed; or,

(2) Participate in HUD programs pursuant to 24 CFR Part 24.

(b) The certification in paragraph (a) above is a material representation of fact upon which reliance was placed when making award. If it is later determined that the bidder knowingly rendered an erroneous certification, the contract may be terminated for default, and the bidder may be debarred or suspended from participation in HUD programs and other Federal contract programs.

6. Minimum Bid Acceptance Period

(a) "Acceptance period," as used in this provision, means the number of calendar days available to the PHA/IHA for awarding a contract from the date specified in this solicitation for receipt of bids.

(b) This provision supersedes any language pertaining to the acceptance period that may appear elsewhere in this solicitation.

(c) The PHA/IHA requires a minimum acceptance period of [Contracting Officer insert time period] calendar days.

(d) In the space provided immediately below, bidders may specify a longer acceptance period than the PHA's/IHA's minimum requirement. The bidder allows the following acceptance period: calendar days.

(e) A bid allowing less than the PHA's/IHA's minimum acceptance period will be rejected.

(f) The bidder agrees to execute all that it has undertaken to do, in compliance with its bid, if that bid is accepted in writing within (1) the acceptance period stated in paragraph (c) above or (2) any longer acceptance period stated in paragraph (d) above.

7. Small, Minority, Women-Owned Business Concern Representation

The bidder represents and certifies as part of its bid/ offer that it --

(a) [ ] is, [ ] is not a small business concern. "Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding, and qualified as a small business under the criteria and size standards in 13 CFR 121.

(b) [ ] is, [ ] is not a women-owned business enterprise. "Women-owned business enterprise," as used in this provision, means a business that is at least 51 percent owned by a woman or women who are U.S. citizens and who also control and operate the business.

(c) [ ] is, [ ] is not a minority business enterprise. "Minority business enterprise," as used in this provision, means a business which is at least 51 percent owned or controlled by one or more minority group members or, in the case of a publicly owned business, at least 51 percent of its voting stock is owned by one or more minority group members, and whose management and daily operations are controlled by one or more such individuals. For the purpose of this definition, minority group members are:

(Check the block applicable to you)

[ ] Black Americans	[ ] Asian Pacific Americans
[ ] Hispanic Americans	[ ] Asian Indian Americans
[ ] Native Americans	[ ] Hasidic Jewish Americans

8. Indian-Owned Economic Enterprise and Indian Organization Representation (applicable only if this solicitation is for a contract to be performed on a project for an Indian Housing Authority)

The bidder represents and certifies that it:

(a) [ ] is, [ ] is not an Indian-owned economic enterprise. "Economic enterprise," as used in this provision, means any commercial, industrial, or business activity established or organized for the purpose of profit, which is at least 51 percent Indian owned. "Indian," as used in this provision, means any person who is a member of any tribe, band, group, pueblo, or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs and any "Native" as defined in the Alaska Native Claims Settlement Act.

(b) [ ] is, [ ] is not an Indian organization. "Indian organization," as used in this provision, means the governing body of any Indian tribe or entity established or recognized by such governing body. Indian "tribe" means any Indian tribe, band, group, pueblo, or

community including Native villages and Native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs.

9. Certification of Eligibility Under the Davis-Bacon Act (applicable to construction contracts exceeding $2,000)

(a) By the submission of this bid, the bidder certifies that neither it nor any person or firm who has an interest in the bidder's firm is a person or firm ineligible to be awarded contracts by the United States Government by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of the contract resulting from this solicitation shall be subcontracted to any person or firm ineligible to be awarded contracts by the United States Government by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U. S. Criminal Code, 18 U.S.C. 1001.

10. Certification of Nonsegregated Facilities (applicable to contracts exceeding $10,000)

(a) The bidder's attention is called to the clause entitled **Equal Employment Opportunity** of the General Conditions of the Contract for Construction.

(b) "Segregated facilities," as used in this provision, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise.

(c) By the submission of this bid, the bidder certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The bidder agrees that a breach of this certification is a violation of the Equal Employment Opportunity clause in the contract.

(d) The bidder further agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) prior to entering into subcontracts which exceed $10,000 and are not exempt from the requirements of the Equal Employment Opportunity clause, it will:

(1) Obtain identical certifications from the proposed subcontractors;

(2) Retain the certifications in its files; and

(3) Forward the following notice to the proposed subcontractors (except if the proposed subcontractors have submitted identical certifications for specific time periods):

Notice to Prospective Subcontractors of Requirement for Certifications of Nonsegregated Facilities

A Certification of Nonsegregated Facilities must be submitted before the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Employment Opportunity clause of the prime contract. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

Note: The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

11. Clean Air and Water Certification (applicable to contracts exceeding $100,000)

The bidder certifies that:

(a) Any facility to be used in the performance of this contract [ ] is, [ ] is not listed on the Environmental Protection Agency List of Violating Facilities:

(b) The bidder will immediately notify the PHA/IHA Contracting Officer, before award, of the receipt of any communication from the Administrator, or a designee, of the Environmental Protection Agency, indicating that any facility that the bidder proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and,

(c) The bidder will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

12. Previous Participation Certificate (applicable to construction and equipment contracts exceeding $50,000)

(a) The bidder shall complete and submit with his/her bid the Form HUD-2530, "Previous Participation Certificate." If the successful bidder does not submit the certificate with his/her bid, he/she must submit it within three (3) working days of bid opening. Failure to submit the certificate by that date may render the bid nonresponsive. No contract award will be made without a properly executed certificate.

(b) A fully executed "Previous Participation Certificate"

[ ] is, [ ] is not included with the bid.

13. Bidder's Signature

The bidder hereby certifies that the information contained in these certifications and representations is accurate, complete, and current.

_____
(Signature and Date)

_____
(Typed or Printed Name)

_____
(Title)

_____
(Company Name)

(Company Address)

Previous Participation Certification

OMB Approval No. 2502-0118
(Exp. 05/31/2019)

US Department of Housing and Urban Development
Office of Housing/Federal Housing Commissioner

US Department of Agriculture
Farmers Home Administration

Part I to be completed by Controlling Participant of Covered Projects *(See instructions)* Reason for submission:		**For HUD HQ/FmHA use only**	
1. Agency name and City where the application is filed		**2.** Project Name, Project Number, City and Zip Code	
3. Loan or Contract amount $	**4.** Number of Units or Beds	**5.** Section of Act	**6.** Type of Project (check one) ☐ Existing ☐ Rehabilitation ☐ Proposed (New)

7. List all proposed Controlling Participants and attach organization chart for all organizations

Name and address of Principals and Affiliates (Name: Last, First, Middle Initial) proposing to participate	**8 Role of Each Principal in Project**	**9. SSN or IRS Employer Number**

Certifications: The controlling participants(s) listed above hereby apply to HUD or USDA FmHA, as the case maybe, for approval to participate as controlling participant(s) in the role(s) and project listed above. The controlling participant(s) each certify that all the statements made on this form are true, complete and correct to the best of their knowledge and belief and are made in good faith, including any Exhibits attached to this form.
Warning: HUD will prosecute false claims and statements. Conviction may result in criminal and/or civil penalties. The controlling participants(s) further certify that to the best of their knowledge and belief:

1. Schedule A contains a listing, for the last ten years, of every project assisted or insured by HUD, USDA FmHA and/or State and local government housing finance agencies in which the controlling participant(s) have participated or are now participating.
2. For the period beginning 10 years prior to the date of this certification, and except as shown on the certification:

a. No mortgage on a project listed has ever been in default, assigned to the Government or foreclosed, nor has it received mortgage relief from the mortgagee;
b. The controlling participants have no defaults or noncompliance under any Conventional Contract or Turnkey Contract of Sale in connection with a public housing project;
c. There are no known unresolved findings as a result of HUD audits, management reviews or other Governmental investigations concerning the controlling participants or their projects;
d. There has not been a suspension or termination of payments under any HUD assistance contract due to the controlling participant's fault or negligence;
e. The controlling participants have not been convicted of a felony and are not presently the subject of a complaint or indictment charging a felony. (A felony is defined as any offense punishable by imprisonment for a term exceeding one year, but does not include any offense classified as a misdemeanor under the laws of a State and punishable by imprisonment of two years or less);
f. The controlling participants have not been suspended, debarred or otherwise restricted by any Department or Agency of the Federal Government or of a State Government from doing business with such Department or Agency;
g. The controlling participants have not defaulted on an obligation covered by a surety or performance bond and have not been the subject of a claim under an employee fidelity bond;

3. All the names of the controlling participants who propose to participate in this project are listed above.
4. None of the controlling participants is a HUD/FmHA employee or a member of a HUD/FmHA employee's immediate household as defined in Standards of Ethical Conduct for Employees of the Executive Branch in 5 C.F.R. Part 2635 (57 FR 35006) and HUD's Standard of Conduct in 24 C.F.R. Part 0 and USDA's Standard of Conduct in 7 C.F.R. Part 0 Subpart B.
5. None of the controlling participants is a participant in an assisted or insured project as of this date on which construction has stopped for a period in excess of 20 days or which has been substantially completed for more than 90 days and documents for closing, including final cost certification, have not been filed with HUD or FmHA.
6. None of the controlling participants have been found by HUD or FmHA to be in noncompliance with any applicable fair housing and civil rights requirements in 24 CFR 5.105(a). (If any controlling participants have been found to be in noncompliance with any requirements, attach a signed statement explaining the relevant facts, circumstances, and resolution, if any).
7. None of the controlling participants is a Member of Congress or a Resident Commissioner nor otherwise prohibited or limited by law from contracting with the Government of the United States of America.
8. Statements above (if any) to which the controlling participant(s) cannot certify have been deleted by striking through the words with a pen, and the controlling participant(s) have initialed each deletion (if any) and have attached a true and accurate signed statement (if applicable) to explain the facts and circumstances.

Name of Controlling Participant	**Signature of Controlling Participant**	**Certification Date (mm/dd/yyyy)**	**Area Code and Tel. No.**
This form prepared by (print name)		**Area Code and Tel. No.**	

Schedule A: List of Previous Projects and Section 8 Contracts. Below is a complete list of the controlling participants' previous participation projects and participation history in multifamily Housing programs of HUD/FmHA, State and local Housing Finance Agencies. **Note:** Read and follow the instruction sheet carefully. Make full disclosure. Add extra sheets if you need more space. Double check for accuracy. If no previous projects, write by your name, "**No previous participation, First Experience**".

1. Controlling Participants' Name (Last, First)	2. List of previous projects (Project name, project ID and, Govt. agency involved)	3.List Participants' Role(s) (indicate dates participated, and if fee or identity of interest participant)	4. Status of loan (current, defaulted, assigned, foreclosed)	5.Was the Project ever in default during your participation **Yes**	**No**	**If yes, explain**	6. Last MOR rating and Physical Insp. Score and date

Part II- For HUD Internal Processing Only

Received and checked by me for accuracy and completeness; recommend approval or refer to Headquarters after checking appropriate box.

Date (mm/dd/yyyy)	Tel No. and area code	☐ A. No adverse information; form HUD-2530 approval recommended.	☐ C. Disclosure or Certification problem
Staff	Processing and Control	☐ B. Name match in system	☐ D. Other (attach memorandum)

Signature of authorized reviewer	Signature of authorized reviewer	Approved ☐ Yes ☐ No	Date (mm/dd/yyyy)

Instructions for Completing the Previous Participation Certificate, form HUD-2530

Carefully read these instructions and the applicable regulations. A copy of those regulations published at 24 C.F.R. part 200, subpart H, can be obtained on-line at www.gpo.gov and from the Account Executive at any HUD Office. Type or print neatly in ink when filling out this form. Mark answers in all blocks of the form. If the form is not filled completely, it will delay approval of your application.

Attach extra sheets as you need them. Be sure to indicate "Continued on Attachments" wherever appropriate. Sign each additional page that you attach if it refers to you or your record. **Carefully read the certification before you sign it.** Any questions regarding the form or how to complete it can be answered by your HUD Account Executive.

Purpose: This form provides HUD with a certified report of all previous participation in HUD programs by those parties making application. The information requested in this form is used by HUD to determine if you meet the standards established to ensure that all controlling participants in HUD projects will honor their legal, financial and contractual obligations and are acceptable risks from the underwriting standpoint of an insurer, lender or governmental agency. HUD requires that you certify your record of previous participation in HUD/USDA-FmHA, State and Local Housing Finance Agency projects by completing and signing this form, before your project application or participation can be approved.

HUD approval of your certification is a necessary precondition for your participation in the project and in the capacity that you propose. If you do not file this certification, do not furnish the information requested accurately, or do not meet established standards, HUD will not approve your certification.

Note that approval of your certification does not obligate HUD to approve your project application, and it does not satisfy all other HUD program requirements relative to your qualifications.

Who Must Sign and File Form HUD-2530: Form HUD-2530 must be completed and signed by all Controlling Participants of Covered Projects, as such terms are defined in 24 CFR 200.212, and as further clarified by the Processing Guide referenced in 24 CFR 200.210(b) and made available on the HUD website at: http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/mfh/prevparticipation.

Where and When Form HUD-2530 Must Be Filed: The original of this form must be submitted to the HUD Office where your project application will be processed at the same time you file your initial project application. This form must be filed with applications for projects listed in 24 CFR 200.214 and for the Triggering Events listed at 24 CFR 200.218.

Review of Adverse Determination: If approval of your participation in a HUD project is denied, withheld, or conditionally granted on the basis of your record of previous participation, you will be notified by the HUD Office. You may request reconsideration in accordance with 24 CFR 200.222 and further clarified by the Processing Guide. Request must be made in writing within 30 days from your receipt of the notice of determination.

Specific Line Instructions are set forth in the Processing Guide.

The Department of Housing and Urban Development (HUD) is authorized to collect this information by law (42 U.S.C. 3535(d) and 24 C.F.R. 200.217) and by regulation at 24 CFR 200.210. This information is needed so that principals applying to participate in multifamily programs can become HUD-approved controlling participants. The information you provide will enable HUD to evaluate your record with respect to established standards of performance, responsibility and eligibility. Without prior approval, a controlling participant may not participate in a proposed or existing multifamily or healthcare project. HUD uses this information to evaluate whether or not controlling participants pose an unsatisfactory underwriting risk. The information is used to evaluate the potential controlling participants and approve only individuals and organizations that will honor their legal, financial and contractual obligations.

Privacy Act Statement: The Housing and Community Development Act of 1987, 42 U.S.C. 3543 requires persons applying for a Federally-insured or guaranteed loan to furnish his/her Social Security Number (SSN). HUD must have your SSN for identification of your records. HUD may use your SSN for automated processing of your records and to make requests for information about you and your previous records with other public agencies and private sector sources. HUD may disclose certain information to Federal, State and local agencies when relevant to civil, criminal, or regulatory investigations and prosecutions. It will not be otherwise disclosed or released outside of HUD, except as required and permitted by law. You must provide all of the information requested in this application, including your SSN.

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. This agency may not collect this information, and you are not required to complete this form, unless it displays a currently valid OMB control number.

A response is mandatory. Failure to provide any of the information will result in your disapproval of participation in this HUD program.

Housing Authority of the City of Pittsburgh

Development & Modernization
412 Boulevard of the Allies, 6th ,
Floor, Pittsburgh, PA 15219
(412) 456-5020
www.hacp.org

SPECIAL PROVISIONS

NOTICE TO ALL PROSPECTIVE BIDDERS
Bedford Dwellings EnVision Center-New Dedicated Heating Plant

Documents Required for Payment
HACP Contract No.: _____

Pursuant to Sections 27, 38, 40 and 46 of the General Conditions for this Contract, each contractor must submit the following required documents with each Payment Estimate ("PE") in order for HACP to process a PE as follows:

A. Periodic Estimate – HUD 51001

B. Schedule of Stored Materials – HUD 51003 (if applicable)

C. Summary of Stored Materials – HUD 51004 (if applicable)

D. Schedule of Change Orders – HUD 51002 (if applicable)

E. Progress Payment Certification

F. Current/Approved Certified Payrolls (submitted to HACP's Davis-Bacon Wage Clerk).

G. MBE/WBE Utilization Report

H. Section 3 Summary Report

Signature of Authorized Officer: _____ Date: _____

THIS DOCUMENT MUST BE SIGNED.

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

NON-COLLUSION AFFIDAVIT

State of_____

County of_____

_____, being first duly sworn, deposes and says:
(Printed or Typed Name)

That he/she is
(Proprietor, General Partner, President or Vice President)

of _____; and having submitted the foregoing Bid for
(Bidder Name)

Bedford Dwellings EnVision Center-New
Dedicated Heating Plant

_____ _____;
(Project Name) *(HACP Contract No.)*

and is the party making the foregoing Bid, and that such Bid is genuine and not collusive or sham; that said Bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any Bidder or person, to put in a sham bid, or to refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any person, to fix the bid price of affiant or of any bidder, or to fix any overhead, profit or cost element of said bid price, or of that of any bidder, or to secure any advantage against the Housing Authority of the City of Pittsburgh or any person interested in the proposed contract; and that all statements in said Bid are true.

_____
(Signature and Date)

Subscribed and sworn to before me

this_____ day of _____, 20__

My Commission expires _____, 20__

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

FORM OF AGREEMENT

THIS AGREEMENT, made this ____ day of _____ in the year Two Thousand _____(20) by and between:

_____

_____

_____

[ ] An individual doing business in his/her own name
[ ] An individual doing business under a fictitious or assumed name
[ ] A partnership
[ ] A Corporation

(Hereinafter called the Contractor)

AND

The Housing Authority of the City of Pittsburgh (hereinafter called the Authority)
412 Boulevard of the Allies,
Pittsburgh, PA 15219

WITNESSETH: That the Contractor and the Authority, for the consideration stated herein, mutually agree as follows:

ARTICLE 1, STATEMENT OF WORK

The Contractor shall provide all labor, materials and equipment, and services necessary to perform and complete all work required in accordance with Tusick & Associates Arc drawings for Bedford Dwellings EnVision Center-New Dedicated Heating Plant _____ dated June 27, 2023 and Project Manual dated August 5, 2024 regarding:

CONTRACT NO. _____

and addenda thereto numbered _____, all as prepared by _____, which said specifications, drawings, and addenda are incorporated herein by reference and are a part hereof.

The work shall begin at the time stipulated in the NOTICE TO PROCEED and in no event exceeding 180 consecutive calendar days from notice to proceed.

ARTICLE 2, THE CONTRACT PRICE

The Authority shall pay the contractor for the performance of the Contract in current fund, subject to additions and deductions as provided in the specifications.

_____ ($_____)

ARTICLE 3, CONTRACT DOCUMENTS

The Contract shall consist of the following component parts:

a. This Agreement
b. Project Manual (including all component parts) dated August 5, 2024.
c. Project Drawings issued by Tusick & Associates Arc dated June 27, 2023.

This Agreement, together with the other documents enumerated in this Article 3 which said other documents are as fully a part of the Contract as if hereto attached or herein repeated, form the Contract. In the event that any provision in any component part of this Contract conflicts with any provision of any other component part, the provision of the component part first enumerated in this ARTICLE 3, shall govern, except as subsequent parts may establish more specific criteria or language in which case these criteria and language shall govern. The various provisions in Addenda shall be construed in the order of preference of the component part of the Contract which each modified.

SIGNED, SEALED AND DELIVERED IN _____ ORIGINAL COUNTERPARTS

this _____ day of _____ 20_____.

IF THE PRINCIPAL IS AN INDIVIDUAL, SIGN HERE

By signing this Form of Agreement, if the Housing Authority accepts and signs Contract No. _____ this contract shall be binding on both parties.

_____ *(Printed or Typed Name)*

Witness

{

_____ *(Signature and Date)*

_____ *(Printed or Typed Name)*

Principal

{

_____ *(Signature and Date)*

IF THE PRINCIPAL IS A PARTNERSHIP, SIGN HERE

By signing this Form of Agreement, if the Housing Authority accepts and signs Contract No. _____ this contract shall be binding on both parties.

_____ *(Printed or Typed Name)*	_____ *(Printed or Typed Name)*
Witness {	*Partner** {
_____ *(Signature and Date)*	_____ *(Signature and Date)*
_____ *(Printed or Typed Name)*	_____ *(Printed or Typed Name)*
Witness {	*Partner** {
_____ *(Signature and Date)*	_____ *(Signature and Date)*

* If the Bidder is a partnership, the Form of Agreement must be signed in the name of the partnership by at least two general partners, whose names and addresses must be listed on the certificate on page BF-3-P of the Bid.

IF THE PRINCIPAL IS A CORPORATION, SIGN HERE

By signing this Form of Agreement, if the Housing Authority accepts and signs Contract No. _____ this contract shall be binding on both parties.

(CORPORATE SEAL)

_____
(Corporate Name)

_____ *(Printed or Typed Name)*	_____ *(Printed or Typed Name)*
Witness {	*President* *V.P.*** {
_____ *(Signature and Date)*	_____ *(Signature and Date)*
_____ *(Corporate Title)*	_____ *(Corporate Title)*

** If the bidder is a corporation, the Form of Agreement must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal (Doc. 00625) must be executed by the Secretary or Assistant Secretary.

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the **Secretary/Assistant Secretary** of the Corporation named a Bidder herein; that *(Circle one)* _____ who signed this Bid on behalf of the Corporation was then _____ of said Corporation that I know his signature and his signature thereto is genuine; and that said Bid was duly signed, sealed and attested in behalf of said Corporation by authority of its governing body.

(CORPORATE SEAL)

_____
(Signature and Date)

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Secretary

Attest

{

_____
(Signature and Date)

Contracting Officer

Principal

{

_____
(Signature and Date)

Darrell Davis, Chief Development Officer

Approved as to Contents and Costs

{

_____
(Signature and Date)

Assistant General Counsel

Approved as to Form

{

_____
(Signature and Date)

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

CONTRACTING OFFICER CERTIFICATION

I _____certify that I am the Recording Secretary of the Housing Authority of the City of Pittsburgh; that _____, who signed this Contract on behalf of the Housing Authority, was then Contracting Officer of said Authority; that the said Contract was duly signed for and on behalf of the Housing Authority of the City of Pittsburgh.

_____ (SEAL)
Secretary

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

PERFORMANCE BOND

THIS BOND IS ISSUED SIMULTANEOUSLY WITH PAYMENT BOND IN FAVOR OF THE AUTHORITY CONDITIONED ON THE FULL AND FAITHFUL PERFORMANCE OF THE CONTRACT.

KNOW ALL MEN BY THESE PRESENTS, that we,

_____, as Principal, and
(Insert name and address of contractor exactly as it appears on Form of Agreement)

_____, as Sureties, are held and firmly bound unto the **Housing Authority of the City of Pittsburgh**, its certain attorney, successors, or assigns (the Obligee, hereinafter called the "Authority") in the penal sum of

_____Dollars ($_____)

lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, personal representatives, successors, and assigns, jointly and severally, firmly by these presents:

WHEREAS, the Principal heretofore has submitted to the said Authority a certain bid, dated

_____, 20_____ (the "Bid"), for construction of
(Insert date of bid)

_____
(Insert name of project exactly as it appears on Form of Agreement)
pursuant to specifications, drawings and other related documents constituting the Invitation for Bids (the "IFB"); and

WHEREAS, the said Authority is a "Contracting body" under provisions of Act No. 385 of the General Assembly of the Commonwealth of Pennsylvania, approved by the Governor on December 20, 1967, known and cited as the "Public Works Contractors' Bond Law of 1967" (8 P.S. 191-202) (the "Act"); and

WHEREAS, the Act, in Section 3 (a), requires that, before an award shall be made to the Principal shall furnish this Bond to the said Authority, with this Bond to become binding upon the award of a Contract to the Principal by the said Authority in accordance with the Bid; and

WHEREAS, it also is a condition of the IFB that this Bond shall be furnished by the Principal to the said Authority; and

WHEREAS, Under the Invitation for Bids, it is provided, inter alia, that if the Principal shall furnish this Bond to the said Authority, and if the said Authority shall make an award to the Principal in accordance with the Bid, then the Principal and the said Authority shall enter into a contract with respect to performance of such work (the "Contract"), the Form of Agreement for which is set forth in the IFB.

NOW, therefore, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the principal shall faithfully perform the Contract on his part as of the time and in the manner therein provided and satisfy all claims and demands incurred in or for the same, or growing out of the same, or for injury or damages to persons or property in the performance thereof, and shall fully indemnify and save harmless the said Authority from any and all cost and damage which the said Authority may suffer by reason of the principal's failure to do so, and shall fully reimburse and repay the said Authority any and all outlay and expense which it incurs by reason of any such default, then this obligation shall be null and void, otherwise it shall remain in full force and virtue.

It is further understood and agreed that the principal shall guarantee for a period of one (1) year from completion date of the contract against defects in workmanship or materials in accordance with the terms of the Contract.

The said surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any wise affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work or to the Specifications.

SIGNED, SEALED AND DELIVERED IN _____ ORIGINAL COUNTERPARTS
(2 required by Authority)

this _____ day of _____ 20_____.

IF THE PRINCIPAL IS AN INDIVIDUAL, SIGN HERE

_____ *(Printed or Typed Name)*	_____ *(Printed or Typed Name)*
Witness	*Principal*
{	{
_____ *(Signature and Date)*	_____ *(Signature and Date)*

IF THE PRINCIPAL IS A PARTNERSHIP, SIGN HERE

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Partner**	
	{		{
	_____ *(Signature and Date)*		_____ *(Signature and Date)*
	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Witness		*Partner**	
	{		{
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

* If the Bidder is a partnership, the Bond must be signed in the name of the partnership by at least two general partners, whose names and addresses must be listed on the certificate on page BF-3-P of the Bid.

IF THE PRINCIPAL IS A CORPORATION, SIGN HERE

(CORPORATE SEAL)

_____
(Corporate Name)

_____		_____	
(Printed or Typed Name)		*(Printed or Typed Name)*	
Witness		*President V.P.***	
{		{	
_____		_____	
(Signature and Date)		*(Signature and Date)*	
_____		_____	
(Corporate Title)		*(Corporate Title)*	

** If the bidder is a corporation, the Bond must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal below must be executed by the Secretary or Assistant Secretary.

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the
Secretary/Assistant Secretary of the Corporation named a Bidder herein; that
(Circle one)
_____ who signed this Bid on behalf of the

Corporation was then _____ of said Corporation that I know his signature and his signature thereto is genuine; and that said Bid was duly signed, sealed and attested in behalf of said Corporation by authority of its governing body.

(CORPORATE SEAL)

_____
(Signature and Date)

SURETY SIGN HERE

(SURETY SEAL)

_____
(Printed or Typed Name)

_____
(Printed or Typed Name)

Attest
{
_____
(Signature and Date)

Surety ***
{
_____
(Signature and Date)

***Power of attorney must be attached to this Bid Bond.

The rate of premium charged is $_____ per thousand.
(To be filled in by Surety)

The total amount of premium charged is $_____
(To be filled in by Surety)

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

PAYMENT BOND
(Labor and Materialmen's Bond)

THIS BOND IS ISSUED SIMULTANEOUSLY WITH PERFORMANCE BOND IN FAVOR OF THE AUTHORITY CONDITIONED ON THE FULL AND FAITHFUL PERFORMANCE OF THE CONTRACT.

KNOW ALL MEN BY THESE PRESENTS, that we,

_____, as Principal, and
(Insert name and address of Contractor exactly as it appears on Form of Agreement)

_____, as Sureties, are held and firmly bound unto the **Housing Authority of the City of Pittsburgh**, its certain attorney, successors, or assigns (the Obligee, hereinafter called the "Authority") in the penal sum of

_____Dollars ($_____)

lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, personal representatives, successors, and assigns, jointly and severally, firmly by these presents:

WHEREAS, the Principal heretofore has submitted to the said Obligee a certain bid, dated

_____, 20_____ (the "Bid"), for construction of
(Insert date of bid)

_____
(Insert name of project exactly as it appears on Form of Agreement)
pursuant to specifications, drawings and other related documents constituting the Invitation for Bids (the "IFB"); and

WHEREAS, the said Authority is a "Contracting body" under provisions of Act No. 385 of the General Assembly of the Commonwealth of Pennsylvania, approved by the Governor on December 20, 1967, known and cited as the "Public Works Contractors' Bond Law of 1967" (8 P.S. 191-202) (the "Act"); and

WHEREAS, the Act, in Section 3 (a), requires that, before an award shall be made to the Principal shall furnish this Bond to the said Authority, with this Bond to become binding upon the award of a Contract to the Principal by the said Authority in accordance with the Bid; and

WHEREAS, it also is a condition of the IFB that this Bond shall be furnished by the Principal to the said Authority; and

WHEREAS, Under the Invitation for Bids, it is provided, inter alia, that if the Principal shall furnish this Bond to the said Authority, and if the said Authority shall make an award to the Principal in accordance with the Bid, then the Principal and the said Authority shall enter into a contract with respect to performance of such work (the "Contract"), the Form of Agreement for which is set forth in the IFB.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH that if said principal and all subcontractors to whom any portion of the work provided for in said contract is sublet and all assignees of said principal and of such subcontractors shall promptly make payment for all material furnished, labor supplied or performed, rental for equipment employed, and services rendered by public utilities in or in connection with the prosecution of the work, whether or not the said material, labor, equipment or services enter into and become component parts of the work or improvement contemplated in said contract, or in any amendment or extension of or addition to said Contract, then the above obligation shall be void; otherwise to remain in full force and effect. PROVIDED, however, that this bond is subject to the following conditions and limitations.

(a) All persons who have performed labor, rendered services or furnished materials or machinery, shall have direct right of action against the principal and surety on this bond, which right of action shall be asserted in proceedings instituted in the State in which such labor was performed, services rendered or materials furnished (or where labor has been performed, services rendered or materials furnished under said Contract is more than one State, then in any such State). Insofar as permitted by the laws of such State, such right of action shall be asserted in a proceeding instituting such action and any or all other persons having claims hereunder, and any other person having a claim hereunder shall have the right to be made a party to such proceeding (but not later than one year after the complete performance of said Contract and final settlement thereof) and to have such claim adjudicated in such action and judgment rendered thereon.

(b) The surety shall not be liable hereunder for any damages or compensation recoverable under any workmen's compensation or employer's liability statute.

(c) In no event shall the surety be liable for a greater sum than the penalty of this bond, or subject to any suit, action or proceeding thereon that is instituted later than one year after the complete performance of said contract and final settlement thereof.

(d) As used herein: The term "person" refers to any individual, firm or corporation who have furnished materials or machinery or public utility services to be used on or incorporated in the work or the prosecution thereof provided for in said Contract or in any amendment or extension of or addition to said Contract, and/or to any person engaged in the prosecution of the work provided for in said Contract or in any amendment or extension of or addition to said Contract, who is an agent, servant or employee of the principal, or of any subcontractor, or of any assignee of said principal or of any subcontractor and also anyone so engaged who performs the work of a laborer or of a mechanic regardless of any contractual relationship between the principal, or any sub-contractor, or any assignee of said principal or of said subcontractor, and such laborer or mechanic, but shall not include office employees not regularly stationed at the site of the work.

The said surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to the work to be performed thereunder or the Specifications accompanying the same, shall in any wise affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work or to the Specifications.

SIGNED, SEALED AND DELIVERED IN _____ ORIGINAL COUNTERPARTS
(2 required by Authority)

this _____ day of _____ 20_____.

IF THE PRINCIPAL IS AN INDIVIDUAL, SIGN HERE

_____	_____
(Printed or Typed Name)	*(Printed or Typed Name)*
Witness	*Principal*
{	{
_____	_____
(Signature and Date)	*(Signature and Date)*

IF THE PRINCIPAL IS A PARTNERSHIP, SIGN HERE

_____	_____
(Printed or Typed Name)	*(Printed or Typed Name)*
Witness	*Partner**
{	{
_____	_____
(Signature and Date)	*(Signature and Date)*
_____	_____
(Printed or Typed Name)	*(Printed or Typed Name)*
Witness	*Partner**
{	{
_____	_____
(Signature and Date)	*(Signature and Date)*

* If the Bidder is a partnership, the Bond must be signed in the name of the partnership by at least two general partners, whose names and addresses must be listed on the certificate on page BF-3-P of the Bid.

IF THE PRINCIPAL IS A CORPORATION, SIGN HERE

(CORPORATE SEAL)

_____
(Corporate Name)

_____		_____	
(Printed or Typed Name)		*(Printed or Typed Name)*	
Witness		*President*	
{		*V.P.***	{
_____		_____	
(Signature and Date)		*(Signature and Date)*	
_____		_____	
(Corporate Title)		*(Corporate Title)*	

** If the bidder is a corporation, the Bond must be executed in the Corporation's correct corporate name by its President or Vice President and attested to by its Secretary or Assistant Secretary or Treasurer or Assistant Treasurer, and the Certification of Corporate Principal (Doc. 00625) must be executed by the Secretary or Assistant Secretary.

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the **Secretary/Assistant Secretary** of the Corporation named a Bidder herein; that

(Circle one)

_____ who signed this Bid on behalf of the

Corporation was then _____ of said Corporation that I know his signature and his signature thereto is genuine; and that said Bid was duly signed, sealed and attested in behalf of said Corporation by authority of its governing body.

(CORPORATE SEAL)

_____
(Signature and Date)

SURETY SIGN HERE

(SURETY SEAL)

	_____ *(Printed or Typed Name)*		_____ *(Printed or Typed Name)*
Attest	{	*Surety*	{
	_____ *(Signature and Date)*		_____ *(Signature and Date)*

The rate of premium charged is $_____ per thousand.
(To be filled in by Surety)

The total amount of premium charged is $_____
(To be filled in by Surety)

General Conditions for Construction Contracts - Public Housing Programs

U.S. Department of Housing and Urban Development
Office of Public and Indian Housing
OMB Approval No. 2577-0157 (exp. 3/31/2020)

Applicability. This form is applicable to any construction/development contract greater than $150,000.

This form includes those clauses required by OMB's common rule on grantee procurement, implemented at HUD in 2 CFR 200, and those requirements set forth in Section 3 of the Housing and Urban Development Act of 1968 and its amendment by the Housing and Community Development Act of 1992, implemented by HUD at 24 CFR Part 135. The form is required for construction contracts awarded by Public Housing Agencies (PHAs).
The form is used by Housing Authorities in solicitations to provide necessary contract clauses. If the form were not used, HAs would be unable to enforce their contracts.
Public reporting burden for this collection of information is estimated to average 1.0 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Responses to the collection of information are required to obtain a benefit or to retain a benefit.
The information requested does not lend itself to confidentiality.
HUD may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB number.

1. Definitions

(a) "Architect" means the person or other entity engaged by the PHA to perform architectural, engineering, design, and other services related to the work as provided for in the contract. When a PHA uses an engineer to act in this capacity, the terms "architect" and "engineer" shall be synonymous. The Architect shall serve as a technical representative of the Contracting Officer. The Architect's authority is as set forth elsewhere in this contract.

(b) "Contract" means the contract entered into between the PHA and the Contractor. It includes the forms of Bid, the Bid Bond, the Performance and Payment Bond or Bonds or other assurance of completion, the Certifications, Representations, and Other Statements of Bidders (form HUD-5370), these General Conditions of the Contract for Construction (form HUD-5370), the applicable wage rate determinations from the U.S. Department of Labor, any special conditions included elsewhere in the contract, the specifications, and drawings. It includes all formal changes to any of those documents by addendum, change order, or other modification.

(c) "Contracting Officer" means the person delegated the authority by the PHA to enter into, administer, and/or terminate this contract and designated as such in writing to the Contractor. The term includes any successor Contracting Officer and any duly authorized representative of the Contracting Officer also designated in writing. The Contracting Officer shall be deemed the authorized agent of the PHA in all dealings with the Contractor.

(d) "Contractor" means the person or other entity entering into the contract with the PHA to perform all of the work required under the contract.

(e) "Drawings" means the drawings enumerated in the schedule of drawings contained in the Specifications and as described in the contract clause entitled Specifications and Drawings for Construction herein.

(f) "HUD" means the United States of America acting through the Department of Housing and Urban Development including the Secretary, or any other person designated to act on its behalf. HUD has agreed, subject to the provisions of an Annual Contributions Contract (ACC), to provide financial assistance to the PHA, which includes assistance in financing the work to be performed under this contract. As defined elsewhere in these General Conditions or the contract documents, the determination of HUD may be required to authorize changes in the work or for release of funds to the PHA for payment to the Contractor. Notwithstanding HUD's role, nothing in this contract shall be construed to create any contractual relationship between the Contractor and HUD.

(g) "Project" means the entire project, whether construction or rehabilitation, the work for which is provided for in whole or in part under this contract.

(h) "PHA" means the Public Housing Agency organized under applicable state laws which is a party to this contract.

(j) "Specifications" means the written description of the technical requirements for construction and includes the criteria and tests for determining whether the requirements are met.

(l) "Work" means materials, workmanship, and manufacture and fabrication of components.

2. Contractor's Responsibility for Work

(a) The Contractor shall furnish all necessary labor, materials, tools, equipment, and transportation necessary for performance of the work. The Contractor shall also furnish all necessary water, heat, light, and power not made available to the Contractor by the PHA pursuant to the clause entitled Availability and Use of Utility Services herein.

(b) The Contractor shall perform on the site, and with its own organization, work equivalent to at least [✓] (12 percent unless otherwise indicated) of the total amount of work to be performed under the order. This percentage may be reduced by a supplemental agreement to this order if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the PHA.

(c) At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the work site a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

(d) The Contractor shall be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence, and shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others. The Contractor shall hold and save the PHA, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(e) The Contractor shall lay out the work from base lines and bench marks indicated on the drawings and be responsible for all lines, levels, and measurements of all work executed under the contract. The Contractor shall verify the figures before laying out the work and will be held responsible for any error resulting from its failure to do so.

(f) The Contractor shall confine all operations (including storage of materials) on PHA premises to areas authorized or approved by the Contracting Officer.

(g) The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. After completing the work and before final inspection, the Contractor shall (1) remove from the premises all scaffolding, equipment, tools, and materials (including rejected materials) that are not the property of the PHA and all rubbish caused by its work; (2) leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer; (3) perform all specified tests; and, (4) deliver the installation in complete and operating condition.

(h) The Contractor's responsibility will terminate when all work has been completed, the final inspection made, and the work accepted by the Contracting Officer. The Contractor will then be released from further obligation except as required by the warranties specified elsewhere in the contract.

3. Architect's Duties, Responsibilities, and Authority

(a) The Architect for this contract, and any successor, shall be designated in writing by the Contracting Officer.

(b) The Architect shall serve as the Contracting Officer's technical representative with respect to architectural, engineering, and design matters related to the work performed under the contract. The Architect may provide direction on contract performance. Such direction shall be within the scope of the contract and may not be of a nature which: (1) institutes additional work outside the scope of the contract; (2) constitutes a change as defined in the Changes clause herein; (3) causes an increase or decrease in the cost of the contract; (4) alters the Construction Progress Schedule; or (5) changes any of the other express terms or conditions of the contract.

(c) The Architect's duties and responsibilities may include but shall not be limited to:

(1) Making periodic visits to the work site, and on the basis of his/her on-site inspections, issuing written reports to the PHA which shall include all observed deficiencies. The Architect shall file a copy of the report with the Contractor's designated representative at the site;

(2) Making modifications in drawings and technical specifications and assisting the Contracting Officer in the preparation of change orders and other contract modifications for issuance by the Contracting Officer;

(3) Reviewing and making recommendations with respect to - (i) the Contractor's construction progress schedules; (ii) the Contractor's shop and detailed drawings; (iii) the machinery, mechanical and other equipment and materials or other articles proposed for use by the Contractor; and, (iv) the Contractor's price breakdown and progress payment estimates; and,

(4) Assisting in inspections, signing Certificates of Completion, and making recommendations with respect to acceptance of work completed under the contract.

4. Other Contracts

The PHA may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with PHA employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by PHA employees

Construction Requirements

5. Pre-construction Conference and Notice to Proceed

(a) Within ten calendar days of contract execution, and prior to the commencement of work, the Contractor shall attend a preconstruction conference with representatives of the PHA, its Architect, and other interested parties convened by the PHA. The conference will serve to acquaint the participants with the general plan of the construction operation and all other requirements of the contract. The PHA will provide the Contractor with the date, time, and place of the conference.

(b) The contractor shall begin work upon receipt of a written Notice to Proceed from the Contracting Officer or designee. The Contractor shall not begin work prior to receiving such notice.

6. Construction Progress Schedule

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring labor, materials, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments or take other remedies under the contract until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as required by the Contracting Officer, and immediately deliver three copies of the annotated schedule to the Contracting Officer. If the Contracting Officer determines, upon the basis of inspection conducted pursuant to the clause entitled Inspection and Acceptance of Construction, herein that the Contractor is not meeting the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the PHA. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the Contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the Default clause of this contract.

7. Site Investigation and Conditions Affecting the Work

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to, (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads;(3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is

reasonably ascertainable from an inspection of the site, including all exploratory work done by the PHA, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the PHA.

(b) The PHA assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the PHA. Nor does the PHA assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

8. Differing Site Conditions

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or (2) unknown physical conditions at the site(s), of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. Work shall not proceed at the affected site, except at the Contractor's risk, until the Contracting Officer has provided written instructions to the Contractor. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, the Contractor shall file a claim in writing to the PHA within ten days after receipt of such instructions and, in any event, before proceeding with the work. An equitable adjustment in the contract price, the delivery schedule, or both shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

9. Specifications and Drawings for Construction

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. 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 drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by", or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown" "as indicated", "as detailed", or of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place" that is "furnished and installed".

(d) "Shop drawings" means drawings, submitted to the PHA by the Contractor, subcontractor, or any lower tier subcontractor, showing in detail (1) the proposed fabrication and assembly of structural elements and (2) the installation (i.e., form, fit, and attachment details) of materials of equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the Contractor to explain in detail specific portions of the work required by the contract. The PHA may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with other contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the PHA's reasons therefore. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Architect approves any such variation and the Contracting Officer concurs, the Contracting Officer shall issue an appropriate modification to the contract, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) It shall be the responsibility of the Contractor to make timely requests of the PHA for such large scale and full size drawings, color schemes, and other additional information, not already in his possession, which shall be

required in the planning and production of the work. Such requests may be submitted as the need arises, but each such request shall be filed in ample time to permit appropriate action to be taken by all parties involved so as to avoid delay.

(h) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the PHA and one set will be returned to the Contractor. As required by the Contracting Officer, the Contractor, upon completing the work under this contract, shall furnish a complete set of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the work is completed and accepted.

(i) This clause shall be included in all subcontracts at any tier. It shall be the responsibility of the Contractor to ensure that all shop drawings prepared by subcontractors are submitted to the Contracting Officer.

10. As-Built Drawings

(a) "As-built drawings," as used in this clause, means drawings submitted by the Contractor or subcontractor at any tier to show the construction of a particular structure or work as actually completed under the contract. "As-built drawings" shall be synonymous with "Record drawings."

(b) As required by the Contracting Officer, the Contractor shall provide the Contracting Officer accurate information to be used in the preparation of permanent as-built drawings. For this purpose, the Contractor shall record on one set of contract drawings all changes from the installations originally indicated, and record final locations of underground lines by depth from finish grade and by accurate horizontal offset distances to permanent surface improvements such as buildings, curbs, or edges of walks.

(c) This clause shall be included in all subcontracts at any tier. It shall be the responsibility of the Contractor to ensure that all as-built drawings prepared by subcontractors are submitted to the Contracting Officer.

11. Material and Workmanship

(a) All equipment, material, and articles furnished under this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the contract to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of, and as approved by the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) Approval of equipment and materials.

(1) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(2) When required by the specifications or the Contracting Officer, the Contractor shall submit appropriately marked samples (and certificates related to them) for approval at the Contractor's expense, with all shipping charges prepaid. The Contractor shall label, or otherwise properly mark on the container, the material or product represented, its place of origin, the name of the producer, the Contractor's name, and the identification of the construction project for which the material or product is intended to be used.

(3) Certificates shall be submitted in triplicate, describing each sample submitted for approval and certifying that the material, equipment or accessory complies with contract requirements. The certificates shall include the name and brand of the product, name of manufacturer, and the location where produced.

(4) Approval of a sample shall not constitute a waiver of the PHA right to demand full compliance with contract requirements. Materials, equipment and accessories may be rejected for cause even though samples have been approved.

(5) Wherever materials are required to comply with recognized standards or specifications, such specifications shall be accepted as establishing the technical qualities and testing methods, but shall not govern the number of tests required to be made nor modify other contract requirements. The Contracting Officer may require laboratory test reports on items submitted for approval or may approve materials on the basis of data submitted in certificates with samples. Check tests will be made on materials delivered for use only as frequently as the Contracting Officer determines necessary to insure compliance of materials with the specifications. The Contractor will assume all costs of retesting materials which fail to meet contract requirements and/or testing materials offered in substitution for those found deficient.

(6) After approval, samples will be kept in the Project office until completion of work. They may be built into the work after a substantial quantity of the materials they represent has been built in and accepted.

(c) Requirements concerning lead-based paint. The Contractor shall comply with the requirements concerning lead-based paint contained in the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4821-4846) as implemented by 24 CFR Part 35.

12. Permits and Codes

(a) The Contractor shall give all notices and comply with all applicable laws, ordinances, codes, rules and regulations. Notwithstanding the requirement of the Contractor to comply with the drawings and specifications in the contract, all work installed shall comply with all applicable codes and regulations as amended by any

waivers. Before installing the work, the Contractor shall examine the drawings and the specifications for compliance with applicable codes and regulations bearing on the work and shall immediately report any discrepancy it may discover to the Contracting Officer. Where the requirements of the drawings and specifications fail to comply with the applicable code or regulation, the Contracting Officer shall modify the contract by change order pursuant to the clause entitled Changes herein to conform to the code or regulation.

(b) The Contractor shall secure and pay for all permits, fees, and licenses necessary for the proper execution and completion of the work. Where the PHA can arrange for the issuance of all or part of these permits, fees and licenses, without cost to the Contractor, the contract amount shall be reduced accordingly.

13. Health, Safety, and Accident Prevention

(a) In performing this contract, the Contractor shall:
(1) Ensure that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his/her health and/or safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation;
(2) Protect the lives, health, and safety of other persons;
(3) Prevent damage to property, materials, supplies, and equipment; and,
(4) Avoid work interruptions.

(b) For these purposes, the Contractor shall:
(1) Comply with regulations and standards issued by the Secretary of Labor at 29 CFR Part 1926. Failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act (Public Law 91-54, 83 Stat. 96), 40 U.S.C. 3701 et seq.; and
(2) Include the terms of this clause in every subcontract so that such terms will be binding on each subcontractor.

(c) The Contractor shall maintain an accurate record of exposure data on all accidents incident to work performed under this contract resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment, and shall report this data in the manner prescribed by 29 CFR Part 1904.

(d) The Contracting Officer shall notify the Contractor of any noncompliance with these requirements and of the corrective action required. This notice, when delivered to the Contractor or the Contractor's representative at the site of the work, shall be deemed sufficient notice of the noncompliance and corrective action required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to take corrective action promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not base any claim or request for equitable adjustment for additional time or money on any stop order issued under these circumstances.

(e) The Contractor shall be responsible for its subcontractors' compliance with the provisions of this clause. The Contractor shall take such action with respect to any subcontract as the PHA, the Secretary of Housing and Urban Development, or the Secretary of Labor shall direct as a means of enforcing such provisions.

14. Temporary Heating

The Contractor shall provide and pay for temporary heating, covering, and enclosures necessary to properly protect all work and materials against damage by dampness and cold, to dry out the work, and to facilitate the completion of the work. Any permanent heating equipment used shall be turned over to the PHA in the condition and at the time required by the specifications.

15. Availability and Use of Utility Services

(a) The PHA shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the PHA or, where the utility is produced by the PHA, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the PHA, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

16. Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed under this contract, and which do not unreasonably interfere with the work required under this contract.

(b) The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during performance of this contract, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(c) The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. Prior to disturbing the ground at the construction site, the Contractor shall ensure that all underground utility lines are clearly marked.

(d) The Contractor shall shore up, brace, underpin, secure, and protect as necessary all foundations and other parts of existing structures adjacent to, adjoining, and in the vicinity of the site, which may be affected by the excavations or other operations connected with the construction of the project.

(e) Any equipment temporarily removed as a result of work under this contract shall be protected, cleaned, and replaced in the same condition as at the time of award of this contract.

(f) New work which connects to existing work shall correspond in all respects with that to which it connects and/or be similar to existing work unless otherwise required by the specifications.
(g) No structural members shall be altered or in any way weakened without the written authorization of the Contracting Officer, unless such work is clearly specified in the plans or specifications.
(h) If the removal of the existing work exposes discolored or unfinished surfaces, or work out of alignment, such surfaces shall be refinished, or the material replaced as necessary to make the continuous work uniform and harmonious. This, however, shall not be construed to require the refinishing or reconstruction of dissimilar finishes previously exposed, or finished surfaces in good condition, but in different planes or on different levels when brought together by the removal of intervening work, unless such refinishing or reconstruction is specified in the plans or specifications.
(i) The Contractor shall give all required notices to any adjoining or adjacent property owner or other party before the commencement of any work.
(j) The Contractor shall indemnify and save harmless the PHA from any damages on account of settlement or the loss of lateral support of adjoining property, any damages from changes in topography affecting drainage, and from all loss or expense and all damages for which the PHA may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.
(k) The Contractor shall repair any damage to vegetation, structures, equipment, utilities, or improvements, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

17. Temporary Buildings and Transportation of Materials

(a) Temporary buildings (e.g., storage sheds, shops, offices, sanitary facilities) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the PHA. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
(b) The Contractor shall, as directed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any federal, state, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

18. Clean Air and Water

The contactor shall comply with the Clean Air Act, as amended, 42 USC 7401 et seq., the Federal Water Pollution Control Water Act, as amended, 33 U.S.C. 1251 et seq., and standards issued pursuant thereto in the facilities in which this contract is to be performed.

19. Energy Efficiency

The Contractor shall comply with mandatory standards and policies relating to energy efficiency which are contained in the energy conservation plan issued in compliance with the Energy Policy and Conservation Act (Pub.L. 94-163) for the State in which the work under the contract is performed.

20. Inspection and Acceptance of Construction

(a) Definitions. As used in this clause -
(1) “Acceptance” means the act of an authorized representative of the PHA by which the PHA approves and assumes ownership of the work performed under this contract. Acceptance may be partial or complete.
(2) “Inspection” means examining and testing the work performed under the contract (including, when appropriate, raw materials, equipment, components, and intermediate assemblies) to determine whether it conforms to contract requirements.
(3) “Testing” means that element of inspection that determines the properties or elements, including functional operation of materials, equipment, or their components, by the application of established scientific principles and procedures.
(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. All work is subject to PHA inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.
(c) PHA inspections and tests are for the sole benefit of the PHA and do not: (1) relieve the Contractor of responsibility for providing adequate quality control measures; (2) relieve the Contractor of responsibility for loss or damage of the material before acceptance; (3) constitute or imply acceptance; or, (4) affect the continuing rights of the PHA after acceptance of the completed work under paragraph (j) below.
(d) The presence or absence of the PHA inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specifications without the Contracting Officer’s written authorization. All instructions and approvals with respect to the work shall be given to the Contractor by the Contracting Officer.
(e) The Contractor shall promptly furnish, without additional charge, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The PHA may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The PHA shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The PHA may conduct routine inspections of the construction site on a daily basis.

(g) The Contractor shall, without charge, replace or correct work found by the PHA not to conform to contract requirements, unless the PHA decides that it is in its interest to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(h) If the Contractor does not promptly replace or correct rejected work, the PHA may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor, or (2) terminate for default the Contractor's right to proceed.

(i) If any work requiring inspection is covered up without approval of the PHA, it must, if requested by the Contracting Officer, be uncovered at the expense of the Contractor. If at any time before final acceptance of the entire work, the PHA considers it necessary or advisable, to examine work already completed by removing or tearing it out, the Contractor, shall on request, promptly furnish all necessary facilities, labor, and material. If such work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray all the expenses of the examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the contract, the Contracting Officer shall make an equitable adjustment to cover the cost of the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(j) The Contractor shall notify the Contracting Officer, in writing, as to the date when in its opinion all or a designated portion of the work will be substantially completed and ready for inspection. If the Architect determines that the state of preparedness is as represented, the PHA will promptly arrange for the inspection. Unless otherwise specified in the contract, the PHA shall accept, as soon as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines and designates can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the PHA's right under any warranty or guarantee.

21. Use and Possession Prior to Completion

(a) The PHA shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the PHA intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The PHA's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the PHA has such possession or use, the Contractor shall be relieved of the responsibility for (1) the loss of or damage to the work resulting from the PHA's possession or use, notwithstanding the terms of the clause entitled Permits and Codes herein; (2) all maintenance costs on the areas occupied; and, (3) furnishing heat, light, power, and water used in the areas occupied without proper remuneration therefore. If prior possession or use by the PHA delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

22. Warranty of Title

The Contractor warrants good title to all materials, supplies, and equipment incorporated in the work and agrees to deliver the premises together with all improvements thereon free from any claims, liens or charges, and agrees further that neither it nor any other person, firm or corporation shall have any right to a lien upon the premises or anything appurtenant thereto.

23. Warranty of Construction

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (j) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or workmanship performed by the Contractor or any subcontractor or supplier at any tier. This warranty shall continue for a period of _____ (one year unless otherwise indicated) from the date of final acceptance of the work. If the PHA takes possession of any part of the work before final acceptance, this warranty shall continue for a period of (one year unless otherwise indicated) from the date that the PHA takes possession.

(b) The Contractor shall remedy, at the Contractor's expense, any failure to conform, or any defect. In addition, the Contractor shall remedy, at the Contractor's expense, any damage to PHA-owned or controlled real or personal property when the damage is the result of—
(1) The Contractor's failure to conform to contract requirements; or
(2) Any defects of equipment, material, workmanship or design furnished by the Contractor.

(c) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for (one year unless otherwise indicated) from the date of repair or replacement.

(d) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect or damage.

(e) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the PHA shall have the right to replace, repair or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(f) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall:
(1) Obtain all warranties that would be given in normal commercial practice;
(2) Require all warranties to be executed in writing, for the benefit of the PHA; and,
(3) Enforce all warranties for the benefit of the PHA.

(g) In the event the Contractor's warranty under paragraph (a) of this clause has expired, the PHA may bring suit at its own expense to enforce a subcontractor's, manufacturer's or supplier's warranty.

(h) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defect of material or design furnished by the PHA nor for the repair of any damage that results from any defect in PHA furnished material or design.

(i) Notwithstanding any provisions herein to the contrary, the establishment of the time periods in paragraphs (a) and (c) above relate only to the specific obligation of the Contractor to correct the work, and have no relationship to the time within which its obligation to comply with the contract may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to its obligation other than specifically to correct the work.

(j) This warranty shall not limit the PHA's rights under the Inspection and Acceptance of Construction clause of this contract with respect to latent defects, gross mistakes or fraud.

24. Prohibition Against Liens

The Contractor is prohibited from placing a lien on the PHA's property. This prohibition shall apply to all subcontractors at any tier and all materials suppliers.

Administrative Requirements

25. Contract Period

this contract within 180 calendar days of the effective date of the contract, or within the time schedule established in the notice to proceed issued by the Contracting Officer.

26. Order of Provisions

In the event of a conflict between these General Conditions and the Specifications, the General Conditions shall prevail. In the event of a conflict between the contract and any applicable state or local law or regulation, the state or local law or regulation shall prevail; provided that such state or local law or regulation does not conflict with, or is less restrictive than applicable federal law, regulation, or Executive Order. In the event of such a conflict, applicable federal law, regulation, and Executive Order shall prevail.

27. Payments

(a) The PHA shall pay the Contractor the price as provided in this contract.

(b) The PHA shall make progress payments approximately every 30 days as the work proceeds, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer. The PHA may, subject to written determination and approval of the Contracting Officer, make more frequent payments to contractors which are qualified small businesses.

(c) Before the first progress payment under this contract, the Contractor shall furnish, in such detail as requested by the Contracting Officer, a breakdown of the total contract price showing the amount included therein for each principal category of the work, which shall substantiate the payment amount requested in order to provide a basis for determining progress payments. The breakdown shall be approved by the Contracting Officer and must be acceptable to HUD. If the contract covers more than one project, the Contractor shall furnish a separate breakdown for each. The values and quantities employed in making up this breakdown are for determining the amount of progress payments and shall not be construed as a basis for additions to or deductions from the contract price. The Contractor shall prorate its overhead and profit over the construction period of the contract.

(d) The Contractor shall submit, on forms provided by the PHA, periodic estimates showing the value of the work performed during each period based upon the approved

submitted not later than 45 days in advance of the date set for payment and are subject to correction and revision as required. The estimates must be approved by the Contracting Officer with the concurrence of the Architect prior to payment. If the contract covers more than one project, the Contractor shall furnish a separate progress payment estimate for each.

(e) Along with each request for progress payments and the required estimates, the Contractor shall furnish the following certification, or payment shall not be made: I hereby certify, to the best of my knowledge and belief, that:

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements; and,

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract.

_____

Name:

_____

Title:

_____

Date:

(f) Except as otherwise provided in State law, the PHA shall retain ten (10) percent of the amount of progress payments until completion and acceptance of all work under the contract; except, that if upon completion of 50 percent of the work, the Contracting Officer, after consulting with the Architect, determines that the Contractor's performance and progress are satisfactory, the PHA may make the remaining payments in full for the work subsequently completed. If the Contracting Officer subsequently determines that the Contractor's performance and progress are unsatisfactory, the PHA shall reinstate the ten (10) percent (or other percentage as provided in State law) retainage until such time as the Contracting Officer determines that performance and progress are satisfactory.

(g) The Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration when computing progress payments.

Material delivered to the Contractor at locations other than the site may also be taken into consideration if the Contractor furnishes satisfactory evidence that (1) it has acquired title to such material; (2) the material is properly stored in a bonded warehouse, storage yard, or similar suitable place as may be approved by the Contracting Officer; (3) the material is insured to cover its full value; and (4) the material will be used to perform this contract. Before any progress payment which includes delivered material is made, the Contractor shall furnish such documentation as the Contracting Officer may require to assure the protection of the PHA's interest in such materials. The Contractor shall remain responsible for such stored material notwithstanding the transfer of title to the PHA.

(h) All material and work covered by progress payments made shall, at the time of payment become the sole property of the PHA, but this shall not be construed as (1) relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or, (2) waiving the right of the PHA to require the fulfillment of all of the terms of the contract. In the event the work of the Contractor has been damaged by other contractors or persons other than employees of the PHA in the course of their employment, the Contractor shall restore such damaged work without cost to the PHA and to seek redress for its damage only from those who directly caused it.

(i) The PHA shall make the final payment due the Contractor under this contract after (1) completion and final acceptance of all work; and (2) presentation of release of all claims against the PHA arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. Each such exception shall embrace no more than one claim, the basis and scope of which shall be clearly defined. The amounts for such excepted claims shall not be included in the request for final payment. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned.

(j) Prior to making any payment, the Contracting Officer may require the Contractor to furnish receipts or other evidence of payment from all persons performing work and supplying material to the Contractor, if the Contracting Officer determines such evidence is necessary to substantiate claimed costs.

(k) The PHA shall not; (1) determine or adjust any claims for payment or disputes arising there under between the Contractor and its subcontractors or material suppliers; or, (2) withhold any moneys for the protection of the subcontractors or material suppliers. The failure or refusal of the PHA to withhold moneys from the Contractor shall in nowise impair the obligations of any surety or sureties under any bonds furnished under this contract.

28. Contract Modifications

(a) Only the Contracting Officer has authority to modify any term or condition of this contract. Any contract modification shall be authorized in writing.

(b) The Contracting Officer may modify the contract unilaterally (1) pursuant to a specific authorization stated in a contract clause (e.g., Changes); or (2) for administrative matters which do not change the rights or responsibilities of the parties (e.g., change in the PHA address). All other contract modifications shall be in the form of supplemental agreements signed by the Contractor and the Contracting Officer.

(c) When a proposed modification requires the approval of HUD prior to its issuance (e.g., a change order that exceeds the PHA's approved threshold), such modification shall not be effective until the required approval is received by the PHA.

29. Changes

(a) The Contracting Officer may, at any time, without notice to the sureties, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract including changes:
(1) In the specifications (including drawings and designs);
(2) In the method or manner of performance of the work;
(3) PHA-furnished facilities, equipment, materials, services, or site; or,
(4) Directing the acceleration in the performance of the work.

(b) Any other written order or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating (1) the date, circumstances and source of the order and (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for a adjustment based on defective specifications, no proposal for any change under paragraph (b) above shall be allowed for any costs incurred more than 20 days (5 days for oral orders) before the Contractor gives written notice as required. In the case of defective specifications for which the PHA is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause, or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting a written statement describing the general nature and the amount of the proposal. If the facts justify it, the Contracting Officer may extend the period for submission. The proposal may be included in the notice required under paragraph (b) above. No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(f) The Contractor's written proposal for equitable adjustment shall be submitted in the form of a lump sum proposal supported with an itemized breakdown of all increases and decreases in the contract in at least the following details:

(1) Direct Costs. Materials (list individual items, the quantity and unit cost of each, and the aggregate cost); Transportation and delivery costs associated with materials; Labor breakdowns by hours or unit costs (identified with specific work to be performed); Construction equipment exclusively necessary for the change; Costs of preparation and/ or revision to shop drawings resulting from the change; Worker's Compensation and Public Liability Insurance; Employment taxes under FICA and FUTA; and, Bond Costs when size of change warrants revision.

(2) Indirect Costs. Indirect costs may include overhead, general and administrative expenses, and fringe benefits not normally treated as direct costs.

(3) Profit. The amount of profit shall be negotiated and may vary according to the nature, extent, and complexity of the work required by the change. The allowability of the direct and indirect costs shall be determined in accordance with the Contract Cost Principles and Procedures for Commercial Firms in Part 31 of the Federal Acquisition Regulation (48 CFR 1-31), as implemented by HUD Handbook 2210.18, in effect on the date of this contract. The Contractor shall not be allowed a profit on the profit received by any subcontractor. Equitable adjustments for deleted work shall include a credit for profit and may include a credit for indirect costs. On proposals covering both increases and decreases in the amount of the contract, the application of indirect costs and profit shall be on the net-change in direct costs for the Contractor or subcontractor performing the work.

(g) The Contractor shall include in the proposal its request for time extension (if any), and shall include sufficient information and dates to demonstrate whether and to what extent the change will delay the completion of the contract in its entirety.

(h) The Contracting Officer shall act on proposals within 30 days after their receipt, or notify the Contractor of the date when such action will be taken.

(i) Failure to reach an agreement on any proposal shall be a dispute under the clause entitled Disputes herein. Nothing in this clause, however, shall excuse the Contractor from proceeding with the contract as changed.

(j) Except in an emergency endangering life or property, no change shall be made by the Contractor without a prior order from the Contracting Officer.

30. Suspension of Work

(a) The Contracting Officer may order the Contractor in writing to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the PHA.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified (or within a reasonable time if not specified) in this contract an adjustment shall be made for any increase in the cost of performance of the contract (excluding profit) necessarily caused by such unreasonable suspension, delay, or interruption and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor or for which any equitable adjustment is provided for or excluded under any other provision of this contract.

(c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order); and, (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

31. Disputes

(a) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to the contract. A claim arising under the contract, unlike a claim relating to the contract, is a claim that can be resolved under a contract clause that provides for the relief sought by the claimant. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim. The submission may be converted to a claim by complying with the requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(b) Except for disputes arising under the clauses entitled Labor Standards - Davis Bacon and Related Acts, herein, all disputes arising under or relating to this contract, including any claims for damages for the alleged breach thereof which are not disposed of by agreement, shall be resolved under this clause.

(c) All claims by the Contractor shall be made in writing and submitted to the Contracting Officer for a written decision. A claim by the PHA against the Contractor shall be subject to a written decision by the Contracting Officer.

(d) The Contracting Officer shall, within 60 (unless otherwise indicated) days after receipt of the request, decide the claim or notify the Contractor of the date by which the decision will be made.

(e) The Contracting Officer's decision shall be final unless the Contractor (1) appeals in writing to a higher level in the PHA in accordance with the PHA's policy and procedures, (2) refers the appeal to an independent mediator or arbitrator, or (3) files suit in a court of competent jurisdiction. Such appeal must be made within (30 unless otherwise indicated) days after receipt of the Contracting Officer's decision.

(f) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under or relating to the contract, and comply with any decision of the Contracting Officer.

32. Default

(a) If the Contractor refuses or fails to prosecute the work, or any separable part thereof, with the diligence that will insure its completion within the time specified in this contract, or any extension thereof, or fails to complete said work within this time, the Contracting Officer may, by written notice to the Contractor, terminate the right to

proceed with the work (or separable part of the work) that has been delayed. In this event, the PHA may take over the work and complete it, by contract or otherwise, and may take possession of and use any materials, equipment, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the PHA resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the PHA in completing the work.

(b) The Contractor's right to proceed shall not be terminated or the Contractor charged with damages under this clause if—

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include (i) acts of God, or of the public enemy, (ii) acts of the PHA or other governmental entity in either its sovereign or contractual capacity, (iii) acts of another contractor in the performance of a contract with the PHA, (iv) fires, (v) floods, (vi) epidemics, (vii) quarantine restrictions, (viii) strikes, (ix) freight embargoes, (x) unusually severe weather, or (xi) delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within days (10 days unless otherwise indicated) from the beginning of such delay (unless extended by the Contracting Officer) notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of the delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, time for completing the work shall be extended by written modification to the contract. The findings of the Contracting Officer shall be reduced to a written decision which shall be subject to the provisions of the Disputes clause of this contract.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been for convenience of the PHA.

33. Liquidated Damages

(a) If the Contractor fails to complete the work within the time specified in the contract, or any extension, as specified in the clause entitled Default of this contract, the Contractor shall pay to the PHA as liquidated damages, the sum of $_____Contracting Officer insert amount] for each day of delay. If different completion dates are specified in the contract for separate parts or stages of the work, the amount of liquidated damages shall be assessed on those parts or stages which are delayed. To the extent that the Contractor's delay or nonperformance is excused under another clause in this contract, liquidated damages shall not be due the PHA. The Contractor remains liable for damages caused other than by delay.

(b) If the PHA terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the PHA in completing the work.

(c) If the PHA does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

34. Termination for Convenience

(a) The Contracting Officer may terminate this contract in whole, or in part, whenever the Contracting Officer determines that such termination is in the best interest of the PHA. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which the performance of the work under the contract is terminated, and the date upon which such termination becomes effective.

(b) If the performance of the work is terminated, either in whole or in part, the PHA shall be liable to the Contractor for reasonable and proper costs resulting from such termination upon the receipt by the PHA of a properly presented claim setting out in detail: (1) the total cost of the work performed to date of termination less the total amount of contract payments made to the Contractor; (2) the cost (including reasonable profit) of settling and paying claims under subcontracts and material orders for work performed and materials and supplies delivered to the site, payment for which has not been made by the PHA to the Contractor or by the Contractor to the subcontractor or supplier; (3) the cost of preserving and protecting the work already performed until the PHA or assignee takes possession thereof or assumes responsibility therefore; (4) the actual or estimated cost of legal and accounting services reasonably necessary to prepare and present the termination claim to the PHA; and (5) an amount constituting a reasonable profit on the value of the work performed by the Contractor.

(c) The Contracting Officer will act on the Contractor's claim within days (60 days unless otherwise indicated) of receipt of the Contractor's claim.

(d) Any disputes with regard to this clause are expressly made subject to the provisions of the Disputes clause of this contract.

35. Assignment of Contract

The Contractor shall not assign or transfer any interest in this contract; except that claims for monies due or to become due from the PHA under the contract may be assigned to a bank, trust company, or other financial institution. Such assignments of claims shall only be made with the written concurrence of the Contracting Officer. If the Contractor is a partnership, this contract shall inure to the benefit of the surviving or remaining member(s) of such partnership as approved by the Contracting Officer.

36. Insurance

(a) Before commencing work, the Contractor and each subcontractor shall furnish the PHA with certificates of insurance showing the following insurance is in force and will insure all operations under the Contract:

(1) Workers' Compensation, in accordance with state or Territorial Workers' Compensation laws.

(2) Commercial General Liability with a combined single limit for bodily injury and property damage of not less than $ 1MILLION [Contracting Officer insert amount]

per occurrence to protect the Contractor and each subcontractor against claims for bodily injury or death and damage to the property of others. This shall cover the use of all equipment, hoists, and vehicles on the site(s) not covered by Automobile Liability under (3) below. If the Contractor has a "claims made" policy, then the following additional requirements apply: the policy must provide a "retroactive date" which must be on or before the execution date of the Contract; and the extended reporting period may not be less than five years following the completion date of the Contract.

(3) Automobile Liability on owned and non -owned motor vehicles used on the site(s) or in connection therewith for a combined single limit for bodily injury and property damage of not less than $ 1MILLION [Contracting Officer insert amount] per occurrence.

(b) Before commencing work, the Contractor shall furnish the PHA with a certificate of insurance evidencing that Builder's Risk (fire and extended coverage) Insurance on all work in place and/or materials stored at the building site(s), including foundations and building equipment, is in force. The Builder's Risk Insurance shall be for the benefit of the Contractor and the PHA as their interests may appear and each shall be named in the policy or policies as an insured. The Contractor in installing equipment supplied by the PHA shall carry insurance on such equipment from the time the Contractor takes possession thereof until the Contract work is accepted by the PHA. The Builder's Risk Insurance need not be carried on excavations, piers, footings, or foundations until such time as work on the superstructure is started. It need not be carried on landscape work. Policies shall furnish coverage at all times for the full cash value of all completed construction, as well as materials in place and/or stored at the site(s), whether or not partial payment has been made by the PHA. The Contractor may terminate this insurance on buildings as of the date taken over for occupancy by the PHA. The Contractor is not required to carry Builder's Risk Insurance for modernization work which does not involve structural alterations or additions and where the PHA's existing fire and extended coverage policy can be endorsed to include such work.

(c) All insurance shall be carried with companies which are financially responsible and admitted to do business in the State in which the project is located. If any such insurance is due to expire during the construction period, the Contractor (including subcontractors, as applicable) shall not permit the coverage to lapse and shall furnish evidence of coverage to the Contracting Officer. All certificates of insurance, as evidence of coverage, shall provide that no coverage may be canceled or non-renewed by the insurance company until at least 30 days prior written notice has been given to the Contracting Officer.

37. Subcontracts

(a) Definitions. As used in this contract -

(1) "Subcontract" means any contract, purchase order, or other purchase agreement, including modifications and change orders to the foregoing, entered into by a subcontractor to furnish supplies, materials, equipment, and services for the performance of the prime contract or a subcontract.

(2) "Subcontractor" means any supplier, vendor, or firm that furnishes supplies, materials, equipment, or services to or for the Contractor or another subcontractor.

(b) The Contractor shall not enter into any subcontract with any subcontractor who has been temporarily denied participation in a HUD program or who has been suspended or debarred from participating in contracting programs by any agency of the United States Government or of the state in which the work under this contract is to be performed.

(c) The Contractor shall be as fully responsible for the acts or omissions of its subcontractors, and of persons either directly or indirectly employed by them as for the acts or omissions of persons directly employed by the Contractor.

(d) The Contractor shall insert appropriate clauses in all subcontracts to bind subcontractors to the terms and conditions of this contract insofar as they are applicable to the work of subcontractors.

(e) Nothing contained in this contract shall create any contractual relationship between any subcontractor and the PHA or between the subcontractor and HUD.

38. Subcontracting with Small and Minority Firms, Women's Business Enterprise, and Labor Surplus Area Firms

The Contractor shall take the following steps to ensure that, whenever possible, subcontracts are awarded to small business firms, minority firms, women's business enterprises, and labor surplus area firms:

(a) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;

(b) Ensuring that small and minority businesses and women's business enterprises are solicited whenever they are potential sources;

(c) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses and women's business enterprises;

(d) Establishing delivery schedules, where the requirements of the contract permit, which encourage participation by small and minority businesses and women's business enterprises; and

(e) Using the services and assistance of the U.S. Small Business Administration, the Minority Business Development Agency of the U.S. Department of Commerce, and State and local governmental small business agencies.

39. Equal Employment Opportunity

During the performance of this contract, the Contractor agrees as follows:

(a) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, or handicap.

(b) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, national origin, or handicap. Such action shall include, but not be limited to, (1) employment, (2) upgrading, (3) demotion, (4) transfer, (5) recruitment or recruitment advertising, (6) layoff or termination, (7) rates of pay or other forms of compensation, and (8) selection for training, including apprenticeship.

(c) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(d) The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, or handicap.

(e) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(f) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(g) The Contractor shall furnish all information and reports required by Executive Order 11246, as amended, Section 503 of the Rehabilitation Act of 1973, as amended, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto. The Contractor shall permit access to its books, records, and accounts by the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(h) In the event of a determination that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part, and the Contractor may be declared ineligible for further Government contracts, or Federally assisted construction contracts under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended, the rules, regulations, and orders of the Secretary of Labor, or as otherwise provided by law.

(i) The Contractor shall include the terms and conditions of this clause in every subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor. The Contractor shall take such action with respect to any subcontract or purchase order as the Secretary of Housing and Urban Development or the Secretary of Labor may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(j) Compliance with the requirements of this clause shall be to the maximum extent consistent with, but not in derogation of, compliance with section 7(b) of the Indian Self-Determination and Education Assistance Act and the Indian Preference clause of this contract.

40. Employment, Training, and Contracting Opportunities for Low-Income Persons, Section 3 of the Housing and Urban Development Act of 1968.

(a) The work to be performed under this contract is subject to the requirements of section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3). The purpose of section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

(b) The parties to this contract agree to comply with HUD's regulations in 24 CFR Part 135, which implement section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the Part 135 regulations.

(c) The contractor agrees to send to each labor organization or representative of workers with which the contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

(d) The contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR Part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR Part 135. The contractor will not subcontract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR Part 135.

(e) The contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR Part 135 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR Part 135.

(f) Noncompliance with HUD's regulations in 24 CFR Part 135 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts.

(g) With respect to work performed in connection with section 3 covered Indian housing assistance, section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e) also applies to the work to be performed under this contract. Section 7(b) requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties to this contract that are subject to the provisions of section 3 and section 7(b)agree to comply with section 3 to the maximum extent feasible, but not in derogation of compliance with section 7(b).

41. Interest of Members of Congress

No member of or delegate to the Congress of the United States of America shall be admitted to any share or part of this contract or to any benefit that may arise therefrom.

42. Interest of Members, Officers, or Employees and Former Members, Officers, or Employees

No member, officer, or employee of the PHA, no member of the governing body of the locality in which the project is situated, no member of the governing body of the locality in which the PHA was activated, and no other public official of such locality or localities who exercises any functions or responsibilities with respect to the project, shall, during his or her tenure, or for one year thereafter, have any interest, direct or indirect, in this contract or the proceeds thereof.

43. Limitations on Payments made to Influence Certain Federal Financial Transactions

(a) The Contractor agrees to comply with Section 1352 of Title 31, United States Code which prohibits the use of Federal appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(b) The Contractor further agrees to comply with the requirement of the Act to furnish a disclosure (OMB Standard Form LLL, Disclosure of Lobbying Activities) if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

44. Royalties and Patents

The Contractor shall pay all royalties and license fees. It shall defend all suits or claims for infringement of any patent rights and shall save the PHA harmless from loss on account thereof; except that the PHA shall be responsible for all such loss when a particular design, process or the product of a particular manufacturer or manufacturers is specified and the Contractor has no reason to believe that the specified design, process, or product is an infringement. If, however, the Contractor has reason to believe that any design, process or product specified is an infringement of a patent, the Contractor shall promptly notify the Contracting Officer. Failure to give such notice shall make the Contractor responsible for resultant loss.

45. Examination and Retention of Contractor's Records

(a) The PHA, HUD, or Comptroller General of the United States, or any of their duly authorized representatives shall, until 3 years after final payment under this contract, have access to and the right to examine any of the Contractor's directly pertinent books, documents, papers, or other records involving transactions related to this contract for the purpose of making audit, examination, excerpts, and transcriptions.

(b) The Contractor agrees to include in first-tier subcontracts under this contract a clause substantially the same as paragraph (a) above. "Subcontract," as used in this clause, excludes purchase orders not exceeding $10,000.

(c) The periods of access and examination in paragraphs (a) and (b) above for records relating to (1) appeals under the Disputes clause of this contract, (2) litigation or settlement of claims arising from the performance of this contract, or (3) costs and expenses of this contract to which the PHA, HUD, or Comptroller General or any of their duly authorized representatives has taken exception shall continue until disposition of such appeals, litigation, claims, or exceptions.

46. Labor Standards - Davis-Bacon and Related Acts

If the total amount of this contract exceeds $2,000, the Federal labor standards set forth in the clause below shall apply to the development or construction work to be performed under the contract.

(a) Minimum Wages.

(1) All laborers and mechanics employed under this contract in the development or construction of the project(s) involved will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the regular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall

be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(2) (i) Any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. HUD shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met: (A) The work to be performed by the classification requested is not performed by a classification in the wage determination; and (B) The classification is utilized in the area by the construction industry; and (C) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(ii) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by HUD or its designee to the Administrator of the Wage and Hour Division, Employee Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary.

(iii) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary.

(iv) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (a)(2)(ii) or (iii) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in classification.

(3) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(4) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(b) Withholding of funds. HUD or its designee shall, upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime Contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working in the construction or development of the project, all or part of the wages required by the contract, HUD or its designee may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased. HUD or its designee may, after written notice to the Contractor, disburse such amounts withheld for and on account of the Contractor or subcontractor to the respective employees to whom they are due.

(c) Payrolls and basic records.

(1) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working in the construction or development of the project. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under 29 CFR 5.5(a)(1)(iv), that the wages of any laborer or mechanic include the amount of costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(2) (i) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer for transmission to HUD or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under subparagraph (c)(1) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The Contractor is responsible for the submission of copies of payrolls by all subcontractors. (Approved by the Office of Management and Budget under OMB Control Number 1214-0149.)

(ii) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(A) That the payroll for the payroll period contains the information required to be maintained under paragraph (c) (1) of this clause and that such information is correct and complete;

(B) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3; and

(C) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(iii) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirements for submission of the "Statement of Compliance" required by subparagraph (c)(2)(ii) of this clause.

(iv) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(3) The Contractor or subcontractor shall make the records required under subparagraph (c)(1) available for inspection, copying, or transcription by authorized representatives of HUD or its designee, the Contracting Officer, or the Department of Labor and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, HUD or its designee may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(d) (1) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship and Training, Employer and Labor Services (OATELS), or with a State Apprenticeship Agency recognized by OATELS, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by OATELS or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator of the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event OATELS, or a State Apprenticeship Agency recognized by OATELS, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under

the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(3) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(e) Compliance with Copeland Act requirements. The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(f) Contract termination; debarment. A breach of this contract clause may be grounds for termination of the contract and for debarment as a Contractor and a subcontractor as provided in 29 CFR 5.12.

(g) Compliance with Davis-Bacon and related Act requirements. All rulings and interpretations of the Davis-Bacon and related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

(h) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this clause shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the PHA, HUD, the U.S. Department of Labor, or the employees or their representatives.

(i) Certification of eligibility.

(1) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded contracts by the United States Government by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(2) No part of this contract shall be subcontracted to any person or firm ineligible for award of a United States Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(3) The penalty for making false statements is prescribed in the U. S. Criminal Code, 18 U.S.C. 1001.

(j) Contract Work Hours and Safety Standards Act. As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics, including watchmen and guards, shall require or permit any such laborer or mechanic in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the provisions set forth in subparagraph (j)(1) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic (including watchmen and guards) employed in violation of the provisions set forth in subparagraph (j)(1) of this clause, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by provisions set forth in subparagraph (j)(1) of this clause.

(3) Withholding for unpaid wages and liquidated damages. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any Federal contract with the same prime Contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the provisions set forth in subparagraph (j)(2) of this clause.

(k) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts all the provisions contained in this clause, and such other clauses as HUD or its designee may by appropriate instructions require, and also a clause requiring the subcontractors to include these provisions in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all these provisions.

47. Non-Federal Prevailing Wage Rates

(a) Any prevailing wage rate (including basic hourly rate and any fringe benefits), determined under State or tribal law to be prevailing, with respect to any employee in any trade or position employed under the contract, is inapplicable to the contract and shall not be enforced against the Contractor or any subcontractor, with respect to employees engaged under the contract whenever such non-Federal prevailing wage rate exceeds:
(1) The applicable wage rate determined by the Secretary of Labor pursuant to the Davis-Bacon Act (40 U.S.C. 3141 et seq.) to be prevailing in the locality with respect to such trade;
(b) An applicable apprentice wage rate based thereon specified in an apprenticeship program registered with the U.S. Department of Labor (DOL) or a DOL-recognized State Apprenticeship Agency; or
(c) An applicable trainee wage rate based thereon specified in a DOL-certified trainee program.

48. Procurement of Recovered Materials.

(a) In accordance with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, the Contractor shall procure items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR Part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition. The Contractor shall procure items designated in the EPA guidelines that contain the highest percentage of recovered materials practicable unless the Contractor determines that such items: (1) are not reasonably available in a reasonable period of time; (2) fail to meet reasonable performance standards, which shall be determined on the basis of the guidelines of the National Institute of Standards and Technology, if applicable to the item; or (3) are only available at an unreasonable price.
(b) Paragraph (a) of this clause shall apply to items purchased under this contract where: (1) the Contractor purchases in excess of $10,000 of the item under this contract; or (2) during the preceding Federal fiscal year, the Contractor: (i) purchased any amount of the items for use under a contract that was funded with Federal appropriations and was with a Federal agency or a State agency or agency of a political subdivision of a State; and (ii) purchased a total of in excess of $10,000 of the item both under and outside that contract.

Housing Authority of the City of Pittsburgh

Development & Modernization
412 Boulevard of the Allies, 6th Floor,
Pittsburgh, PA 15219
(412) 456-5020
www.hacp.org

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP Contract No. 600-21-24

SUPPLEMENTAL GENERAL CONDITIONS

SUPPLEMENTAL GENERAL CONDITIONS

To the extent that there is a conflict between the terms of the General Conditions and the terms of the Supplemental General Conditions, the terms of the Supplemental General Conditions shall govern to the extent of such conflict.

If HUD 5370 applies:

Section 31(e) of the General Conditions shall be deleted in its entirety and replaced by the following:

31(e). Forum. The Contracting Officer's decision shall be final unless, within thirty (30) days of receipt of the Contracting Officer's decision, the Contractor files suit in a court of competent jurisdiction.

If HUD 5370-EZ applies:

Section 3(d) of the General Conditions shall be deleted in its entirety and replaced by the following:

31(d). Forum. The Contracting Officer's decision shall be final unless, within thirty (30) days of receipt of the Contracting Officer's decision, the Contractor files suit in a court of competent jurisdiction.

If HUD 5370-C applies:

Section 1 Item 7(d) of the General Conditions shall be deleted in its entirety and replaced by the following:

Section 1 Item 7(d). Forum. The Contracting Officer's decision shall be final unless, within thirty (30) days of receipt of the Contracting Officer's decision, the Contractor files suit in a court of competent jurisdiction.

HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Date: _____ Signature: _____
Contracting Officer

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_____
Vendor Name(Insert vendor company name above)

Date: _____ Signature: _____

Title: _____

THE HOUSING AUTHORITY OF THE CITY OF PITTSBURGH

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

HACP Contract No. 600-21-24

WAGE DETERMINATION SCHEDULE

The construction covered by this contract is subject to the requirements of Clause 47 **Labor Standards - Davis-Bacon and Related Acts** of the General Conditions of the Contract for Construction. In accordance with 47 (a)(1) the wage determination of the Secretary of Labor is attached.

"General Decision Number: PA20240001 06/21/2024

Superseded General Decision Number: PA20230001

State: Pennsylvania

Construction Type: Building

County: Allegheny County in Pennsylvania.

BUILDING ERECTION AND FOUNDATION EXCAVATION PROJECTS (does not include residential construction consisting of single family homes and apartmennts up to and including 4 stories) EXCLUDING SEWAGE AND TREATMENT PLANT PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2024
1	01/12/2024
2	02/23/2024
3	05/31/2024

4 06/07/2024
5 06/21/2024

ASBE0002-001 08/01/2023

	Rates	Fringes
Asbestos Workers/Insulator Includes the application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems	$ 45.50	28.93

BOIL0154-001 01/01/2023

	Rates	Fringes
BOILERMAKER	$ 45.60	31.37

BRPA0009-029 12/01/2022

	Rates	Fringes
BRICKLAYER	$ 36.99	24.67

BRPA0009-060 12/01/2022

	Rates	Fringes
MASON - STONE	$ 38.56	23.36

BRPA0009-061 12/01/2022

	Rates	Fringes
TILE SETTER	$ 35.64	21.63

CARP0142-001 06/01/2023

	Rates	Fringes
Carpenter/Lather	$ 38.92	20.06

CARP0274-003 01/01/2024

	Rates	Fringes
PILEDRIVERMAN	$ 40.63	21.92

CARP1759-001 06/01/2023

	Rates	Fringes
FLOOR LAYER: Carpet	$ 35.94	19.02

ELEC0005-007 12/22/2023

	Rates	Fringes
ELECTRICIAN	$ 48.61	30.91

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* ELEC0126-006 06/03/2024

	Rates	Fringes
LINE CONSTRUCTION		

Cable Splicer	$ 54.38	34.25%+11.50
Groundmen	$ 32.63	34.25%+11.50
Lineman	$ 54.38	34.25%+11.50
Truck Driver	$ 35.35	34.25%+11.50
Winch Truck Operator	$ 38.07	34.25%+11.50

ELEV0006-001 01/01/2024

	Rates	Fringes
ELEVATOR MECHANIC	$ 58.55	37.885+a+b

FOOTNOTE: A. Employer contributes 8% of regular hourly rate as vacation pay credit for employees with more than 5 years of service, and 6% for 6 months to 5 years of service.

B. Eight Paid Holidays (provided employee has worked 5 consecutive days before and the working day after the holiday): New Years's Day; Memorial Day; Independence Day; Labor Day; Veteran's Day; Thanksgiving Day and the Friday after Thanksgiving Day, and Christmas Day.

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* ENGI0066-001 06/01/2021

	Rates	Fringes
Power equipment operators:		
CLASS 1	$ 37.09	23.35
CLASS 2	$ 31.02	23.35
CLASS 3	$ 28.23	23.35

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

CLASS I

Asphalt Paver, Asphalt Roller, Asphalt Plant Operator, Athey Loader, Auger (Truck or Tractor Mounted), Auto Grader (C.M.I. and similar), Backhoe (180' and 360' swing), Back-Filling Machine, Batch Plant, Bulldozer, Cable Layer, Cableway, Caisson Drill, Central Mix Plant, Compactor with Blade, Concrete Pump (all types), Over-Head Crane, Crane (Crawler or Truck Mounted)*, Tower Crane (Stationary or Climbing Type), Rough Terrain Crane**, Wagon Crane, Crushing and/or Screening Plant, Derrick Traveler, Derrick (all types)(when assistance is needed it will be an oiler or apprentice), Derrick Boats, Dragline, Drill (Davey or similar), Dredge, Drill (Well and Core)(Truck or Skid Mounted), Elevator, Excavating Equipment (all other), Fork Lift (Lull or similar), Franki Pile Machine (or similar), Guard Post Driver, Gradall (all types), Grader, Elevating Grader, Equipment Greaser, Helicopter, Helicopter Hoist Operators, Front End Loader, Hoist, Hydraulic Boom Truck, Jumbo Operator, Kocal, Koehring Scooper, Locomotive, Metro Chip Harvester (or similar), Mix Mobile, Mixer - Paver, Mucking Machine, Multiple Bowl Machines, Pile Driver (Sonic or similar), Scrapers, Shovels (powered), Slip Form Paver (C.M.I. and similar), Spreader (Concrete, Asphalt, or Stone), Tire Repairman (when assigned to a jobsite), Tower Mobile, Tractors (all types), Trencher, Tug Boat, Vermeer Saw, Welder (repairman), Whirley

* Cranes with Boom or Mast length (including jib) 100 ft or over shall be paid an additional $.50 per hour for each 50-foot increment of additional boom and/or jib length)

** Rough Terrain Cranes with Boom or Mast length (including jib) 101 ft or over shall be paid an Additional $.50 per hour for each 50-foot increment of additional boom and/or jib length)

Note: An additional $1.25 per hour (not counting boom pay) shall be paid for any crane (excluding overhead cranes) rated 100 ton or over.

CLASS II

Ballast Regulator, Boat (material or personnel)(powered), Boiler, Boring Machine, Compressor (combined with Air Tugger, Air Pump, Gunite Machine, or Sand Blaster), Concrete Belt Placer, Concrete Saw, Conveyor, Carry Crane, Crushing/Screening Plants, Curb Builder (self-propelled), Forklifts (ridden or self-propelled), Form Line Machine, Generator (over 5KW), Grout Pump, Heaters, Hoist (monorail, roof, one drum-regardless of power used), Huck Machine (or similar), Hydraulic Jack (single or multiple)(power driven), Ladavator, Mortar Mixer, Mulching Machine, Pavement Breaker (self-propelled or ridden), Pin Puller (powered), Pipe Cleaning Machine, Pipe Dream, Power Broom (except push type), Pulverizer, Pumps (regardless of power used), Roller/Compactor (Dirt), Refrigeration Plant, Ross Carrier (or similar), Seeding Machine, Skid Steer Loader (or similar), Slab Lifting Machine (hydraulic), Soil Stabilizer (pump type), Spray Cure Machine (power driven), Side Delivery Shoulder Spreader (attachment), Steam Jenny (or similar), Stone Crusher, Stone Spreader (self-propelled), Siphon (steam or air), Tie Tamper (multiple heads), Tractor (when used for landscaping, snaking, or hauling), Truck (Winch)(when hoisting and placing), Tube Finisher (C.M.I. and similar), Tugger, Water Blaster, Welding Machine, Well Point System

CLASS III

Brakeman, Deck Hand, Helicopter Signalman, Oiler*, Elevator (Alterations & Remodeling Commercial Buildings),

* Oilers on Truck Cranes: less than 50 ton shall receive $.10 over the Class III base rate; 50 ton up to 100 ton rated capacity shall be paid an additional $.25 per hour over the Class III base rate; 100 ton and over shall be paid an additional $1.00 per hour over the Class III base rate.

General Note: Hazardous Material Sites Level C & D receive $1.00 per hour premium for all classifications and Levels A & B receive $2.50 premium for all classifications

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IRON0003-002 06/01/2023

	Rates	Fringes
IRONWORKER	$ 38.89	34.54

LABO0613-002 01/01/2019

	Rates	Fringes
Laborers:		
GROUP 1	$ 22.37	17.60
GROUP 2	$ 22.52	17.60
GROUP 3	$ 22.65	17.60
GROUP 4	$ 23.12	17.60

LABORERS CLASSIFICATIONS

GROUP 1: COMMON LABORER - Building laborer; Brick removal for alterations; Carryable pumps; West brick buggy or similar; Walk behind forklift or similar (non self-propelled); Stripper and mover of forms; Toolroom man;

all material conveyors (regardless of power used, including starting and stopping); Pouring of mortar or aggregate into blocks of voids

GROUP 2: SKILLED LABORER - West brick buggy or similar (self propelled); Power wheelbarrows and buggies; walk behind forklift or similar (self-propelled); Drill runner; All operators of compacting equipment; Pipe layer; Burner; Jackhammer man - concrete buster; Vibrator operator; Clay spade and/or similar; Gunnite nozzleman; Blaster; Concrete saw operator; Hod carrier; Scaffold builder; Air track operator; Bell and Bottom Man on furnace and stacks; Grout machine feeder and pump operator; Gunnite machine operator or similar; Gunnite machine potman or similar; Mortar Mixer; Mortar mixer machine (regardless of power used, including starting and stopping); Wagon drill operator; Laser cleaner; Lancer

GROUP 3: Asbestos removal or abatement laborer

GROUP 4: Toxic or Hazardous waste handling laborer

LABO0952-004 01/01/2024

	Rates	Fringes
Landscaping		
GROUP 1	$ 24.37	18.53
GROUP 2	$ 24.79	18.53
GROUP 3	$ 25.09	18.53

LANDSCAPING CLASSIFICATIONS

GROUP 1: Landscape laborer to include general landscaping work and the driving of trucks for the distribution of materials on the job site but not to include trucks used to transport supplies to the job

GROUP 2: Skilled Landscape Laborer to plant all types of trees and shrubs without direct supervision.

GROUP 3 - Landscape tractor operator to operate small industrial rubber tire tractor equipped with front end loader and backhoe attachment or a skid loader with landscape attachments used for the sole purpose of landscape work including soil spreading, unloading and loading of materials and such other landscaping work but not for heavy and highway construction work

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PAIN0057-003 06/01/2023

	Rates	Fringes
PAINTER		
Brush & Roller	$ 30.56	23.72

PAIN0057-005 06/01/2023

	Rates	Fringes
DRYWALL FINISHER/TAPER	$ 32.39	23.26

PAIN0751-001 09/01/2023

	Rates	Fringes

GLAZIER.....$ 35.65 29.73

PLAS0526-007 06/01/2021

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	$ 31.77	21.89

PLUM0027-002 06/01/2023

	Rates	Fringes
PLUMBER.....	$ 48.65	25.47

PLUM0449-001 06/01/2023

	Rates	Fringes
PIPEFITTER.....	$ 46.10	27.97

ROOF0037-001 06/01/2024

	Rates	Fringes
ROOFER.....	$ 38.00	20.67

SFPA0542-001 07/01/2023

	Rates	Fringes
SPRINKLER FITTER.....	$ 43.84	25.20

SHEE0012-002 07/01/2022

	Rates	Fringes
SHEET METAL WORKER.....	$ 39.50	30.79

TEAM0040-007 01/01/2024

	Rates	Fringes
Truck drivers:		
GROUP 1.....	$ 34.93	22.71
GROUP 2.....	$ 35.39	23.02

FOOTNOTES:

A. Hazardous/toxic waste material/work level A & B receive additional $2.50 per hour above classification rate

B. Hazardous/toxic waste materials/Work level C & D receive $1.00 per hour above classification

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1 - Single Axle (2 axles including steering axle); Includes partsman and warehoueman. Tandem - Tri-Axle - Semi-Tractor Trailer (combination) (3 axles or more including steering axle)

GROUP 2 - Specialty Vehicles; Heavy equipment whose capacity exceeds that for which state licenses are issued specifically refers to units in excess of eight (8) feet width (such as Euclids, Atley Wagon, Payloder, Tournawagons, and similar equipment when not self loaded); Tar and Asphalt Distributors Trucks, Heavy Duty Trailer, such as Low Boy, High Boy

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that

no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

State Adopted Rate Identifiers

Classifications listed under the ""SA"" identifier indicate that the prevailing wage rate set by a state (or local) government was adopted under 29 C.F.R §1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 01/03/2024 reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

PART 4: TECHNICAL SPECIFICATIONS

Bedford Dwellings EnVision Center-New Dedicated Heating Plant

IFB CONTRACT NO. 600-21-24

HOUSING AUTHORITY CITY OF PITTSBURGH – BEDFORD DWELLINGS ENVISION CENTER

SPECIFICATIONS

BEDFORD DWELLINGS ENVISION CENTER – NEW DEDICATED HEATING PLANT. TASK ORDER NO.113

BEDFORD HOPE CENTER

Tusick & Associates Architects, Inc.
123 3rd Street
Blawnox, PA 15238

July 30, 2023

TABLE OF CONTENTS
CONTRACT DOCUMENTS

SECTION 011000
SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Type of the Contracts.
3. Work under other contracts.
4. Use of premises.
5. Owner's occupancy requirements.
6. Work restrictions.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Task Order #113 – Dedicating Heating Plant at the Homework North Housing Community

1. Project Location: 2305 Bedford Ave, Housing Community, Pittsburgh, PA 15219

B. Owner: Housing Authority of the City of Pittsburgh (HACP).

1. Owner's Contact: Darnell Walker, Darnell.Walker@hacp.org
2. Voice: 412-742-7825

C. Architect: Tusick & Associates Architects, Inc.; 53 Windsor Road, Pittsburgh, PA 15215

1. Architect's Contact: Susan Tusick, R.A., stusick@tusickarchitects.com
2. Voice: 412-781-8896

D. The Work generally consists of

a. Installation of 2 new boilers – "Heating Plant / pumps / flues" in the existing dedicated Boiler Room.

b. Perform a gas analysis of all the existing gas loads to determine if a gas increase is necessary.

c. Renovation and modify VAV boxes and ductwork in areas required to match the current use and new design configuration.

d. Rebalancing the hot water piping distribution system where required to ensure that sufficient hot water is available during winter months and the flow pressure is acceptable.

e. Provide architectural & engineering drawings & specifications.

1.3 TYPE OF CONTRACTS

A. Project will be constructed under a single General Construction Contract.

1.4 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work: Owner may awarded separate contract(s) for construction operations at the premises. Those operations will be conducted simultaneously with work under this Contract and should not interfere with the construction operations at the Project site.

1.5 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

B. Use of Site: Limit use of premises to the Project site only, within the Contract limits indicated. Do not disturb portions of premises beyond the Project site.

1. Owner Occupancy: Owner will occupy the premises during the entire construction period.
2. Use by the public of Owner’s facilities will be ongoing.
3. Driveways and Entrances: Keep driveways, roadways and entrances serving premises clear and available to Owner, Owner's employees, and the public at all times. Do not use these areas outside the Project site limits for parking or storage of materials.

C. Use of Existing Facilities: Use of existing buildings, parking area and ground outside the Project Site will not be permitted. Maintain existing building entrances, parking lots, driveways and roadways in good condition throughout construction period. Repair damage caused by construction operations. Protect adjacent buildings and their occupants during construction period.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy premises during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used portions of the facility. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 5 days' notice to Owner of activities that will affect Owner's operations.
3. Some of the work of this project requires access to Owners’ apartments for proper completion. Prior and/or repeated notices may be necessary to gain access to private dwellings. Delay of the work will not be permitted due to failure of access. Take action to prevent any access delays.

1.7 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 8 a.m. to 5 p.m., Monday through Friday, except as otherwise indicated.

1. Weekend Hours: Only permitted if Owner and tenant agree to permit access to work area. If requesting weekend access – work hours shall remain between 8 a.m. to 5 p.m.
2. Hours for Utility Shutdowns on Premises: Not permitted.

a. Utilities on Project site may incur momentary shutdowns based on Contractors requirements.

B. Existing Utility Interruptions: Do not interrupt utilities serving portion of facility occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect, Owner’s Representative, and Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's Representative’s or Owner’s written permission.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

DOCUMENT 00 7200

GENERAL CONDITIONS

1.1SUMMARY

A. Related Documents:
   1. Document 00 7300 - Supplementary Conditions.
   2. Division 01 - General Requirements.

1.2 DOCUMENT

A. American Institute of Architects (AIA) Document A201-2007, General Conditions of the Contract for Construction, forms a part of this Contract and by reference is incorporated herein as fully as if repeated at length.

END OF DOCUMENT

SECTION 012900
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

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

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with Continuation Sheets.
b. Contractor's Construction Schedule.

2. Submit the Schedule of Values per General Conditions Forms to Architect at earliest possible date but no later than ten days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Contract Documents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Submit draft of the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.
b. Description of the Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value.

1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents in the amount of 5 percent of the Contract Sum.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
6. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment as items become completed.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: Progress payments shall be submitted to Architect by the 5th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month previous the submission.

C. Payment Application Forms: Use Applications for Payment forms provided by PHA and in accordance with the HUD General Conditions and as specified herein.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment. Include waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

    1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
    2. When an application shows completion of an item, submit final or full waivers.
    3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
    4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
    5. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

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

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. List of Contractor's staff assignments.
6. List of Contractor's principal consultants.
7. Copies of building permits.
8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
9. Initial progress report.
10. Report of preconstruction conference.
11. Certificates of insurance and insurance policies.
12. Performance and payment bonds.
13. Data needed to acquire Owner's insurance.

H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. Evidence that claims have been settled.
7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
8. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100
PROJECT MEETINGS AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

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

1. Administrative and supervisory personnel.
2. Preconstruction project meeting.
3. Requests for Interpretation (RFIs).

1.2 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.3 COORDINATION

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

1.4 PROJECT MEETINGS

A. Preconstruction Conference: HACP will schedule a preconstruction conference before starting construction, at a time convenient to Owner, and Contractor, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Tentative construction schedule.
    b. Critical work sequencing and long-lead items.
    c. Designation of key personnel and their duties.
    d. Procedures for processing field decisions and Change Orders.
    e. Procedures for RFIs.
    f. Procedures for testing and inspecting.
    g. Procedures for processing Applications for Payment.
    h. Submittal procedures.
    i. Use of the premises.
    j. Work restrictions.
    k. Owner's occupancy requirements.
    l. Responsibility for temporary facilities and controls.
    m. Construction waste management and recycling.

n. Parking availability.
o. Office, work, and storage areas.
p. Equipment deliveries and priorities.
q. Security.
r. Progress cleaning.
s. Working hours.
t. Identify exactly which trees require trimming.

3. Minutes: Architect will record and distribute meeting minutes.

1.5 REQUESTS FOR INTERPRETATION (RFIs)

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

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
3. Follow guidelines noted in the “Contractor’s Handbook” when providing RFIs.
4. Do not communicate directly with Architect. Submit RFIs correspondence through HACP.

B. Required Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Architect.
5. RFI number, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Hard-Copy RFIs: Identify each page of attachments with the RFI number and sequential page number.

D. HACP's Action: HACP will review and forward each RFI request to Architect for additional review, determine action required, and return it. Allow seven working days for HACP review and another seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.

b. Requests for approval of substitutions.
c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or RFIs with numerous errors.

2. HACP's action may include a request for additional information, in which case Architect's time for response will start again.
3. HACP's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Progress Schedule (Gantt Chart).
2. Field condition reports.
3. Special reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

C. Gantt Chart: Horizontal bar chart used for planning and scheduling a construction project where activities are arranged chronologically based on milestones and have starting and ending dates.

D. Milestone: A key or critical point in time for reference or measurement.

E. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.3 SUBMITTALS

A. Contractor's Construction Progress Schedule: Submit three opaque copies of initial schedule, large enough to show entire schedule for entire construction period in accordance with HACP requirements.

B. Field Condition Reports: Submit four copies at time of discovery of differing conditions in accordance with HACP requirements.

C. Special Reports: Submit four copies at time of unusual event in accordance with HACP requirements.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Progress Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

C. If any contractor fails to submit schedule information to the General Contractor in a timely manner as specified in the contract documents, General Contractor shall immediately notify the Housing Authority of this fact in writing. Failure of any contractor to submit required information in a timely manner shall be a default in accordance with the terms of the contract.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION PROGRESS SCHEDULE

A. Comply with the requirements of the HUD General Conditions for submissions of Progress Schedule. Include start and completion dates and other activities such as acquiring labor, materials and equipment.

B. Submit Schedule to the Contracting Officer to indicate progression of the work. Failure to provide Construction Schedule and periodic updates may result in withheld approvals of progress payments.

1. Submit Construction Progress Schedule 5 days after start of the work.

C. Procedures: Comply with procedures contained in Associated General Contractors of America (AGC) "Construction Planning & Scheduling" for horizontal Gantt Chart construction schedules.

D. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

E. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule.
3. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

F. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work under More Than One Contract: Include a separate activity for each contract.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Work Restrictions: Show the effect of the following items on the schedule:
    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.

d. Use of premises restrictions.
e. Environmental control.

4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Installation.
d. Tests and inspections.
e. Curing.
f. Placement into final use and operation.

G. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

2.2 REPORTS

A. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

B. Special Reports: Submit directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

C. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION PROGRESS SCHEDULE

A. Scheduling: Provide planning, evaluation, and reporting of the Work using the horizontal Gantt Chart schedule. Within 5 calendar days of execution of the Contract Agreement by HAGP submit the proposed Construction Schedule.

B. Contractor's Construction Progress Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule immediately after changes have been made.

1. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
2. As the Work progresses, indicate Actual Completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. When revisions are made, distribute updated schedules to the same parties. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

C. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

a. Project name and date.
b. Name and address of Architect**.**
c. Name and address of Contractor.
d. Name and address of subcontractor.
e. Name and address of supplier.
f. Name of manufacturer.
g. Number and title of appropriate Specification Section.
h. Drawing number and detail references, as appropriate.
i. Location(s) where product is to be installed, as appropriate.
j. Other necessary identification.

D. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

E. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

2. If additional copies are submitted for maintenance manuals, they will not be marked with action taken and will be returned.

F. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "Approved or Approved as Noted on Architect's action stamp."

H. Use for Construction: Use only final submittals with mark indicating "Approved or Approved as Noted on Architect's action stamp."

PART 2 - PRODUCTS

2.1 SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options meet the requirements specified.
3. Submit Product Data before or concurrent with Samples.
4. Number of Copies: Submit five copies of Product Data, unless otherwise indicated. Architect will return two copies. Mark up and retain one returned copy as a Project Record Document.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Dimensions.
c. Notation of dimensions established by field measurement.
d. Fabrication and installation drawings.
e. Roughing-in and setting diagrams.
f. Templates and patterns.
g. Compliance with specified standards.
h. Notation of coordination requirements.
i. Relationship to adjoining construction clearly indicated.
j. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.

3. Number of Copies: Submit three copies where copies are required for operation and maintenance manuals. Architect will retain one copy; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of appropriate Specification Section.

3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit two sets of Samples. Architect will retain one Sample sets; remainder will be returned.

E. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for construction schedule submittals and updates.

F. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

G. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

2.2 INFORMATIONAL SUBMITTALS

A. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

C. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

D. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

E. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

F. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Approved.
2. Approved As Noted
3. Not Approved
4. Revise And Resubmit

C. Corrections or comments made to the submittal do not relieve the Contractor from compliance with the requirements of the Contract Documents. This stamp indicates only a review for conformance with the design concepts of the project and compliance with the information given in the Contract Documents. The Contractor is solely responsible for: confirming and correlating all quantities and dimensions including field confirmed dimensions, selecting fabrication processes and techniques of construction; coordinating the work of all trades; and conforming with all applicable codes. This review des not authorize any additional cost for labor or material.

D. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

E. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

F. Submittals not required by the Contract Documents will not be reviewed and will be discarded.

END OF SECTION 013300

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. References.
2. Quality assurance and control of installation.
3. Manufacturer's field services and reports.
4. Design data and calculations.
5. Test reports and certifications.
6. Manufacturer's installation instructions.

1.2 REFERENCES

A. For products or workmanship specified by reference to association, trade, or industry standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Should specified reference standards conflict with Contract Documents, request clarification from Design/Builder before proceeding.

C. Conform to edition of reference standard in effect as of [date of Project Manual.] [date of [Design/Builder-Subcontractor] Agreement.]

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

1.3 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

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

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Design/Builder before proceeding.

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

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

G. Removal:

1.4 MANUFACTURERS' FIELD SERVICES AND REPORTS
Not used

1.5 DESIGN DATA AND CALCULATIONS

A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide design data and calculations.

B. Accuracy of design data and calculations is the responsibility of the Subcontractor.

C. When so specified, prepare design data and calculations under the direction of a professional engineer licensed in the state in which the Project is located. Affix engineer’s seal to submittals.

D. Submit one copy. [Submit electronically in Adobe PDF format.]

1.6 TEST REPORTS AND CERTIFICATIONS

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide test reports and manufacturers’ certifications.

B. Indicate that material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Submittals may be recent or previous test results on material or Product but must be acceptable to Design/Builder.

D. Submit one copy.[Submit electronically in Adobe PDF format.]

1.7 MANUFACTURER'S INSTALLATION INSTRUCTIONS

A. When Contract Documents require that Products be installed in accordance with manufacturer's instructions:
   1. Submit manufacturer's most recent printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, as applicable.
      a. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
      b. Identify conflicts between manufacturers' instructions and requirements of Contract Documents.
   2. Perform installation of Products to comply with requirements of manufacturer's instructions.
   3. If installation cannot be performed in accordance with manufacturer's instructions, notify Design/Builder and await instructions.
   4. Submit one copy. [Submit electronically in Adobe PDF format.]

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

OF SECTION END

SECTION 014500
PROJECT QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

1.2 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

E. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 QUALITY CONTROL

A. Contractor's Responsibilities: Where quality-control services are indicated as Contractor's responsibility, Contractor will engage a qualified testing agency to perform these services.

1. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014500

SECTION 02 4120

BUILDING DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removal of designated building construction, equipment, and fixtures.
   2. Identification of utilities.

1.2 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition work, safety of structure, and dust control.

B. Obtain required permits from authorities.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Conform to applicable codes when hazardous or contaminated materials are discovered.

E. Do not close or obstruct exits.

F. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

1.3 PROJECT CONDITIONS

A. Minimize interference with streets, walks, public right-of-ways, and adjacent facilities.

B. If hazardous materials are discovered, notify [Architect] [Design/Builder] and await instructions.

C. If any of the following conditions are encountered, cease work immediately, notify Architect, and Design/Builder, and await instructions:
   1. Structure is in danger of movement or collapse.
   2. Materials or conditions encountered differ from those designated in the Contract Documents.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 PREPARATION

A. Erect temporary partitions, barricades, warning devices, and controls.

B. Provide protective coverings, shoring, bracing, and supports for construction designated to remain.

C. Temporarily or permanently disconnect utilities as required.

3.2 DEMOLITION

A. Remove existing construction to extent indicated and as necessary to join new work to existing. Do not remove more than is necessary to allow for new construction.

B. Do not damage work designated to remain.

C. Minimize noise and spread of dirt and dust.

D. Assign work to trades skilled in procedures involved.

E. Plug ends of disconnected utilities with threaded or welded caps.

F. Protect and support active utilities designated to remain. Post warning signs showing location and type of utility and type of hazard.

G. Store items designated to remain property of Owner where directed by Owner.

H. Remove and dispose of waste materials off site.

END OF SECTION

SECTION 08 3100

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Access doors and frames for ceiling surfaces.

B. Related Sections:
1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

A. ASTM International (ASTM):
1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

B. Underwriters Laboratories (UL) 10B - Standard for Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Submittals for Review:
1. Product Data: Provide sizes, types, finishes, scheduled locations, and details of adjoining work.

1.4 QUALITY ASSURANCE

A. Fire Door Construction: Conform to UL 10B.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. Babcock-Davis Hatchways, Inc. (www.babcockdavis.com)
2. J.L. Industries. (www.jlindustries.com)
3. Karp Associates, Inc. (www.karpinc.com)
4. Milcor. (www.milcorinc.com)
5. Nystrom Building Products, Inc. (www.nystrom.com)
6. Best Access Doors. (www.bestaccessdoors.com)
7. [____].
8. [____].

B. Substitutions: [Under provisions of Division 01.] [Not permitted.]

2.2 MATERIALS

A. Steel Sheet: ASTM A1008/A1008M, cold rolled.

B. Galvanized Steel Sheet: ASTM A653/A653M, Structural Quality.

2.3 FABRICATION

A. Fabricate door frame of steel sheet:
   1. Doors 36 x 36 inches and smaller: Minimum 18 gage.
   2. Fabricate frames with drywall flanges.

B. noncombustible insulation.

C. Recess door face to receive gypsum board flush with adjacent surface.

D. Hardware:
   1. Continuous steel hinges, 175 degree opening.
   2. Screwdriver operated cam latch.

2.4 FINISHES

A. Interior Doors: One coat rust-inhibiting primer paint, sprayed and baked.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install plumb and level in openings. Secure rigidly in place.

C. Position access door where indicated or where required to provide convenient access to concealed work requiring maintenance. Door is to be mounted to ceiling joist. Location is to be determined after demolition of required access to facilitate each separately, HVAC – xVAV-1 & xVAV-2 valve installation. The access panel location is to provide maintenance access to these valves. Field verify valve, and conclude the best access, and structural availability to determine location of the access door. If the door size 36”x 36” is to large to attach with the ceiling joist structure then down size to 24”x24” Field verify.

END OF SECTION

SECTION 09 2900
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following: Interior gypsum board.

B. Related Sections include the following:

1. Section 061053 "Miscellaneous Carpentry" for non-structural framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.4 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

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

1. CertainTeed Gypsum, Inc.
2. G-P Gypsum.
3. Lafarge North America Inc.
4. National Gypsum Company.
5. USG Corporation.

B. Abuse-Resistant Type: ASTM C 1629/C 1629M, Level 2. Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.

1. Thickness: 5/8 inch (12.7 mm).
2. Long Edges: Tapered.

2.2 TRIM ACCESSORIES

A. Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape For Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

2. Fill Coat: For second coat, use setting-type, sandable topping compound.
3. Finish Coat: For third coat, use setting-type, sandable topping compound.
4. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

C. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

D. Form control and expansion joints with space between edges of adjoining gypsum panels.

E. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

F. Attachment to Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.2 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Abuse-Resistant Type: Vertical surfaces, unless otherwise indicated.
2. Type X: Where required for fire-resistance-rated assembly.

B. Single-Layer Application:

1. On partitions/walls, apply gypsum panels vertically (parallel to framing), horizontally (perpendicular to framing), or required by fire-resistance-rated assembly, and minimize end joints.
2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.3 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect. Install joints on both sides above framed door openings at locations where ceiling height is greater than 8-feet.

C. Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. Bullnose Bead: Use at outside corners where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.

3.4 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated. Including surfaces scheduled to receive wall covering.

   a. Primer and its application to surfaces are specified in other Division 09 Sections.

2. Level 5: Not used unless indicated on Drawings.

END OF SECTION 092900

SECTION 09 5100

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Suspended metal ceiling grid system.
   2. Acoustical panels.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
   2. C635 - Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
   3. C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
   4. E1264 - Standard Classification of Acoustical Ceiling Products.

B. Ceiling and Interior Systems Construction Association (CISCA) - Ceiling Systems Handbook.

C. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

D. Quality Control Submittals:
   1. Certificates of Compliance: Certification from an independent testing laboratory that acoustical panels meet fire hazard classification requirements.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years [documented] experience in work of this Section.

B. Installed System: Conform to UL Floor/Ceiling Design.

C. Fire Hazard Classification: Class A rated, tested to ASTM E1264.

1.4 PROJECT CONDITIONS

A. Environmental Requirements: Install in approximately same conditions of temperature and humidity as will prevail after installation.

1.5 MAINTENANCE

A. Extra Materials: 2 percent of acoustical panels.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Suspension System:
   1. Dune Second Look. https://www.armstrongceilings.com/commercial/en/commercial-ceilings-walls/dune-second-look-ceiling-tiles.html
   2. Armstrong World Industries, Inc. (www.ceilings.com)
   3. Chicago Metallic Corporation. (www.chicago-metallic.com)

4. USG Interiors, Inc. (www.usg.com)

B. Acceptable Manufacturers - Acoustical Units:
   1. Dune Second Look. https://www.armstrongceilings.com/commercial/en/commercial-ceilings-walls/dune-second-look-ceiling-tiles.html
   2. Armstrong World Industries, Inc. (www.ceilings.com)
   3. BPB America, Inc. (www.bpb-na.com)
   4. USG Interiors, Inc. (www.usg.com)

C. Substitutions: Not permitted.

2.2 MATERIALS

A. Suspension Grid System:
   1. ASTM C635, intermediate, heavy duty, die cut, interlocking ends.
   2. Face dimensions: 9/16”
   3. Grid type: Exposed T.
   4. Material: Galvanized steel.
   5. Runners: 1-1/2 inches high, 15/16-inch exposed width, Bolt-slot, dimensional tee, exposed tee profile.
   6. Perimeter molding: Channel shape.
   7. Finish: Factory applied enamel paint, sprayed, and baked. White
   8. Accessories: Stabilizer bars, clips, and splices.

B. Acoustical Panels:
   1. Source: DUNE Second Look
   2. Size: 24 x 48 inches x 3/4 inch thick.
   3. Edge configuration: Square.
   4. Performance requirements: Tested in accordance with ASTM E1264.

2.3 ACCESSORIES

A. Support Channels: Hot-dippedGalvanized Prime painted galvanized steel; size and type to suit application.

B. Hanger Wire:
   1. ASTM A641, minimum 12 gage galvanized steel.

C. Hold Down Clips: Minimum 24 gage spring steel, manufacturer's standard profile.

D. Impact Clips: Minimum 24 gage spring steel, manufacturer's standard profile.

E. Touch-Up Paint: Color to match acoustical panels and suspension grid.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install ceilings in accordance with ASTM C636 and CISCA Handbook.

B. Minimize panels less than one half size.

C. Install molding around perimeters and abutting surfaces. Miter molding at exterior corners; cut flanges and bend web to form interior corners.

D. Space hanger wires maximum 48 inches on center. Install additional hangers where required to support light fixtures and ceiling supported equipment.

E. Do not suspend hangers directly from metal deck. Attach steel channel horizontally to adjacent framing members; place hanger at regular spacing.

F. Hang suspension system independent of walls, columns, ducts, pipes, and conduit.

G. Where ducts or other equipment prevent regular spacing of hangers:
   1. Reinforce nearest related hangers to span extra distance, or:
   2. Suspend steel channel horizontally beneath duct or equipment; place hanger at regular spacing.

H. Install main tees at maximum 48 inches on center.

I. Install cross tees to form 24 x 48 inch modules. Lock cross tees to main tees.

J. Support ends of tees on flange of perimeter molding.

K. Place acoustical panels with edges resting flat on suspension grid.

L. Cutting Acoustic Units:
   1. Cut to fit irregular grid and perimeter edge trim and around penetrations.
   2. Locate cuts to be concealed.
   3. Cut and field paint exposed edges of reveal edge units to match factory edge.

M. Place hold down clips over cross tees at midpoint of each module.

N. Place impact clips over cross tees at midpoint of each module.

O. Lighting Fixture Protection: Form trapezoidal, five-sided box of acoustical panels cut to size over each light fixture; conform to UL requirements.

P. Installation Tolerances: Ceilings level to 1/8 inch in 12 feet measured in any direction.

3.2 ADJUSTING

A. Touch up minor scratches and abrasions to match factory finish.

END OF SECTION

SECTION 099100
EXTERIOR AND INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and field painting of, but not limited to, the following exposed exterior and interior items and surfaces.
   1. Gypsum surfaces surrounding windows.
   2. Pre-primed surfaces.

B. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item, or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, The Authority will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:
      a. Finished mechanical and electrical equipment.
      b. Light fixtures.
   2. Finished metal surfaces include the following:
      a. Anodized aluminum.
      b. Stainless steel.
      c. Chromium plate.
      d. Copper and copper alloys.
      e. Bronze and brass.
   3. Operating parts include moving parts of operating equipment
   4. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.2 DEFINITIONS

A. Agencies, and the abbreviations used to reference them, include the following:
   1. ASTM - American Standards for Testing Materials.
   2. FM - Factory Mutual.
   3. SSPC - Steel Structures Painting Council.

B. Standard coating terms defined in ASTM D 16 apply to this Section.
   1. Flat: A lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell: Low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Semi Gloss: Medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.

4. Gloss: High-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.3 SUBMITTALS

A. Product Data:
   1. Material List: Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by highlighting the manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Manufacturer's technical information, including MSDS label analysis and instructions for handling, storing, and applying each coating material.
   3. Color chart with manufacturer’s full range of standard colors

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats. Products shall not contain TCLP metals and PCB's.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain storage containers in a clean condition, free of foreign materials and residue. The Authority requires additional safety controls and health rules for on-site service for flammable material storage.
   1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.6 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 degrees F.

B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing-and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers unless an approval request is submitted and approved by The Authority. Furnish manufacturer’s material data MSDS and certificates of performance for proposed substitutions.

C. Colors: As selected by Architect from manufacturer's full range of color chips.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
   1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify the Authority about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturers written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Ferrous Metals: Clean unga1vanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
      a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
      b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush; clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

D. Material Preparation: Mix and prepare paint materials according to manufacturers written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Surface Preparation Schedule:

NO.	SURFACE	SURFACE PREPARATION
SP-11	Gypsum Board Surfaces	Fill minor defects with filler compound and sand smooth. Spot prime defects after repair.
SP-13	Interior Wood (or wood products)	Wipe off dust and grit prior to priming. Seal knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
   2. Do not paint over dirt, rust, scale; grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   3. Provide finish coats that are compatible with primers used.
   4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
   5. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
   6. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
   2. Omit primer over metal surfaces that have been shop primed and touchup painted.
   3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, comers, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
   4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Electrical items to be painted include, but are not limited to, the following:
   1. Panelboards.
   2. Electrical equipment that is indicated to have a factory-primed finish for field painting.

F. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no bum-through or other defects due to insufficient sealing.

G. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform (mish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 PAINTING & COATING SYSTEMS

A. General: Work with Painting Schedule for number of coats.

SYSTEM	MATERIAL & CONDITION	SURFACE PREP	PRIMER COAT	INTERMEDIATE COAT	FINISH COAT

G1	Gypsum Board Interior Normal Service	SP-11	Acrylic Latex 1 coat @ 1.5-1.9 MDF per coat Color: White	N/A	Acrylic Latex 2 coats @ 1.4.-1.7 MDF per coat Color: Per Painting Schedule
W1	Wood or Wood Product, Interior Normal Surface	SP-13	Modified Alkyd 1 coat @ 2.0-2.6 MDF per coat Color: White	N/A	Styrene Acrylic Latex 1 coat@ 1.4-1.7 MDF per coat Color: Per Painting Schedule

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by The Authority.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
   1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA Pl.

END OF SECTION 099100

SECTION – 099200
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. See Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

C. See Division 07 Section "Penetration Firestopping" for patching fire-rated construction.

1.2 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increasedmaintenance or decreased operational life or safety.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visuallyunsatisfactory manner.

1.3 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existingwarranties.

PART 2 - PRODUCTS

2.1 MATERIAL

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protect ion from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 099200

SECTION 230000
HVAC INDEX

SECTION 230500
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Definitions
2. Permits, Codes, and Inspections.
3. Visiting Premises
4. Sleeves.
5. Escutcheons.
6. Grout.
7. HVAC demolition.
8. Painting and finishing.
9. Fire stopping.
10. Roof curbs.
11. Concrete bases.
12. Supports and anchorages.
13. Access doors and panels.

1.3 DEFINITIONS

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

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

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

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

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

1.4 SUBMITTALS

A. Product data for the following:

1. Escutcheons.
2. Interference/Coordination drawings.
3. Roof curbs.
4. Access doors and panels.

1.5 PERMITS, CODES, AND INSPECTIONS

A. Contractor shall obtain and pay for all permits and inspections required by laws, ordinances, rules, and regulations having jurisdiction for work included under this Contract, and shall submit approval certificates to the Architect.

B. The HVAC installation shall comply fully with:

1. All local, county and state laws, ordinances and regulations having jurisdiction and as applicable to the HVAC installations.
2. All approved published instructions set forth by manufacturers of equipment furnished or installed on this project.

C. The HVAC installation and all components shall be in compliance with all applicable codes and ordinances adopted by the local authority having jurisdiction. Unless noted otherwise in the applicable codes and ordinances adopted by the local authority having jurisdiction, requirements of the latest or state-adopted edition of the following Standards shall apply.

1. American Society for Testing and Materials (ASTM)
2. Americans with Disabilities Act (ADA)
3. International Building Code (IBC)
4. International Fire Code (IFC)
5. International Energy Conservation Code (IECC)
6. National Electric Code (NEC)
7. National Fire Protection Association (NFPA)
8. National Safety Code
9. Occupational Safety and Health Act (OSHA)
10. Sheet Metal & Air Conditioning Contractors National Association Standards (SMACNA)
11. Underwriter's Laboratories, Inc. (UL)

D. Submit certificates issued to authorized agencies which indicate the work conforms to the above requirements, as well as any additional certificates as may be required for the performance of this contract work.

E. Certificate of Inspection: The Contractor shall procure and pay for the Certificate of Inspection from the municipality-approved inspection agency and deliver it to the Architect before final payment is made.

1.6 VISITING PREMISES

A. All bidders are encouraged to visit the project site prior to submitting a bid proposal. The Contractor's is responsible for becoming familiar with the existing conditions of the project prior to submitting a bid proposal. Sufficient allowances shall be included in the bid proposal to

perform work that may not be illustrated on the drawings, but due to existing conditions can be reasonably inferred as belonging to work required to complete this contract. Items which cannot be determined from a visual inspection, such as unforeseen conditions that are buried within walls, beneath concrete floors, or above hard ceilings, would not apply.

B. By submission of a bid, the Contractor is attesting that responsible personnel are aware and familiar with all existing pertinent conditions.

C. Contractor shall verify all measurements and dimensions at the site which may materially affect the contract price prior to submitting a bid proposal.

1.7 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

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

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

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

B. Deliver ducts with shop-applied plastic covers over each opening of every duct. Prior to applying the plastic covers on each duct, vacuum all dirt and debris from its interior. Maintain the plastic covers through shipping and storage. Handle ducts to prevent damage to the ducts and to the plastic covers. If a ducts plastic cover(s) is damaged or comes loose, re-vacuum the interior of the duct and apply new plastic covers. The plastic cover shall be maintained over the openings of each duct until that duct is ready to be installed.

1.9 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 operable mechanical systems complete in every respect.

B. Any apparatus, appliance, material or work not typically shown on drawings as standard industry practice but is mentioned in the specifications, or vice versa, shall be provided by the HVAC Trade without additional expense to the Owner.

C. The drawings are diagrammatic, intending to show general arrangement and location of system components, and are not intended to be rigid in detail.

D. Due to the small scale of the drawings, all offsets and fittings required for a complete installation may not be shown but shall be provided at no change in Contract price.

E. The equipment schedules shown on the drawings list the manufacturer used as the basis of design in the preparation of the Bid Drawings.

1. The equipment specifications list that manufacturer as well as other manufacturers the Engineer, Architect and/or Owner find acceptable from a performance and product quality perspective, but not as the basis of design, provided the requirements of the specifications are met.
2. Listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether they offer products which meet all of the specified requirements.

    a. Manufacturers shall only offer proposals that meet the specified items.
    b. Substitutions that in the engineer's opinion, do not meet the specified requirements due to variations in manufacturing or available options, will not be approved.

3. Listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether they have a positive or negative monetary impact on the design shown on the Bid Drawings.
4. In addition, listing these other manufacturers in no way implies that the Engineer or Architect has exhaustively researched the products available by these manufacturers to determine whether the dimensions of these products will have a negative impact on the space allotted for this equipment.
5. If the Contractor or his Subcontractors decide to use a product or manufacturer that is listed as acceptable in the specifications but is different from the product or manufacturer scheduled on the drawings, it will be the responsibility of the Contractor or his Subcontractors to fully explore the product to ensure that it can be installed in the space allotted and shall pay any and all costs (including additional professional design fees) associated with the use of these products or manufacturers that impact the structure, the electrical system(s), the plumbing system(s) and/or the fire protection system(s) due to an increase in weight, electrical load, drain and vent requirements, connection sizes, etc., between the scheduled item and the equipment item used.
6. Use of a product or manufacturer not scheduled on the Bid Drawings constitutes a representation that:

    a. The HVAC Trade has investigated the proposed product and determined that the product can be installed within the space allotted.
    b. The HVAC Trade will coordinate the installation of product used into the work
    c. The HVAC Trade will be responsible for making all changes as may be required to make the work complete in all respects; waives all claims for additional costs under his responsibility, which may subsequently become apparent.

PART 2 - PRODUCTS

2.1 NAMEPLATE DATA

A. Provide factory-installed, permanent operational data nameplate on each item of HVAC equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.

2.2 SLEEVES

A. Galvanized Steel Sheet (For Ductwork Only): 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.3 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome plated finish.

C. One-Piece, Cast brass Type: With set screw.

1. Finish: Polished chrome plated and rough brass.

D. Split-Casting, Cast brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome plated and rough brass.

E. One-Piece, Stamped-Steel Type: With spring clips and chrome plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome plated finish.

G. One-Piece, Floor plate Type: Cast iron floor plate.

H. Split-Casting, Floor plate Type: Cast brass with concealed hinge and set screw, and chrome plated finish.

2.4 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic cement grout.

1. Characteristics: Post hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.5 METAL SUPPORTS AND ANCHORAGES

A. Structural design shall be provided through the HVAC trade by a civil or structural Engineer who is registered in the Commonwealth of Pennsylvania.

B. Details of all structural steel shall be provided in shop drawing format. All structural steel shop drawings shall be stamped by the HVAC Trade's design Engineer prior to submittal.

C. The design, materials, fabrication and erection shall conform to "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, "Code of Standard Practice for Steel Buildings and Bridges", of the American Institute of Steel Construction, and also, when applicable, shall conform to the "Code for Welding Building Construction" of the American Welding Society.

D. Steel angles, channels, and plate shall be in accord with ASTM A36.

E. Bolts, including nuts and washers, used for fabricating steel members shall be in accord with ASTM A325.

F. Steel members, including fasteners, exposed to weather shall be galvanized.

G. Refer to Division 23 Section 230529 “Hangers and Supports for HVAC Piping and Equipment” for additional requirements for hanging and supporting HVAC piping, ductwork and equipment.

2.6 FIRESTOPPING

A. Firestopping material shall be in accordance with ASTM E 814 or UL 1479. Refer to Division 07 for requirements.

B. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1. Nelson Firestop Products
2. 3M Fire Protection Products
3. Tremco, Inc.; Tremco Fire Protection Systems Group
4. USG Corporation

D. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Fire-resistance-rated walls include fire walls, fire barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

E. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies. Refer to the Architectural Drawings for locations and types of rated horizontal assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

2.7 ROOF CURBS

A. All roof curbs shall be sloped to match the pitch of the roof to provide a level equipment installation.

B. The HVAC trade shall furnish all roof mounted air handling units and packaged rooftop air conditioning units with factory built vibration isolation roof curb rails. Refer to Division 23 Section 230548.13 “Vibration Controls for HVAC Piping and Equipment” for requirements.

C. The HVAC trade shall furnish all other roof mounted equipment items, such as gravity roof ventilators, roof exhaust fans, etc., with factory built roof curbs. Roof curbs serving equipment items shall be furnished by their respective equipment manufacturers. Refer to equipment specifications in other Division 23 Sections for roof curb requirements that are indicated to be furnished by the particular equipment manufacturers.

D. The HVAC trade shall furnish factory built roof curbs at all duct openings.

1. Factory built roof curbs shall be of box section design, 18 gauge galvanized steel with continuous welded corner seams, factory installed wood nailer and insulated with 1-1/2 inch, 3 pound density rigid fiberglass board.
2. The base of each curb shall be manufactured to match the roof pitch while maintaining a level equipment installation or a vertical duct installation.
3. Minimum installed height of curb shall be 24 inches above the finished surface of the roof. Coordinate the height of the roofing materials with the Architectural Drawings and with the Roofing trade.
4. Roof curbs shall be similar to the Roof Products Systems (RPS) Type RC-4.

2.8 ACCESS DOORS AND PANELS

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

1. Bar-Co.,Inc.
2. J.L. Industries
3. Karp Associates, Inc.
4. Milcor Division, Inryco, Inc.
5. Nystrom, Inc.

B. Steel Access Doors and Frames: Factory fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded, with welds ground smooth and flush with adjacent surfaces.

1. Door material - 16-gauge steel, having a factory-prime finish suitable for field painting except as follows:

a. For kitchens, toilet rooms, janitor's closet, or elsewhere as indicated, 16-gauge stainless steel having a No. 4 finish.

2. Frame material - same material and finish as door, with the following features:

a. For installation in masonry, concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
b. For gypsum wallboard or plaster: Perforated flanges with wallboard bead.
c. For full-bed plaster applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

C. Flush Panel Doors: Furnish with concealed spring hinges or concealed continuous piano hinge.

D. Fire rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

1. Fire Resistance Rating: Not less than 1½-hours.

E. Locking Devices: Flush, screwdriver operated cam locks.

F. Size: Doors and/or panels shall be of sufficient size for the intended function, but not less than 12 inches by 16 inches.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Before any HVAC construction work is performed and/or any equipment and materials are ordered, the HVAC Trade shall examine the project area(s) where HVAC work will be performed to verify actual locations, dimensions, and other conditions that may affect the installation of HVAC equipment, materials and associated work.

3.2 COORDINATION

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

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

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

D. Cooperation and Coordination with Other Trades:

1. This HVAC trade must cooperate completely and coordinate work with the General Trade and other trades providing equipment under this division and other divisions of the specifications.
2. Interference drawings shall be prepared as a combined effort of all trades. Each trade shall proceed with their own set of drawings on electronic backgrounds in AutoCAD format prepared by the HVAC trade. The HVAC trade shall start its drawings immediately upon award of contract. Drawings shall be at 1/4" = 1'0" scale based on sheet size and plan location and orientation as shown on the architectural drawings. All interference drawings shall be capable of being overlaid to coordinate interferences and for printing. All congested areas and mechanical room plans shall be drawn at 3/8" = 1'0" scale.
3. After the HVAC trade has finished, it shall forward one print along with an electronic file to the Plumbing trade that, in turn, will show and coordinate the plumbing work on the combined plans with the other trades. After the Plumbing trade has finished, it shall forward one print along with an electronic file to the Electrical trade that, in turn, will show and coordinate the electrical work on the combined plans with the other trades. After the Electrical trade has finished, it shall forward one print along with an electronic file to the Fire Protection trade that, in turn, will show and coordinate the fire protection work on the combined plans with the other trades.
4. Interference plans and elevations shall show in detail the location of the following items that require coordination because of size and proximity to other equipment and systems. Drawings shall show in order of installation priority within the allotted space the items prioritized in the article contained in Part 3 of this Section entitled "Space Priority".

    a. In addition, show mechanical and electrical work in equipment rooms.
    b. On the interference drawings, show all electrical conduits which are 1-1/2" and larger.

5. Reproducible copies along with an electronic file of the finished interference drawings shall be submitted to the Architect for record and approval before actual installation work begins. Each trade shall make completed interference drawings available to their craft for installation of the work.
6. Individual trade interference drawings may be used as shop drawings and/or as record drawings at the completion of the project.

3.3 SUBSTITUTIONS

A. Provide in accordance with Division 01 Section SUBSTITUTION PROCEDURES and as stated below.

B. Where the contractor proposes substitute equipment, contractor to submit complete product data indicating compliance with all requirements of the documents, including performance rating, size and resistance to wear and deterioration equivalent to the specified item at least ten (10) days prior to the bid date. In instances where substituted equipment requires additional material or work beyond that shown or required by the specified item, said additional material or work shall be the responsibility of this Contractor, regardless of the trade involved.

3.4 SUBMITTALS

A. Provide in accordance with Division 01 Section SUBMITTAL PROCEDURES.

3.5 HVAC DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material. Remove and dispose the contents of any piping indicated to be removed, including but not limited to glycol, refrigerant, or fuel oil in a lawful manner compliant with all applicable codes, ordinances, and authorities having jurisdiction.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. The HVAC trade shall demolish all work as outlined on the drawings.

E. The Owner shall decide the disposition of all removed materials. The HVAC trade shall deliver to the Owner all materials identified to be salvaged. The HVAC trade shall properly dispose of all materials not identified to be salvaged.

F. Refer to the paragraph entitled "Special Conditions Related to HVAC Work" in this section for requirements related to utility shut downs, capping of existing system, and air balancing services which may be required.

G. When demolishing existing equipment, the HVAC trade shall remove all existing piping, ductwork, insulation, supports, hangers, hanger rods, anchor bolts, structural steel, and concrete pads related to the work being removed. When demolishing piping or ductwork branch run outs, remove the entire branch which is accessible above lay-in ceilings or accessible during the construction period back to the main, unless otherwise noted. When demolishing equipment and diffusers and the branch run outs are inaccessible, cap, seal, and abandon the branch run outs in an approved manner.

H. Where demolition of work results in unsightly openings in occupied spaces or jeopardizes the integrity of a fire or smoke barrier, the opening shall be patched in accordance with the paragraph in this section entitled "Cutting and Patching".

I. Where demolition requires the removal of a concrete equipment pad, remove the pad, cut all anchor bolts, dowel pins, and steel bases off flush with the floor so as to eliminate any tripping

hazard. Fill any openings, voids, or holes with a fine cement grout or another appropriate floor patching material. Provide surface finish to match adjacent flooring material.

3.6 CUTTING AND PATCHING

A. Cutting and patching shall be in accordance with the General Conditions and the applicable Section of Division 01, General Requirements.

B. The HVAC trade shall seal all openings he has utilized in fire rated floors, ceilings or partitions after his work has been installed. The material used for sealing the openings shall have a fire-rating equal to or greater than the rating of the floor, ceiling or partition material.

C. In new construction, where openings, chases, sleeves, inserts, anchors, etc., have not been provided by the HVAC trade shall be responsible for providing all cutting, patching, and finishing of new construction which is not specifically shown on the Architectural Drawings, but is required for the proper installation of HVAC equipment and materials as shown on the HVAC Drawings and specified in Division 23.

D. The HVAC trade shall be responsible for providing all cutting, patching, and finishing of existing construction which is not specifically shown on the Architectural Drawings and which is required for the proper installation of his equipment and materials which are to be installed in the existing portion of this project. This work shall also be provided when removing existing equipment and materials. All cutting shall be kept to an absolute minimum consistent with the requirements of the project.

E. Cutting, patching and finishing shall be performed by workmen skilled in this type of work. All patching shall be done utilizing materials of the same quality and texture as the adjacent undisturbed areas. All finishing shall match the undisturbed adjacent areas. Painting of the final finished areas, where general construction work occurs, will be the responsibility of the General Trade. Painting of the final finished areas, where no general construction work occurs, shall be the responsibility of the HVAC trade. The HVAC trade shall paint entire plane in which damage occurs whether the surface is a wall or a ceiling.

F. No cutting shall be done which may affect the building structurally or architecturally without first consulting with the General Trade and then securing the approval of the Architect. Cutting shall be accomplished in such a manner as not to cause damage to the building or leave unsightly surfaces which cannot be concealed by plates, escutcheons or other construction. Where such unsightly conditions are caused, the HVAC trade shall be required, at his own expense, to repair the damaged areas. Note: all holes or openings in existing concrete or masonry shall be drilled, core bored or saw cut.

G. Where an opening is cut into a block or brick wall for the purpose of ductwork or piping to pass through the wall, the HVAC trade shall be responsible for furnishing and installing a properly sized lintel to support the block or brick above the opening.

H. Where present equipment or material is removed and unused openings remain in walls, floors, partitions, etc., the HVAC trade shall properly patch all such openings.

3.7 SPECIAL CONDITIONS RELATED TO HVAC WORK

A. During the course of construction, cap or otherwise seal off, in an approved manner, those portions of the piping or duct system in which work is not being performed, in order to prevent the entry of dirt or dust. Should the HVAC trade fail to cover open ends of ducts, he may be required to vacuum the entire duct system and remove sections of ductwork for inspection.

B. The HVAC trade shall coordinate all utility shutdowns with the Owner to determine when the most advantageous time is for the Owner to accommodate the utility shutdown. The HVAC trade shall coordinate the utility shutdown a minimum of **7 days** in advance.

C. When the HVAC trade demolishes only a portion of an existing air system and the remainder of the system is to remain in service, the Testing and Balancing trade shall measure the air flow in the undisturbed portions of system prior to disconnecting work in the construction areas. The Testing and Balancing trade shall rebalance the affected systems to these measurements immediately following the disconnection of the ductwork being demolished/modified and also immediately after placing the new/modified system into service.

D. Install equipment along with control devices and all replaceable fittings with sufficient clearance for operation and maintenance functions.

E. Do not install piping and ductwork in transformer vaults, elevator equipment rooms or electrical equipment rooms unless the piping and/or ductwork serves HVAC equipment located in that room and is dedicated to provide cooling and/or heating to that room. Do not install piping and ductwork adjacent to or above any surface of electrical controls, panels, switches, terminals, boxes or similar electrical equipment. Drip-pan protection shall not be permitted, except where detailed.

F. Exposed piping shall be run so as to allow maximum headroom consistent with proper pitch. Piping shall not interfere with any light, opening, door, window or equipment. Headroom in front of openings, doors and windows shall not be less than the top of the opening. Minimum clearance of 1 inch shall be maintained around all piping, valves and fittings.

G. Lay out the work and establish all heights **and grades** required for installation.

H. Provide safety guards for all pulleys, belt-drives and rotating equipment. Safety requirements of OSHA shall be met.

3.8 SPACE PRIORITY

A. Ensure equitable use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

1. Gravity flow piping systems.
2. Vent piping systems.
3. Ceiling recessed lighting fixtures.
4. Concealed air terminal units, fans.
5. Air duct systems.
6. Sprinkler systems piping.
7. Forced flow piping systems.
8. Electrical conduit, wiring, control wiring.

B. Order of priority does not dictate installation sequence. Installation sequence shall be as mutually agreed by all affected trades.

C. Change in order of priority is permissible by mutual agreement of all affected trades.

D. The work of a particular trade shall not infringe upon the allocated space of another trade without permission of the contractor for the affected trade.

E. The work of a particular trade shall not obstruct access for installation, operation, and maintenance of the Work, materials and equipment of another trade.

3.9 ESCUTCHEONS

A. Install escutcheons where piping penetrates walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Insulated Piping: One-piece, stamped-steel type with spring clips.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast brass type with polished chrome plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece (for drywall type ceilings) or split-casting (for lay-in type ceilings), cast brass type with polished chrome plated finish.
e. Bare Piping in Unfinished Service Spaces and Equipment Rooms: One-piece, cast brass type with polished rough-brass finish.
f. Bare Piping at Floor Penetrations in Unfinished Service Spaces and Equipment Rooms: One-piece, floor plate type.

3.10 SLEEVES

A. Sleeves are not required for core-drilled holes.

B. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches** above finished floor level. Extend cast iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 8 (DN 200).

4. Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 for material and installation requirements of joint sealants.

C. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 for material and installation requirements of firestopping.

3.11 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

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

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

D. Install equipment to allow right of way for piping installed at required slope.

E. Install all new, relocated, or owner furnished equipment in accord with the manufacturer’s written installation instructions.

3.12 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.13 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.

1. Construct concrete bases of dimensions indicated, but not less than 3 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03.

3.14 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Provide all materials, equipment, supplies and labor necessary to construct all miscellaneous steel required for supporting piping, ductwork and equipment for installation of the HVAC system. All miscellaneous steel, metal supports and anchorages required for supporting ductwork, piping and equipment is not shown on the Drawings, but shall be provided.

B. All structural steel shall be designed to attach to the main building structure in such a manner as to not overstress this structure. Reinforcement of the building structure may be required in work areas located in existing buildings and in areas where the HVAC trade has relocated ductwork, piping, and equipment to areas other than is shown on the Drawings.

C. Refer to Division 05 Section "Metal Fabrications" for structural steel.

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

E. Shop and Field Welding: Shop and field welding shall be in accordance with AWS D1.1.

3.15 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.16 FINAL CLEANING

A. Provide in accordance with Division 01 Section CLOSEOUT PROCEDURES.

3.17 WARRANTIES

A. Provide in accordance with Division 01 Section CLOSEOUT PROCEDURES and as stated below.

B. Refer to individual equipment specifications for additional warranty requirements. If a contradiction exists, the most demanding requirements shall prevail.

C. Compile and assemble the warranties specified in Division 23 into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

D. Provide complete warranty information for each item to include date of beginning of warranty or bond; duration of warranty or bond; and names, address, and telephone numbers and procedures for filing a claim and obtaining warranty services.

E. Submit a single warranty stating that all portions of the work are in accordance with Contract requirements. Warrant all work against faulty and improper material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, such longer term shall apply. Within 24 hours after notification, correct any deficiencies that occur during the warranty period at no additional cost to Owner, all to the satisfaction of the Owner and Architect. Obtain similar warranties from subcontractors, manufacturers, suppliers and sub-trade specialists.

F. Any material, equipment or appurtenance whose operation or performance does not comply with the requirements of the Contract Documents or that are damaged prior to acceptance will be held as defective and shall be removed and properly replaced at no additional cost to the Owner.

3.18 FIRESTOPPING

A. Firestopping is required in the following locations:

1. Where exposed and concealed horizontal ducts penetrate fire rated walls and shaft walls, except where fire dampers are installed in ducts.
2. Where exposed and concealed vertical ducts penetrate rated and non-rated floors, except where fire dampers are installed in ducts.
3. Where exposed and concealed horizontal pipes penetrate fire rated walls and shaft walls.
4. Where exposed and concealed vertical pipes penetrate rated and non-rated floors.

B. Clean surfaces to be in contact with firestopping materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

C. Install materials in accordance with printed instructions of the UL Fire Resistance Directory and per manufacturer's published instructions.

D. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges which are installed in accordance with fire damper manufacturer's recommendations.

E. Where large openings are created in walls or floors to permit installation of ducts or other items, close unused portions of opening with firestopping material tested for the application.

F. Fill annular space between duct and sleeve, with approved material. Depth of material shall be in accord with laboratory tests for 1, 2, or 3 hour rated assemblies.

G. Damming material may be temporary non-fire approved, or permanent fire-approved. Where permanent fire-approved damming material is used, depth of firestopping material may be decreased in accord with manufacturer's recommendations. Temporary damming material shall be removed after installation of firestopping material.

H. Seal all gaps or voids in cured foam with material to match the firestopping material.

I. Trim excess cured foam from around all openings and leave smooth, flush surface.

J. Position metal collar on duct penetrating floors or walls in air plenums and air shafts. Secure neck of collar to duct with screws.

3.19 INSTALLATION OF ROOF CURBS

A. Prefabricated roof curbs shall be furnished and installed by the HVAC Trade, including base flashing and counter flashing.

B. Rooftop curbs, for equipment or components that require service, shall be located to provide a minimum of 10'-0" clearance from the face of the equipment to adjacent roof edges.

C. Cutting of roof deck will be performed by the HVAC Trade shall coordinate the exact opening sizes with the entity designated to cut the roof deck to ensure roof deck is not over-cut. Verify the exact opening requirements with the unit manufacturer.

1. For rooftop units, the void space on the interior of the roof curb shall be completely filled with alternating layers of flexible sound barrier and acoustical insulation for sound attenuation purposes by the HVAC Trade. Refer to Division 23 Section 230548.13 "Vibration Controls for HVAC Piping and Equipment" for in-curb acoustical treatment requirements.
2. All openings between the ducts and the roof deck, within the curb area, shall be caulked with Dow Corning 799 Silicone Metal Building Sealant by the HVAC Trade.

3.20 INSTALLATION OF ACCESS DOORS AND PANELS

A. Access Doors and Panels:

1. Where HVAC devices which require periodic maintenance, cleaning or adjustment will be concealed in shafts, chases, above drywall ceilings and in other inaccessible general construction work, the HVAC Trade shall furnish **and install** access doors and panels for all such devices. These HVAC devices include, but are not limited to, valves, traps, air vents, cleanouts, damper regulators, fire dampers, smoke dampers, controls and other
2. Access doors and panels shall be installed in accordance with the manufacturers written recommendations and Division 08 of these Specifications.

3.21 BOILERS AND PRESSURE VESSELS

A. Construct all fired and unfired pressure vessels, tanks and cylinders in accordance with the applicable ASME Code and the requirements of the Pennsylvania Department of Labor and Industry (L & I), Boiler Division. Each pressure vessel shall be ASME stamped and ASME and L & I certificates shall be submitted for approval.

B. Prepare and submit drawing(s) of the boiler room(s) at ¼" = 1'-0" minimum scale to the Pennsylvania Department of Labor and Industry (L&I) Boiler Division along with an application for boiler inspection. Drawing(s) shall contain a plan of the boiler room along with at least one full longitudinal section. Drawings shall show the exact installation condition of the **boiler(s) and/or fired and unfired pressure vessel(s)** including all required valves, platforms, ladders, exits and clearances.

C. After receiving approved drawings from L&I, submit one copy to the Architect for record purposes and retain one copy on site. Then, arrange for an inspection by a commissioned inspector through the L & I Boiler Division.

D. Submit to the Boiler Division of the Pennsylvania Department of Labor and Industry a report on installation and inspection on Form No. LIB1236, certified by a commissioned inspector.

E. Factory testing certificates for **hot water tanks and heaters** shall be submitted, in duplicate, to the Architect.

3.22 TEMPORARY HEATING, COOLING, AND DEHUMIDIFICATION

A. Provide specified temporary services in accordance with Division 01 Section “TEMPORARY FACILITIES AND CONTROLS”.

B. Provide temporary services to facilitate scheduled completion of the work for every entity authorized to do work at project site. Maintain interior conditions as required for each type of work to be performed.

C. Refer to Division 01 for requirements.

3.23 FINAL HVAC CONNECTIONS

A. Provide rough-in and final connection of all HVAC services needed for equipment provided by the Owner or by other trades. Shop Drawings will be furnished by those providing the equipment. These Drawings shall be checked by the trade responsible for rough-in and final connections before submission to the Architect for approval. The work shall be done in accordance with the approved Shop Drawings.

B. In general, connection and termination points are given in the Contract Documents. Where not given or where conflicts occur, refer the question to the Architect for a binding decision.

3.24 MAINTENANCE MANUALS

A. Provide in accordance with Division 01 Section OPERATION AND MAINTENANCE DATA and as stated below.

B. Include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Provide a cover sheet for each manual including the project name, Architect’s name and contact information, Engineer’s name and contact information, and Division 23 contractor’s name and contact information.

6. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.
7. Manufacturer's data of each piece of equipment including:

    a. Installation instructions.
    b. Drawings and Specifications.
    c. Parts list, including recommended items to be stocked.
    d. Complete wiring diagrams.
    e. Marked or changed prints locating all concealed parts and all variations from the original system design.
    f. Test and inspection certificates.

3.25 RECORD DOCUMENTS

A. Provide in accordance with Division 01 Section PROJECT RECORD DOCUMENTS and as stated below.

B. Indicate installed conditions for the following:

1. Ductwork.
2. Duct Accessories
3. Piping.
4. Piping Accessories.
5. Valves.
6. HVAC Equipment.
7. Automatic Temperature Control Panels, Control Devices, and Sensors.
8. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

3.26 DEMONSTRATION AND TRAINING

A. Provide in accordance with Division 01 Section DEMONSTRATION AND TRAINING and as stated below.

B. After the tests and adjustments have been made, approved factory-authorized system representatives and the Contractor shall fully instruct Owner in all details of operation and maintenance of equipment installed under this Contract. Dates and times of such instructions shall be as directed by Owner, including any necessary weekend or after-hours instruction.

C. The following is a list system that require Demonstration and Training, refer to the individual specification sections for additional training requirements:

1. Automatic Temperature Controls
2. HVAC Equipment.
3. Duct Accessories
4. Piping Accessories.
5. Valves.

END OF SECTION 230500

SECTION 230510
BASIC ELECTRICAL 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 01 Specification Sections, apply to this Section.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section includes the following:

1. Disconnect Switches
2. Fuses
3. Electrical Requirements - General
4. Piping and Ductwork Coordination

1.3 SUBMITTALS

A. Product Data

1. For each type of disconnect switch. Include dimensions and electrical characteristics, ratings, and finishes. Also include dimensioned plans, elevations, sections, and details, Include the following:

a. Wiring Diagrams: Power wiring.

2. For each type of fuse. Include electrical characteristics and ratings.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain disconnect switches of a single type through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store disconnect switches and fuses indoors in clean, dry space with uniform temperature to prevent condensation. Protect disconnect switches and fuses from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover disconnect switches and fuses to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside equipment; install electric heating of sufficient wattage to prevent condensation.

1.6 COORDINATION

A. Coordinate layout and installation of disconnect switches with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate features of disconnect switches with pilot devices and control circuits to which they connect.

C. Coordinate features, accessories, and functions of each disconnect switch with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

A. Acceptable Manufacturers

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

B. Heavy Duty Safety Switches: Provide surface-mounted, heavy-duty type, sheet-steel enclosed safety switches of types, sizes and electrical characteristics indicated on the drawings.

C. Provide switches with quick-make, quick-break type operation, with switchblades that are visible in the 'OFF' position with door open.

D. Operating handle shall be an integral part of the enclosure base the operating position shall be easily recognizable and pad-lockable in OFF position.

E. Current carrying parts shall be constructed of 98% conductivity copper, with silver-tungsten type switch contacts and positive pressure type reinforced fuse clips.

F. Enclosures shall meet environmental conditions of installed location.

1. Indoor Locations: NEMA 250, Type 1
2. Mechanical Rooms: NEMA 250, Type 4.

G. Provide motor and motor starter disconnects with horsepower ratings suitable to the loads.

H. Fusible Switches: Heavy duty switches, with positive pressure type reinforced fuse clips and fuses of classes and current ratings indicated.

1. Non-fused disconnect switches may be used provided that the equipment nameplate makes no reference to "maximum fuse size", "maximum overcurrent protection", "fuse size" or "MFS".

I. Provide disconnect switches having the capability to have auxiliary contacts mounted as required.

J. Disconnects shall be finished in manufacturer's standard gray finish unless otherwise noted on drawings.

K. Disconnect switches specified as being an integral part of a piece of equipment shall come factory installed and wired.

2.2 FUSES

A. Acceptable Manufacturers

1. Bussman Division of Cooper Industries, Inc.
2. Shawmut Division of Gould, Inc.
3. Littlefuse, Inc.

B. All fuses shall be Class RK1, time delay type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive disconnect switches for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ELECTRICAL REQUIREMENTS - GENERAL

A. While Electrical Trade is responsible for proper direction of rotation of all 3-phase equipment, it is the duty of the HVAC Trade to confirm that all 3-phase equipment is rotating in the proper direction during start-up of equipment and to inform the Electrical Trade of any equipment that is not rotating in the proper direction.

B. In general, rigid conduit or tubing shall be used, but equipment that requires movement or that would transmit vibration to conduit shall be wired with flexible (liquid tight) steel conduit not exceeding 18" in length.

C. All equipment shall be grounded with a green-covered ground wire run inside the conduit and connected to equipment frame on one end and to grounding system on the other end.

D. All electrical work required in Division 23 shall conform to all applicable requirements of Division 26 of these Specifications, and shall comply with the latest edition of the National Electric Code.

E. The HVAC Trade shall assign all low-voltage and line-voltage Electrical Control Work required under this Contract to the Automatic Temperature Control Subcontractor, who shall perform this work with qualified electricians employed by that Subcontractor.

F. The HVAC Trade shall co-operate with the contractor for Electrical Work in making all necessary tests and in receiving, storing and setting all motor-driven equipment, electrical devices, and controls furnished and/or installed under these Contracts.

G. Single phase equipment controls and wiring shall be as follows:

1. HVAC Trade shall retain the services of an ATC Subcontractor, who shall furnish and install all control devices, such as motor sentinel switches, PE switches, thermostats, etc.
2. The Electrical Trade shall complete all power wiring and connections for single phase equipment, through the disconnect and/or the thermal cutouts and local control stations to the equipment as required.
3. The HVAC Trade will furnish a THERMAL OVERLOAD SWITCH for all single phase motors except where units are furnished with built-in Thermal Protection, in which case he will furnish a single pole switch.

H. Three phase equipment controls and wiring shall be as follows:

1. The HVAC Trade shall furnish all combination motors starters; refer to Division 23 Section 230511 “Enclosed Motor Controllers for HVAC Equipment” for requirements. The Electrical Trade shall install all combination motor starters.
2. The HVAC Trade shall retain the services of an ATC Subcontractor, who shall furnish and install all control devices, such as EP and PE switches, thermostats, etc.
3. The ATC Subcontractor shall furnish and install all controls and control wiring from control devices to motor starters and contactors and between control devices.
4. The Electrical Trade shall complete all electrical connections through the disconnect, starter and motor terminals of all three phase equipment. He shall be responsible for all power wiring and connections.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers according to Division 26.

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic control devices where applicable.

1. Connect selector switches to bypass only manual control and automatic control devices that have no safety functions when switch is in hand position.
2. Connect selector switches in both hand and automatic positions for safety-type control devices such as low and high pressure cutouts, high temperature cutouts, and motor overload protectors.

3.4 CONNECTIONS

A. Conduit installation requirements are specified in other Division 26. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Ground equipment according to Division 26.

3.5 DISCONNECT SWITCHES

A. For each HVAC equipment item being furnished on the project the HVAC Trade shall:

1. Review/coordinate with the equipment manufacturer to determine whether a disconnect switch will be furnished with it.
2. Review the electrical drawings and/or coordinate with the Electrical Trade to determine whether the Electrical Trade will be providing a disconnect switch for the equipment item.

B. A disconnect switch shall be provided for each HVAC equipment item that has a 1-phase or 3-phase power connection. The HVAC Trade shall provide a disconnect switch for an equipment item unless one of the following occur:

1. The equipment manufacturer is required to furnish or provide a disconnect switch or a combination motor starter/disconnect for the equipment item.
2. The electrical drawings require the Electrical Trade to provide a disconnect switch for the equipment item.

C. Mount disconnect switch to the equipment item it serves. If a disconnect switch cannot be mounted to the equipment item it serves or the drawings indicate the disconnect switch to be mounted in a different location, mount switch in a location within 50 feet and within eyesight of the equipment item. Provide miscellaneous steel as required to mount the disconnect switch.

1. Bolt disconnect switches to equipment casing or to wall, or mount on free-standing lightweight structural steel channels and bolted to floor, equipment rails or roof curb.
2. Structural steel channels, angle iron and other miscellaneous steel are specified in Division 23 Section 230529 “Hangers and Supports for HVAC Piping and Equipment.”

3.6 FUSES

A. Fuses: Fuses shall be provided for each HVAC equipment item having power connection and requiring fuses. If fuses are not furnished with the HVAC equipment item, then the HVAC Trade shall provide all the necessary fuses for proper operation of the equipment and the electrical circuit.

1. Install fuses in each fusible switch. Comply with requirements in Division 26.

3.7 IDENTIFICATION

A. Identify disconnect switches, components, and control wiring according to Division 23 Section 230553 "Identification for HVAC Piping and Equipment."

3.8 PIPING AND DUCTWORK COORDINATION

A. The HVAC Trade shall not run ductwork or piping above switchboards or panelboards in accordance with the National Electric Code Article 384. Before ductwork or piping is installed coordinate the exact locations with the Electrical Trade. Failure to comply with this requirement shall be cause for the ductwork and piping to be removed and relocated at no additional cost to the Owner.

END OF SECTION 230510

SECTION 230511
ENCLOSED MOTOR CONTROLLERS 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 01 Specification Sections, apply to this Section.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Across-the-line, enclosed magnetic-type motor controllers.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon controlled rectifier.

1.4 SUBMITTALS

A. Product Data

1. For each type of across-the-line, magnetic controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes. Also include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following

a. Each installed unit's type and details.
b. Nameplate legends.
c. Short circuit current rating of integrated unit.
d. Listed and labeled for series rating of overcurrent protective devices in combination controllers by an NRTL acceptable to authorities having jurisdiction.

e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
f. Wiring Diagrams: Power, signal, and control wiring.

B. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Source Limitations: Obtain enclosed controllers and disconnect switches of a single type through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

D. Testing Agency Qualifications: Member Company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

E. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside equipment; install electric heating of sufficient wattage to prevent condensation.

1.7 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.

C. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.8 PROJECT CONDITIONS

A. Environmental Limitations - rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than -22°F and not exceeding 104°F.
2. Altitude: Not exceeding 6600 feet.

PART 2 - PRODUCTS

2.1 ACROSS-THE-LINE ENCLOSED MOTOR CONTROLLERS

A. Acceptable Manufacturers

1. Cerus
2. Eaton
3. General Electric
4. Square D
5. Furnas
6. Cutler-Hammer
7. Allen-Bradley

B. Combination Magnetic Controller: NEMA ICS 2, Class A, full voltage, non-reversing, across the line, unless otherwise indicated; and disconnect switch.

1. Control Circuit: 120-volt, single-phase power; obtained from an integral control power transformer with sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity. The control circuit transformer shall have dual primary fusing and a fuse in a hot secondary leg, and one normally open auxiliary contact.
2. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 20 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
3. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.
4. Accessories: The following devices shall be factory installed in controller enclosure, unless otherwise indicated.

a. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

1) Each combination magnetic controller that serves equipment specified or scheduled to be manually controlled shall be provided with a START-STOP push-button station.

2) Each combination magnetic controller that serves equipment specified or scheduled to be automatically controlled shall be provided with a HAND-OFF-AUTO selector switch.
3) Each combination magnetic controller shall be provided with red 'RUN' and green 'STOP' indicating lights.

b. Control Relays:

1) Provide an auxiliary relay for control of associated equipment.
2) Provide an adjustable time-delay relay to eliminate nuisance tripping when momentary loss of power occurs.

c. Phase Failure and under voltage relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable under voltage setting.
d. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
e. Space heaters, with N.C. auxiliary contacts, to mitigate condensation in Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
f. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
g. Terminals for connecting power factor correction capacitors to the **line side or load side** of overload relays.
h. Spare control wiring terminal blocks, quantity as indicated; **unwired or wired**.

C. Enclosures:

1. Description: Flush or surface mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.

a. Indoor Mechanical Equipment Room, NEMA 250, Type 4.

D. Factory Finishes:

1. Finish: Manufacturer's standard paint applied to factory assembled and tested enclosed controllers before shipping.

E. Application - the HVAC Trade shall furnish properly-sized across-the-line, magnetic controller for all 3-phase motors provided under Division 23 to include the following:

1. Centrifugal pumps.

F. For enclosed magnetic controllers with external control voltages, furnish an auxiliary contact on the disconnect switch to disconnect the external voltage source when the disconnect switch is off.

G. For the hot water system that can be powered by emergency power, provide the starters for the hot water pumps and the air handing units with time delay relays. The pumps shall start after 60 seconds of power.

H. All safety devices shall be wired so that they stop the motor with the Hand-Off-Auto switch in the Hand as well as the Auto position. This will normally mean breaking the common wire from the Hand-Off-Auto switch to the starter's holding coil through the safety devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ENCLOSED CONTROLLER APPLICATIONS

A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

C. Furnish an enclosed controller for each HVAC equipment item provided on the project that will operate on 3-phase power to the Electrical Trade. The Electrical trade shall mount and wire each enclosed controller.

1. Enclosed controllers are not required for the following:

a. HVAC equipment that is scheduled, noted, or indicated to be provided with a variable frequency motor controller.
b. HVAC equipment that is scheduled, noted, or indicated to operate on 1-phase power.
c. HVAC equipment that is furnished with an integral enclosed controller from the factory.

3.3 INSTALLATION

A. Mount enclosed controllers as follows:

1. Wall Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

E. Install, connect, and fuse thermal-protector relays furnished with motor-driven equipment.

F. Install power factor correction capacitors. Connect to the **line or load** side of overload relays. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.

G. Comply with NECA 1.

H. While Electrical Trade is responsible for proper direction of rotation of all 3- phase equipment, it is the duty of the HVAC Trade to confirm that all 3-phase equipment is rotating in the proper direction during start-up of equipment and to inform the Electrical Trade of any equipment that is not rotating in the proper direction.

I. Equipment delivered with enclosures that are inadequate for the installed location shall be equipped with special enclosures that suit the conditions of the installed location by the HVAC Contractor furnishing the equipment.

J. Controls and wiring for enclosed motor controllers furnished on the project shall be as follows:

1. The HVAC Trade shall furnish all enclosed motor controllers. The Electrical Trade shall install all enclosed motor controllers.
2. The HVAC Trade shall retain the services of an ATC Subcontractor, who shall furnish and install all control devices, such as EP and PE switches, thermostats, etc.
3. The ATC Subcontractor shall furnish and install all controls and control wiring from control devices to enclosed motor controllers and contactors and between control devices.
4. The Electrical Trade shall complete all electrical connections through the disconnect, enclosed motor controller and motor terminals of all three phase equipment. He shall be responsible for all power wiring and connections.

3.4 IDENTIFICATION

A. Identify enclosed motor controllers according to Division 23 Section 230553 "Identification for HVAC Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed motor controller element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Manufacturer's Field Service - engage a factory authorized service representative to perform the following:

1. Inspect enclosed motor controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.

2. Assist in field testing of equipment including pretesting and adjusting of enclosed motor controllers.
3. Report results in writing.

C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 ADJUSTING

A. Set field adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed motor controllers. Refer to Division 01.

END OF SECTION 230511

SECTION 230513

COMMON 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 01 Specification Sections, apply to this Section.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Efficiency: NEMA Premium efficiency, as defined in NEMA MG 1.

1. Electric motors shall comply with the requirements of the Energy Policy Act of 1992.
2. Motors that are single-speed, polyphase, 1-500 horsepower, 2, 4, and 6 pole, squirrel cage induction type, NEMA Design A or B, continuous rated shall be NEMA Premium efficiency electric motors.
    a. NEMA Premium efficiency electric motors must meet or exceed the nominal energy efficiency levels presented below.
        1) The NEMA Premium efficiency levels are contained in NEMA Standards Publication MG 1-2006, in Tables 12-12 and 12-13, respectively.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 104°F and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Service Factor: 1.15.

C. Rotor: Random-wound, squirrel cage.

D. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

E. Temperature Rise: Match insulation requirements.

F. Insulation: Class F.

G. Code Letter Designation:
1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

H. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230519
METERS AND GAUGES 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 01 Specification Sections, apply to this Section.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gauges.
4. Gauge attachments.
5. Test plugs.
6. Test plug kits.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gauges.
4. Gauge attachments.
5. Test plugs.
6. Test plug kits.

B. Operation and Maintenance Data: For meters and gauges to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Plastic-Case, Liquid-in-Glass Thermometers

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

a. Ashcroft Inc.
b. Ernst Flow Industries
c. Miljoco Corporation

d. Palmer Wahl Instrumentation Group
e. Trerice, H. O. Company
f. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
g. Weiss Instruments, Inc.
h. WIKA Instrument Corporation - USA.
i. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Plastic 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in degree F.
7. Window: Glass or plastic.
8. Stem: Aluminum, brass, or stainless steel and of length to suit installation.

a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches with ASME B1.1 screw threads.
10. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR (copper nickel 90-10) or CUNI (copper nickel 70-30).
4. Material for Use with Steel Piping: CRES (corrosion-resistant steel) or CSA (steel).
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAUGES

A. Direct Mounted, Plastic Case, Dial-Type Pressure Gauges:

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

a. Ashcroft Inc.
b. Ernst Flow Industries

c. Miljoco Corporation
d. Palmer Wahl Instrumentation Group
e. Trerice, H. O. Company
f. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
g. Weiss Instruments, Inc.
h. WIKA Instrument Corporation - USA
i. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 4-1/2-inch nominal diameter.
4. Pressure Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with ASME B1.20.1 pipe threads and bottom-outlet type.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark colored metal.
9. Window: Glass or plastic.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAUGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, brass needle, or stainless steel needle, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

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

1. Flow Design, Inc.
2. Miljoco Corporation
3. Peterson Equipment Co., Inc.
4. Sisco Manufacturing Company, Inc.
5. Trerice, H. O. Company
6. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
7. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

E. Minimum Pressure and Temperature Rating: 500 psig at 200°F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.6 TEST PLUG KITS

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

1. Flow Design, Inc.
2. Miljoco Corporation
3. Peterson Equipment Co., Inc.
4. Sisco Manufacturing Company, Inc.
5. Trerice, H. O. Company
6. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
7. Weiss Instruments, Inc.

B. Furnish one test plug kit containing two thermometers, one pressure gauge and adapter, and carrying case. Thermometer sensing elements, pressure gauge, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 25° to 125°F.

D. High Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0° to 220°F.

E. Pressure Gauge: Small, Bourdon-tube insertion type with 2- to 3-inch diameter dial and probe. Dial range shall be at least 0 to 200 psig.

F. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gauge for fluids (except steam).

H. Install test plugs in piping tees.

I. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic boiler.

J. Install pressure gauges in the following locations:

1. Discharge of each pressure reducing valve.
2. Suction and discharge of each pump.

3.2 CONNECTIONS

A. Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines, and equipment.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

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

3.4 THERMOMETER SCALE RANGE SCHEDULE

A. Scale Range for Heating, Hot Water Piping: 30° to 240°F.

3.5 PRESSURE GAUGE SCALE RANGE SCHEDULE

A. Scale Range for Heating, Hot Water Piping: 0 to 100 psi and 0 to 600 kPa.

END OF SECTION 230519

SECTION 230523
GENERAL - DUTY 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 01 Specification Sections, apply to this Section.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes

1. Bronze ball valves.
2. Bronze swing check valves.
3. Iron swing check valves.
4. Bronze gate valves.
5. Bronze globe valves.

B. Related Sections

1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
2. Division 23 Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product data for each type of valve indicated.

1. Bronze ball valves.
2. Bronze swing check valves.

3. Bronze gate valves.
4. Bronze globe valves.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

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

B. Use the following precautions during storage:

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

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

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types

1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Hand lever: For quarter-turn valves NPS 6 (DN 150) and smaller.

E. Valves in Insulated Piping - with 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve End Connections

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim

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

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves
c. Crane Co.; Crane Valve Group; Crane Valves
d. Hammond Valve
e. Milwaukee Valve Company
f. Nibco, Inc.
g. Red-White Valve Corporation
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome plated brass.
j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless steel Trim

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

a. Conbraco Industries, Inc.; Apollo Valves
b. Crane Co.; Crane Valve Group; Crane Valves
c. Hammond Valve

d. Milwaukee Valve Company
e. Nibco, Inc.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc

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

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves
c. Crane Co.; Crane Valve Group; Jenkins Valves
d. Crane Co.; Crane Valve Group; Stockham Division
e. Hammond Valve
f. Milwaukee Valve Company
g. Nibco, Inc.
h. Red-White Valve Corporation
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.4 BRONZE GATE VALVES

A. Class 125, RS Bronze Gate Valves

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

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves

c. Crane Co.; Crane Valve Group; Jenkins Valves
d. Crane Co.; Crane Valve Group; Stockham Division
e. Hammond Valve
f. Milwaukee Valve Company
g. Nibco, Inc.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or Solder joint
e. Stem: Bronze
f. Disc: Solid wedge; bronze
g. Packing: Asbestos free
h. Handwheel: Malleable iron

2.5 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc

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

a. Crane Co.; Crane Valve Group; Crane Valves
b. Crane Co.; Crane Valve Group; Stockham Division
c. Hammond Valve
d. Milwaukee Valve Company
e. Nibco, Inc.
f. Red-White Valve Corporation
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded
e. Stem and Disc: Bronze
f. Packing: Asbestos free
g. Handwheel: Malleable iron

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

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

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

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

3.2 VALVE INSTALLATION

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

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

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

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly**,** or gate valves.
2. Butterfly Valve Dead-End Service: Single flange (lug) type.
3. Throttling Service except Steam: Globe, ball, or butterfly valves.
4. Pump-Discharge Check Valves:

    a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: **Threaded** ends.

3.5 HOT WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: Threaded ends.
2. Ball Valves: Two-piece, full port, bronze with bronze or stainless steel trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, rising-stem, bronze.
5. Bronze Globe Valves: Class 125, bronze disc.

END OF SECTION 230523

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water. Design of pipe supports shall be provided through the HVAC trade by a civil or structural Engineer who is registered in the Commonwealth of Pennsylvania.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components. Design of equipment supports shall be provided through the HVAC trade by a civil or structural Engineer who is registered in the Commonwealth of Pennsylvania.

1.5 SUBMITTALS

A. Product data for the following:

1. Steel pipe hangers and supports.

2. Thermal hanger shield inserts.
3. Powder actuated fastener systems.
4. Trapeze pipe hangers. Include Product Data for components.
5. Metal framing systems. Include Product Data for components.
6. Pipe stands. Include Product Data for components.
7. Equipment supports.

1.6 QUALITY ASSURANCE

A. Welding - qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory fabricated components. Refer to Part 3 "Hanger and Support Applications" article for where to use specific hanger and support types.

B. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. AAA Technology & Specialties Co., Inc.
2. B-Line Systems, Inc.; a division of Cooper Industries.
3. ERICO/Michigan Hanger Company
4. Globe Pipe Hanger Products, Inc.
5. Grinnell Corporation
6. GS Metals Corporation
7. National Pipe Hanger Corporation
8. PHD Manufacturing, Inc.

C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop or field fabricated pipe support assembly made from structural steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field fabricated pipe support assembly made of steel channels and other components.

B. Manufacturers - subject to compliance with requirements, provide products by one of the following:

1. B-Line Systems, Inc.; a division of Cooper Industries
2. ERICO/Michigan Hanger Company; ERISTRUT Division
3. GS Metals Corporation
4. Power-Strut Division; Tyco International, Ltd.
5. Thomas & Betts Corporation
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings:

1. General Areas: Manufacturer's standard finish, unless bare metal surfaces are indicated.

2.4 FASTENER SYSTEMS

A. Powder actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

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

a. Hilti, Inc.
b. ITW Ramset/Red Head
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC
e. Powers Fasteners

2.5 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field fabricated assemblies made of manufactured corrosion-resistant components to support **floor mounted** piping.

B. Curb-Mounting-Type Pipe Stands: Shop or field fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop or field fabricated equipment support made from structural steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory mixed and packaged, dry, hydraulic cement, non-shrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Horizontal Piping Hangers and Supports - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).

F. Vertical Piping Clamps - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

G. Hanger-Rod Attachments - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

H. Building Attachments - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

a. Light (MSS Type 31): 750 lb.
b. Medium (MSS Type 32): 1500 lb.
c. Heavy (MSS Type 33): 3000 lb.

I. Saddles and Shields - unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
2. Thermal hanger Shield Inserts: For supporting insulated pipe.

J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

L. Use **powder actuated fasteners** instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

1. Suspend hangers from building structural members and concrete floor slabs as follows:

a. Install hangers plumb and free from contact with objects within ceiling plenum that are not part of supporting structural system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support loads within performance limits established by referenced standards.
c. Secure hangers either directly to structural steel or to inserts, eye screws, or other devices that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
d. Anchors must be installed in “rib” portion of metal deck/concrete slab (thickest portion of slab).
e. Do not attach hangers to steel deck tabs.
f. Do not attach hangers to steel roof deck. Provide supplemental framing between structural members where spacing of members exceeds required spacing of hangers.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field assembled metal framing systems.

D. Thermal hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder actuated tool manufacturer. Install fasteners according to powder actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded structural steel shapes.

H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2½ (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by **ASME B31.9 (for building services piping)** are not exceeded.

M. Insulated Piping - comply with the following:

1. Attach clamps and spacers to piping.
2. Insulation shall pass through pipe hangers and pipe clamps uninterrupted.
3. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

4. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

5. Shield Dimensions for Pipe - not less than the following:

a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.

6. Insert Material: Length at least as long as protective shield.
7. Thermal hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for **trapeze pipe hangers and equipment supports**.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1½-inches unless ceiling height dictates a smaller excess length. Coordinate with ceiling height and trim

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 230548.13
VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Spring hangers.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

1.5 SUBMITTALS

A. Product Data: Include rated load, rated deflection, and overload capacity for each vibration isolation device. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of isolation device component used.

B. In-Curb Digital Image Shop Drawing Submittal: Refer to “PART 3 - EXECUTION”.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

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

1. Amber/Booth Company, Inc.
2. Kinetics Noise Control
3. Mason Industries
4. Vibration Eliminator Co., Inc.
5. Vibration Isolation
6. Vibration Mountings & Controls, Inc.

B. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime coat finish ready for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIELD QUALITY CONTROL

A. In-Curb Digital Image Shop Drawing Submittal: Provide a shop drawing submittal, with digital images of the completed “In-Curb Acoustical Treatment”, for each equipment instance/location where “In-Curb Acoustical Treatment” is specified for this project. Each digital image shall be labelled with the HVAC equipment identification tag. The Contractor shall provide the “In-Curb Digital Image Shop Drawing Submittal” a minimum of two weeks prior to concealing “In-Curb Acoustical Treatment” beneath curb mounted equipment. If this submittal is not received and approved prior to placement of applicable curb mounted HVAC equipment, the Contractor shall, at his expense, create temporary openings in the curb sides, and provide the images thru the use of a directional digital borescope.

3.3 VIBRATION CONTROL DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

C. Install bushing assemblies for mounting bolts for wall mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

E. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.5 VIBRATION CONTROLS SCHEDULE

A. Vibration Isolators

1. Spring Hangers - provide spring hangers for the following:

a. Each suspended in-line centrifugal pump.
b. Piping hangers installed within 20-feet upstream and downstream of in-line pumps.

END OF SECTION 230548.13

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Equipment labels
2. Pipe labels
3. Valve tags
4. Ceiling valve markers

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

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

B. Coordinate installation of identifying devices with locations of access panels and doors.

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment: Provide metal labels containing equipment performance data if not furnished and attached to the equipment item at the factory.

1. Material and Thickness: Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch.

4. Fasteners: Stainless steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
6. Label Content: Include equipment's performance data including capacity and electrical data.

B. Plastic Labels for Equipment: Provide plastic label for each HVAC equipment item.

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160°F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/2 inch for viewing distances up to 72 inches.
7. Fasteners: Stainless steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
9. Label Content: Include equipment's drawing designation or unique equipment number.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and/or pipe insulation, and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.4 CEILING VALVE MARKERS

A. Ceiling Valve Markers: Round adhesive solid color stickers, 3/4 inch diameter.

1. Color of markers shall be the same for similar applications.
2. Colors of markers shall be one of the following: yellow, orange, red, magenta, lavender, blue, green, dark green, dark blue, purple, brown, black plus fluorescent green, yellow, orange and pink.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided in lieu of pre-tensioned type pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands on each piping system in accordance with the color schedule described herein. The stenciled pipe labels shall include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction; and, shall be the minimum size indicated for the self-adhesive type pipe labels.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule

1. Heating Water Piping:

a. Background Color: Yellow.
b. Letter Color: Black.

2. Non-Potable Water Piping:

a. Background Color: Yellow.
b. Letter Color: Black.

3.4 VALVE TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory fabricated equipment units; shutoff valves; and, HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve Tag Size and Shape: 2 inches round.
2. Valve Tag Color: Natural.
3. Letter Color: Black

3.5 CEILING VALVE MARKER INSTALLATION

A. Install ceiling valve markers on metal ceiling grid nearest to valves and control devices located above lay-in ceilings.

3.6 NON-POTABLE WATER OUTLETS

A. Provide a plastic equipment label at each non-potable water outlet, such as hose bibbs. The label shall read “NON-POTABLE WATER --- DO NOT DRINK --- AVOID CONTACT.”

END OF SECTION 230553

SECTION 230593
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 01 Specification Sections, apply to this Section.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes

1. Balancing Air Systems:

a. Variable air volume systems.

2. Balancing Hydronic Piping Systems:

a. Constant flow hydronic systems.
b. Primary secondary hydronic systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Certified TAB reports.

B. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB, AABC, or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB, AABC, or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB, AABC, or TABB as a TAB technician.

B. TAB Conference: Meet with Architect, Owner, Construction Manager, and Commissioning Agent on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide fourteen (14) days advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms published by AABC or NEBB.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven (7) days advance notice to the Contractor and Owner prior to commencement of TAB work. Include scheduled test dates and times. Provide seven (7) days advance notice to any changes in the scheduled dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

C. Coordinate with ATC Contractor to balance VAV box and AHU damper positions. Pay particular attention to AHU minimum outside air damper position as listed in Division 23 Section 230993 “Sequence of Operations for HVAC Control.”

1.8 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following independent TAB contractors to provide the TAB work:

1. Kahoe Air Balance Company
2. Northstar Environmental, Ltd.
3. Professional Balance Company
4. WAE Balancing, Inc.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment. Notify contractor, Architect and Engineer immediately upon discovery of any deficiencies.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible. Notify contractor immediately upon discovery of any balancing devices not present that will prevent balancing of the system.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

E. Verify that transfer ducts or penetrations in plenum walls exist to enable air flow through plenum as indicated or required.

F. Examine equipment performance data including fan and pump curves.

G. Obtain and examine start-up test reports to verify that start-up testing, cleaning, and adjusting of HVAC equipment and systems have been performed prior to the commencement of TAB work.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine suspended equipment, such as variable air volume boxes, fan coil units, in-line fans, etc., and verify that they are accessible and their controls are connected and functioning.

J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine system pumps to ensure absence of entrained air in the suction piping.

N. Examine operating safety interlocks and controls on HVAC equipment.

O. Report deficiencies discovered before and during performance of TAB procedures to the contractor, Architect and Engineer.

3.2 PREPARATION

A. Complete system-readiness checks. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balancing, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING, ADJUSTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance," NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing," and the requirements contained in this Section.

B. Cut insulation, **ducts, pipes, and equipment cabinets** for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section 230713 "Duct Insulation", Section 230716 "HVAC Equipment Insulation", and Section 230719 "HVAC Piping Insulation".

C. Mark equipment and balancing devices, including **damper control positions, valve position indicators, fan speed control levers**, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Where the Drawings require the HVAC trade to demolish and/or modify only a portion of an existing air system and the remainder of the system is to remain in service, the Testing, Adjusting and Balancing (TAB) trade shall measure the air flow rates in the undisturbed portions of system prior to disconnecting work in the construction areas. The TAB trade shall rebalance the affected systems to these measurements immediately following the disconnection of the ductwork being demolished/modified and also immediately after placing the new/modified system into service.

B. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

C. For variable air volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outdoor air louvers and dampers and the return and exhaust air dampers through the supply fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air handling unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR VARIABLE AIR VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure Independent, Variable air volume Systems - after the fan systems have been adjusted, adjust the variable air volume systems as follows:

1. Set outdoor air dampers at minimum, and set return and exhaust air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal unit discharge system losses.

3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Measure static pressure at the most critical terminal unit and adjust the static pressure controller at the main supply air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
7. Record final fan performance data.

C. Pressure Dependent, Variable air volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable air volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable airflow controller set at maximum airflow.
3. Set terminal units at full airflow condition.
4. Adjust terminal units starting at the supply fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Where the Drawings require the HVAC trade to demolish and/or modify only a portion of an existing water system and the remainder of the system is to remain in service, the Testing, Adjusting and Balancing (TAB) trade shall measure the water flow rates in the undisturbed portions of system prior to disconnecting work in the construction areas. The TAB trade shall rebalance the affected systems to these measurements immediately following the disconnection of the piping being demolished/modified and also immediately after placing the new/modified system into service.

B. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water station pressure gage for adequate pressure for highest vent.

4. Check flow control valves for specified sequence of operation, and set at indicated flow.
5. Set differential pressure control valves at the specified differential pressure.
6. Check pump motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
7. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 PROCEDURES FOR CONSTANT FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

    a. If the adjustment to the pump discharge valve results in a pressure drop of 20 feet or greater across the valve, provide an impeller trim. Comply with requirements in Division 23 Section 232123 "Hydronic Pumps." If an impeller is trimmed, note the beginning diameter and final diameter in the balance report.
    b. If the flow rate is greater than 10% below the scheduled design flow rate with all valves open, notify the Architect and Engineer immediately to discuss an impeller change.
    c. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 10 percent of design.

B. Set calibrated balancing valves, at calculated pre-settings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

E. Wherever constant volume pumps are equipped with a variable frequency controller and a triple duty valve; use the triple duty valve to measure the flow rate and use the variable frequency controller to achieve flow that is 5 percent greater than indicated flow.

1. The triple duty valve shall be placed in its full-open position and shall only be used for flow measurement purposes, for shutoff purposes, and flow short-circuit prevention purposes (check function).

F. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor air temperature.

H. Measure the differential pressure control valve settings existing at the conclusion of balancing.

I. Check settings and operation of each safety valve. Record settings.

3.8 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

A. Balance the primary circuit flow first and then balance the secondary circuits.

3.9 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger - test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal protection element rating.

3.10 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record water flow.

B. Steam Boilers: Measure and record entering water temperature and flow and leaving steam pressure, temperature, and flow.

3.11 PROCEDURES FOR HEAT TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Water flow rate.
2. Water pressure drop.
3. Airflow.
4. Air pressure drop.

3.12 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure and record the water flow and head of each pump.
3. Measure motor voltage and amperage. Compare the values to motor nameplate information.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the condition and operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for condition and proper operation.
8. Measure the airflow rate at each air terminal inlet and outlet.
9. Measure the water flow rate at each equipment item in the system.
10. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If design flow rates increase or decrease the measured airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.13 TOLERANCES

A. Set HVAC system's **air flow rates and water flow rates** within the following tolerances:

1. Supply, Return, Relief and Exhaust Fans and Equipment with Fans: Zero to plus 5 percent of scheduled design flow.
2. Air Outlets and Inlets: Plus, or minus 10 percent of design flow indicated.
3. Heating Water Pump Flow Rate: Zero to plus 5 percent of scheduled design flow.
4. Cooling Water Pump Flow Rate: Zero to plus 5 percent of scheduled design flow.
5. Terminal Unit Cooling Water Flow Rate: Plus, or minus 10 percent of design flow indicated.

6. Terminal Unit Heating Water Flow Rate: Plus, or minus 10 percent of design flow indicated.

3.14 REPORTING

A. Status Reports: Prepare a progress report a minimum of once per week to include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.15 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Not all components listed below apply to this project. Provide data for each existing component, or component furnished to the jobsite as applicable.

B. Final Report Contents: In addition to certified field report data, include the following:

1. Field test reports (start-up reports) prepared by system and equipment installers.
2. Other information relative to equipment performance such as fan curves and pump curves; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for **pump** performance forms including the following:

    a. Settings for outdoor, return, and exhaust air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Variable frequency drive settings for variable air volume systems.

e. Settings for supply air, static pressure controller.
f. Other system operating conditions that affect performance.

D. Air handling unit and Rooftop Unit Test Reports - for air handling units and rooftop units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.

2. Fan data - for each fan, include the following:

a. Fan sheave make, size in inches and bore.
b. Center-to-center dimensions of sheave, and amount of adjustments in inches.
c. Number, make, and size of belts.
d. Number, type, and size of filters.

3. Motor data - for each motor, include the following:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Motor sheave make, size in inches and bore.
f. Center-to-center dimensions of fan and motor sheaves, and amount of adjustments in inches.

4. Coil data - for each coil, include the following:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Rated voltage and amperage of each phase.
g. Capacity in KW.
h. Make and model number.
i. Face area in sq. ft.
j. Tube size in NPS (DN).
k. Circuiting arrangement.

5. Gas fired Heat Exchanger Data - for each gas-fired heat exchanger in rooftop units, include the following:

a. Location.
b. Make and type.
c. Fuel type.
d. Output capacity in Btu/h.
e. Ignition type.
f. Burner control types.
g. Burner motor volts, phase, hertz, rpm and horsepower.

6. Unit Test Data (Indicated and Actual Values):

    a. Total air flow rate in cfm.
    b. Outdoor airflow in cfm.
    c. Return airflow in cfm.
    d. Total system static pressure in inches wg.
    e. Fan rpm for each fan.
    f. Voltage at each connection.
    g. Amperage for each phase.
    h. Unit discharge static pressure in inches wg.
    i. Unit inlet static pressure in inches wg.
    j. Filter static pressure differential in inches wg for each filter bank.
    k. Outdoor air damper position.
    l. Return air damper position.
    m. Relief-air damper position.
    n. Air blender static pressure differential in inches wg.
    o. Variable frequency drive speed (for each fan).

7. Coil Test Data (Indicated and Actual Values) - for each coil, include the following:

    a. Average face velocity in fpm.
    b. Air pressure drop in inches wg.
    c. Water flow rate in gpm.
    d. Water pressure differential in feet of head or psig.
    e. Inlet steam pressure in psig.
    f. Voltage at each connection.
    g. Amperage for each phase.

8. Gas fired Heat Exchanger Test Data (Indicated and Actual Values):

    a. Air static pressure differential in inches wg.

E. Terminal Equipment Unit (Without Fan) Test Reports - for **convectors, finned tube radiation units, and radiant ceiling panels**, include the following:

1. Coil Data:

    a. System identification.
    b. Location.
    c. Make and model number.
    d. Tube size in NPS (DN).
    e. Fin spacing in fins per inch o.c.
    f. Tube and fin materials.

2. Terminal Heating Unit Water Test Data (Indicated and Actual Values): **For convectors, finned tube radiation units, and radiant ceiling panels**, include the following:

    a. Water flow rate in gpm.
    b. Water pressure differential in feet of head or psig.

F. Apparatus Coil Test Reports - for **VAV terminal boxes with reheat coils and for duct mounted coils**, include the following:

1. Coil Data:

    a. System identification.
    b. Location.
    c. Coil type.
    d. Number of rows.
    e. Fin spacing in fins per inch o.c.
    f. Make and model number.
    g. Face area in sq. ft.
    h. Tube size in NPS (DN).
    i. Tube and fin materials.
    j. Rated voltage and amperage of each phase.
    k. Capacity in KW.

G. Air Terminal Device Reports - for each diffuser, register and grille, include the following:

1. Unit Data:

    a. System and air handling unit identification.
    b. Location and zone.
    c. Apparatus used for test.
    d. Area served.
    e. Make.
    f. Number from system diagram.
    g. Type and model number.
    h. Size.
    i. Effective area in square feet.
    j. Design air flow rate in cfm.

2. Test Data (Indicated and Actual Values):

    a. Air flow rate in cfm.
    b. Air velocity in fpm.
    c. Preliminary air flow rate in cfm.
    d. Preliminary velocity in fpm.
    e. Final air flow rate in cfm.
    f. Final velocity in fpm.

H. Pump Test Reports - calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Service.
    d. Make and size.
    e. Model number and serial number.
    f. Water flow rate in gpm.
    g. Water pressure differential in feet of head or psig.

h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

I. Boiler Test Reports - for each boiler, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and size.
d. Model number and serial number.
e. Water flow rate in gpm.
f. Water pressure differential in feet of head or psig.
g. Voltage at each connection.
h. Amperage for each phase.

2. Test Data (Indicated and Actual Values):

a. Water pressure differential in feet of head or psig.
b. Water flow rate in gpm.
c. Burner motor voltage at each connection.
d. Burner motor amperage for each phase.

J. Instrument Calibration Reports

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.16 INSPECTIONS

A. Owner Inspection:

1. After testing and balancing work is complete and accurately documented in the final report, the TAB subcontractor shall request that a final inspection be made by the Owner or his representative.
2. The TAB subcontractor shall conduct the inspection in the presence of the Owner or his representative.
3. The Owner or his representative will randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 15 percent of the total measurements recorded.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

B. TAB Work will be considered defective if it does not pass the Owner inspection. If the TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second Owner inspection.
2. If the second Owner inspection also fails, Owner may request the HVAC Trade to contract the services of another TAB subcontractor to complete TAB Work according to the Contract Documents or the Owner may contract the services of another TAB subcontractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the HVAC contractor’s final payment.

C. Prepare test and inspection reports.

3.17 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713
DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Mineral fiber.

2. Adhesives.
3. Mastics.
4. Lagging adhesives.
5. Sealants.
6. Factory applied jackets.
7. Field applied fabric reinforcing mesh.
8. Field applied cloths.
9. Field applied jackets.
10. Tapes.
11. Securements.
12. Corner angles.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Fire test response Characteristics: Insulation and related materials shall have fire test response characteristics indicated below as tested in accordance with ASTM E 84.

1. Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.
2. Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

1.5 COORDINATION

A. Coordinate clearance requirements with duct installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field applied jackets and finishes and for space required for maintenance.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Mineral fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory applied FSK jacket. Factory applied jacket requirements are specified in "Factory applied Jackets" article.

1. Products - subject to compliance with requirements, provide the following:

a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; All-Service Duct Wrap.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral fiber adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

C. FSK Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20° to plus 180°F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire and water resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40° to plus 250°F.
5. Color: Aluminum.

2.5 FACTORY APPLIED JACKETS

A. Insulation system schedules indicate factory applied jackets on various applications. When factory applied jackets are indicated, comply with the following:

2.6 FIELD APPLIED JACKETS

A. Field applied jackets shall comply with ASTM C 921, Type I, for ducts operating at below ambient temperatures and Type II, for ducts operating at above ambient temperatures.

2.7 TAPES

A. FSK Tape: Foil face, vapor retarder tape matching factory applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products - subject to compliance with requirements, provide the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.8 SECUREMENTS

A. Insulation Pins and Hangers:

1. Capacitor Discharge Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor discharge welding, minimum 0.106-inch diameter shank, length, to suit depth of insulation indicated.

a. Products - subject to compliance with requirements, provide the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor Discharge Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor discharge welding, minimum 0.106-inch diameter shank diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon steel washer.

a. Products - subject to compliance with requirements, provide the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers - subject to compliance with requirements, provide the following:

a. C & F Wire
b. Childers Products
c. PABCO Metals Corporation
d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

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

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

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

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

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

H. Install insulation with least number of joints practical.

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

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

K. Install insulation with factory applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of duct. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

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

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

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

O. For above ambient services, do not install insulation to the following:

1. Vibration control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.4 PENETRATIONS

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

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

1. Comply with requirements in Division 07 for fire-stopping and fire-resistive joint sealers.

3.5 MINERAL FIBER INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor discharge weld pins and speed washers or cupped-head, capacitor discharge weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not over compress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory or field applied jacket, adhesive, vapor barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50°F at 18-foot intervals. Vapor stops shall consist of vapor barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2 inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor retarder jackets and exposed insulation with vapor barrier mastic.

3.7 INSULATION SCHEDULE FOR DUCTS AND PLENUMS INSTALLED INDOORS

A. Existing Ducts

1. Existing, concealed; rectangular, and round including square to round transitions; supply air duct insulation shall be the following:

    a. Mineral fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

B. Supply Air Ducts:

1. Concealed; round duct insulation shall be the following:

    a. Mineral fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

2. Concealed; rectangular; upstream of a VAV box; duct insulation shall be the following:

    a. Mineral fiber Blanket: 1½-inches thick and 1.50-lb/cu. ft. nominal density.

3. Concealed; rectangular; downstream of a VAV box; duct insulation shall be the following:
    a. Ductwork shall be internally insulated. Refer to Division 23 Section 233113 “Metal Ducts” for duct liner requirements.

END OF SECTION 230713

SECTION 230716
HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes

1. Insulation Materials:

a. Flexible elastomeric.
b. Mineral fiber.

2. Adhesives.
3. Mastics.
4. Sealants.
5. Factory applied jackets.
6. Field applied jackets.
7. Tapes.
8. Securements.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Fire Test Response Characteristics: Insulation and related materials shall have fire test response characteristics indicated below as tested in accordance with ASTM E 84.

1. Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.
2. Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

1.5 COORDINATION

A. Coordinate size and location of supports and hangers specified in Division 23 Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with the equipment installer for equipment insulation application. Before preparing Shop Drawings, establish and maintain clearance requirements for installation of insulation and field applied jackets and finishes and for space required for maintenance.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Mineral Fiber, Pipe, and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semi-rigid board material with factory applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density shall be 2.5 lb/cu. ft. or more. Thermal conductivity at 100°F shall be 0.29 Btu x in./h x sq. ft. x degree F or less. Factory applied jacket requirements are specified in "Factory Applied Jackets" article.

1. Products - subject to compliance with requirements, provide the following:

   a. CertainTeed Corp.; CrimpWrap.
   b. Johns Manville; MicroFlex.
   c. Knauf Insulation; Pipe and Tank Insulation.
   d. Manson Insulation Inc.; AK Flex.
   e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products - subject to compliance with requirements, provide the following:

   a. Childers Products, Division of ITW; CP-82.
   b. Foster Products Corporation, H. B. Fuller Company; 85-20.
   c. ITW TACC, Division of Illinois Tool Works; S-90/80.
   d. Marathon Industries, Inc.; 225.
   e. Mon-Eco Industries, Inc.; 22-25.

C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products - subject to compliance with requirements, provide the following:

   a. Childers Products, Division of ITW; CP-82.
   b. Foster Products Corporation, H. B. Fuller Company; 85-20.
   c. ITW TACC, Division of Illinois Tool Works; S-90/80.

d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20° to plus 180°F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.4 SEALANTS

A. ASJ Flashing Sealants

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire and water resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40° to plus 250°F.
5. Color: White.

2.5 FACTORY APPLIED JACKETS

A. Insulation system schedules indicate factory applied jackets on various applications. When factory applied jackets are indicated, comply with the following:

1. ASJ: White, Kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.6 FIELD APPLIED JACKETS

A. Metal Jacket

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; Metal Jacketing Systems.
b. PABCO Metals Corporation; Surefit.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

a. Factory cut and rolled to size; or, sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 2.5-mil thick Polysurlyn.

2.7 TAPES

A. ASJ Tape: White vapor retarder tape matching factory applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products - subject to compliance with requirements, provide the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. Aluminum Foil Tape: Vapor retarder tape with acrylic adhesive.

1. Products - subject to compliance with requirements, provide the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Bands

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers - subject to compliance with requirements, provide the following:

a. C & F Wire
b. Childers Products
c. PABCO Metals Corporation
d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

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

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

D. Install multiple layers of insulation with longitudinal and end seams staggered.

E. Keep insulation materials dry during application and finishing.

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

G. Install insulation with least number of joints practical.

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

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

J. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    a. For below ambient services, apply vapor barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

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

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

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

N. For above ambient services, do not install insulation to the following:

1. Vibration control devices
2. Testing agency labels and stamps
3. Nameplates and data plates
4. Manholes
5. Handholes

3.4 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe, and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not over compress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch pre-stressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch pre-stressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.

3.5 FIELD APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.6 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless steel jackets.

3.7 EQUIPMENT INSULATION SCHEDULE

A. Heating-hot-water expansion/compression tank and air separator insulation shall be the following:

1. Mineral fiber Pipe and Tank: 1½ inches thick.

3.8 FIELD APPLIED JACKET SCHEDULE FOR EQUIPMENT INSTALLED INDOORS

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

B. Hot Water Expansion Tanks, and Chilled Water Air Separators:

1. Aluminum, Smooth: 0.024 inch thick.

C. Provide waterproof sealant over jacketing for chilled water expansion tanks and chilled water air separators.

END OF SECTION 230716

SECTION 230719
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes

1. Insulation Materials

a. Flexible elastomeric.
b. Mineral fiber.

2. Adhesives.
3. Mastics.
4. Lagging adhesives.
5. Sealants.
6. Factory applied jackets.
7. Field applied fabric reinforcing mesh.
8. Field applied cloths.
9. Field applied jackets.
10. Tapes.
11. Securements.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Fire Test Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated below as tested in accordance with ASTM E 84.

1. Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.
2. Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

1.5 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Mineral fiber, Preformed Pipe Insulation:

1. Products - subject to compliance with requirements, provide the following:

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000 Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850°F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory applied ASJ or factory applied ASJ-SSL. Factory applied jacket requirements are specified in "Factory applied Jackets" article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products - subject to compliance with requirements, provide the following:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Speedline Vinyl Adhesive.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20° to plus 180°F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.4 SEALANTS

A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40° to plus 250°F.
5. Color: White.

2.5 FACTORY APPLIED JACKETS

A. Insulation system schedules indicate factory applied jackets on various applications. When factory applied jackets are indicated, comply with the following:

1. ASJ: White, Kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.6 FIELD APPLIED JACKETS

A. Field applied jackets shall comply with ASTM C 921, **Type II, for pipes operating at above ambient temperatures**.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 30 mils thickness; roll stock ready for shop or field cutting and forming. Thickness is indicated in field applied jacket schedules.

1. Products - subject to compliance with requirements, provide the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory fabricated tank heads and tank side panels.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products - subject to compliance with requirements, provide the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products - subject to compliance with requirements, provide the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
b. Compac Corp.; 130.
c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
d. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.8 SECUREMENTS

A. Bands:

1. Products - subject to compliance with requirements, provide the following:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers - subject to compliance with requirements, provide the following:

a. C & F Wire
b. Childers Products
c. PABCO Metals Corporation
d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

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

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

D. Insulation installed on piping systems shall pass through pipe hangers and pipe clamps uninterrupted.

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

F. Install multiple layers of insulation with longitudinal and end seams staggered.

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

H. Keep insulation materials dry during application and finishing.

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

J. Install insulation with least number of joints practical.

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

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

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

M. Install insulation with factory applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

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

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

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

Q. For above ambient services, do not install insulation to the following:

1. Vibration control devices.
2. Cleanouts.

3.4 PENETRATIONS

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

B. Insulation Installation at Fire Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire rated walls and partitions.

1. Comply with requirements in Division 07 for fire-stopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 for fire-stopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for

above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

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

3.6 MINERAL FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 INSULATION SCHEDULE FOR PIPING INSTALLED INDOORS

A. Heating Hot Water, 200°F and below:

1. NPS 1½ (DN 40) and Smaller: Mineral fiber, Preformed Pipe, Type I, 1½ inches thick.
2. NPS 2 (DN 50) and Larger: Mineral fiber, Preformed Pipe, Type I, 2-inches thick.

B. Hot Service Drains:

1. All Pipe Sizes: Mineral fiber, Preformed Pipe, Type I or II, 1½ inches thick.

C. Hot Service Vents:

1. All Pipe Sizes: Mineral fiber, Preformed Pipe, Type I or II, 1½ inches thick.

3.9 FIELD APPLIED JACKET SCHEDULE FOR PIPES INSTALLED INDOORS

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

B. Piping, Exposed and Concealed, Fittings Only:

1. PVC 30 mils thick.

END OF SECTION 230719

SECTION 230801
COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. The HVAC Contractor will procure the services of independent Commissioning Consultant; other terms are Commissioning Provider, Commissioning Agent, and Commissioning Authority. The Commissioning Consultant shall be an independent and knowledgeable third party, contracted to verify that the HVAC systems, service water heating systems, lighting control systems, and other systems where indicated below, operate as illustrated, described or specified in the contract documents. The Commissioning Consultant will inform the Engineer and the Architect of the results of the commissioning and provide suggestions, as necessary, to correct deficiencies in observed performance or installation.

B. Commissioning is the process to verify to The HVAC Contractor that systems, equipment, mechanical, electrical, controls and special systems function together properly to meet performance requirements and design intent, and as described in the Contract Documents. The HVAC Contractor shall be responsible for participation in the commissioning process as outlined below and in references and attachments throughout the Contract Documents. The HVAC Contractor shall furnish labor and materials sufficient to meet all requirements of building commissioning under this contract.

C. Various sections in the Division 00, 01, 22, 23 and 26 Specifications as well as specifications in other sections outline the specific commissioning responsibilities of each Contractor and corresponding subcontractors for the respective division and obligate the HVAC Contractor to coordinate and manage the commissioning responsibility of those subcontractors.

1.2 REQUIREMENTS INCLUDED

A. Duties of Contractor.

B. Duties of Commissioning Consultant.

C. Commissioning Field Notebook.

D. Acceptance Procedures.

E. Performance Period.

F. Training and Instruction.

1.3 RELATED SECTIONS

A. All Division 1 Sections and General Requirements

B. All Division 22 Sections

C. All Division 23 Sections

D. All Division 26 Sections

1.4 TERMS

A. Acceptable Performance: A component or system being able to meet specified design parameters under actual load including satisfactory documented completion of all functional performance tests, control system trending and resolution of outstanding issues.

B. Basis of Design: The Contract Documents shall constitute the Basis of Design.

C. Commissioning Plan: The HVAC Contractor's Commissioning Consultant prepares The Commissioning Plan. *The Commissioning plan is a document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process (ASHRAE Guideline 0-2013)*. In addition, the Plan defines the scope and format of the commissioning process and the responsibilities of all involved parties. The commissioning team reviews the Commissioning Plan to inform the intent and scope of the commissioning process, to ensure inclusion in the construction project scope/schedule and to facilitate and expedite the commissioning process. The Commissioning Plan is to be distributed by the Commissioning Consultant during the first third of the construction timeframe.

D. Functional Performance Testing: Is a full range of checkouts and tests carried out to determine if all components, sub-systems, systems and interfaces between systems function in accordance with the Contract Documents and meets the design intent. In this context, "function" includes all modes and sequences of control operation, all interlocks and conditional control responses and all specified responses to abnormal emergency conditions. The Commissioning Consultant will prepare the functional performance tests.

E. Commissioning (Also Commissioning Process) is *a quality-focused process enhancing the delivery of a project. The process focusses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements. (ASHRAE Guideline 0-2013).* Process to demonstrate The HVAC Contractor that building equipment controls and systems function together properly to meet design intent and performance requirements shown in a composite manner in the Contract Documents.

F. Resolution Log: The purpose of this document is to provide a method for tracking and resolution of deficiencies discovered during the commissioning process. This list also includes the current disposition of issues and the date of final resolution as confirmed by the Commissioning Consultant. Deficiencies are issues where products, execution or performance does not satisfy the Specifications and/or the design intent. The Commissioning consultant creates and manages the Resolution Log.

G. Pre-functional Construction Checklists: Commissioning Consultant prepares Checklist for equipment of systems and assemblies. See paragraph 1. A. Checklist shall be for the systems or equipment involved in the commissioning process to verify installation and start-up of equipment is complete and verify that systems are ready for functional testing. These documents require signature by the Contractor prior to continuing with the commissioning process, and are required as a pre-condition of beginning the Functional Performance Testing.

H. Testing and balancing (TAB) process. A complete pencil copy of TAB reports, on a system-by-system basis, is required prior to the start of any final functional performance test.

1.5 DUTIES OF CONTRACTOR

A. Provide copies of all approved shop drawings, manufacturer's literature, maintenance information or other information as may be needed for systems and assemblies to the Commissioning Consultant.

B. Collect the information requested by Commissioning Consultant for development of a complete Commissioning Plan, Commissioning Field Notebook, and Functional Performance Tests and provide to the Commissioning Consultant. The HVAC Contractor shall review the Commissioning Plan, Commissioning Field Notebook, and Functional performance Test and confirm in writing to the Architect, and Commissioning Consultant any known areas of conflict or areas requiring clarifications.

C. Collect all proposed equipment start-up and Pre-Functional Construction Checklists documentation and place into the Commissioning Field Notebook. The HVAC Contractor will provide the Commissioning Consultant with the completed commissioning field notebook.

D. Provide the Contractor's schedule to the commissioning Consultant for review and comment. Plan for and incorporate commissioning activities into the construction schedule. Provide a sufficient detailed level of scheduling, activity, detail to properly coordinate and schedule the trades. Provide a detailed Commissioning Schedule Fragnet to the project schedule, updated monthly.

E. Provide Commissioning Consultant with submittals for all systems and assemblies for review and comments. Include submittals of controls system and wiring diagrams and narrative sequences of operation, in time for use in preparing the Functional Test Procedures. The Commissioning Consultant review comments of pertinent submittals is coordinated through the Architect.

F. Provide a fully operational system per Specifications, started, verified, debugged, calibrated, balanced, tested and under automatic control.

G. Provide qualified personnel to participate in the commissioning tests, including seasonal testing.

H. Cooperate with the Commissioning Consultant's personnel.

I. Provide access to site for the Commissioning Consultant for review, verification and testing activities.

J. Provide updates to all project documentation to reflect all supplemental instructions, addenda or other revisions to the project construction documents. Updates and architect's supplemental instructions must be posted to the master set of documentation for review and reference by all Contractors and for the Commissioning Consultant's use.

K. Provide adequate time and resources to perform functional testing of systems and assemblies in contract. These times and activities shall be reflected in the Commissioning Fragnet schedule, updated monthly.

L. Coordinate participation of all pertinent subcontractors including mechanical, electrical, controls and Testing and Balancing TAB subcontractors in the commissioning process.

M. Participate in any efforts to finalize sequences of operations with Architect and Commissioning Consultant.

N. Verify that coordination, installation, quality control and final testing have been completed such that installed systems and equipment comply with construction documents.

O. Review the Commissioning Plan, Project Reports and test results and submit comments to the Commissioning Authority.

P. In a timely manner, address issues identified during construction that may affect the commissioning process or final system performance.

Q. Perform equipment start-up and testing of mechanical and electrical equipment and systems and document as required with start-up reports and completion of Pre-functional Construction Checklists. These checklists include installation documentation, start-up documentation, controls point-to-point documentation and calibration documentation, verification that controls sequence of operations meets design intent and TAB final documentation. Reports will be stored in the Contractor's field trailer, as a part of the Commissioning Field Notebook. Contractor will coordinate efforts to complete the pre-functional documentation.

R. Provide preliminary TAB report, indicating all actual field values recorded to the Commissioning Consultant through the Architect, prior to initiation of functional testing. These reports shall be incorporated in the commissioning field notebook. Provide these "pencil copy" TAB data on a system by system basis, as systems have been finally and completely balanced.

S. Pre-test all systems prior to scheduling the final Functional Performance Test for the record. Operate equipment and systems as required in preparation of final functional performance testing. This includes, but is not limited to; manipulating the appropriate controls systems to execute the Functional Test Procedures.

T. The HVAC Contractor shall issue a written Notice of Readiness *for each system*; include verification of system completion, TAB completion and controls. Provide the Commissioning Consultant a copy of the Notice of Readiness upon completion of all systems work, start-up and Pre-functional Construction Checklists requirements by trade contractors including but not limited to plumbing and electrical contractors.

U. Participate in the fine-tuning or troubleshooting of system performance, if of these measures becomes necessary.

V. Review operating and maintenance data for verification, organization, distribution and conformance to requirement of the Contract Documents.

W. Submit complete operation and maintenance information and as-built drawings to the Architect, for compliance review of the requirement of the Contract Documents. Incorporate changes and recommendations provided by the commissioning Consultant into the documentation.

X. Provide all proprietary test equipment required to test all the systems and equipment in this project. The HVAC Contractor shall provide all necessary tools, lifts, ladders, access, PPE and other equipment required for the Commissioning Consultant to witness Functional Performance Testing.

Y. The Commissioning Field Notebook will be stored in the HVAC Contractors field trailer and will be managed by the HVAC Contractor. The HVAC Contractor shall confirm in writing to the Commissioning Consultant that systems are complete, functional and the appropriate subcontractors have completed the specified tasks and signed off all pre function documentation.

1. Use of an electronic, internet enabled data storage and sharing site is permitted, provided all applicable stakeholders agree to its use, in writing.

1.6 DUTIES OF COMMISSIOING CONSULTANT

A. Develop the Commissioning Plan.

B. Review the Commissioning Field Notebook with appropriate documentation provided from HVAC Contractor. Provide supplemental documentation as necessary to ensure that all aspects of start-up and testing have been complete and documented prior to functional testing.

C. Develop Functional Test Procedures from Contract Documents and final equipment submittals including narrative sequences of operation, control diagrams and software code for execution with the assistance of HVAC Contractor staff as required.

D. Review the Contractor's submittals relative to the systems and assemblies. Provide comments on the submittals during the same timeframe as the architect / engineer's review. Architect / Engineer have final decision on incorporating comments by the Commissioning Consultant. Architect formally incorporates the response to the HVAC Contractor.

E. Observe or review documentation of validation activities including: Proper test and balance activities, rotating equipment drive alignment, vibration testing, acoustical testing, electrical testing and functional tests for normal and off-normal operating sequences.

F. Review submittal of all required pre-functional and start-up documentation provided by the HVAC Contractor for completeness and reasonableness. This includes installation documentation, start-up documentation, point-to-point checklists and preliminary TAB report, prior to initiation of functional testing.

G. Assist with scheduling, direct and witness complete functional testing as defined in the Commissioning Plan and Functional Test Procedures. All testing to be performed and verified by the HVAC, Plumbing or Electrical Contractors as applicable and documented by the Commissioning Consultant.

H. Witness and verify satisfactory completion of equipment and system tests and inter-systems functional performance tests.

I. Provide functional tests or other project reports in a timely manner.

J. Document inconsistencies or deficiencies in system operations and system compliance. System deficiencies shall be forwarded to the Architect and documented in the Resolution Log.

K. Coordinate via the Architect participation of owner's personnel with equipment, component and systems performance verification and participation in required training.

L. When commissioning has been successfully completed, recommend acceptance to the Architect, and provide suggestions for those systems not performing as expected.

M. Complete, certify and submit a Preliminary Commissioning Report that is organized into mechanical, service water heating and lighting controls for independent review. The Report shall include a 2018 International Energy Conservation Code, Section C408.2.4 Preliminary Commissioning Report compliant "Commissioning Compliance Checklist", and shall identify:

1. Itemization of deficiencies found during testing that have not been corrected at the time of report preparation.
2. Tests deferred because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.
4. Results of functional performance tests.
5. Functional performance test procedures used during the commissioning process, including measurable criteria for test acceptance.

N. After all functional tests are successfully completed and all outstanding issues resolved, the Commissioning Consultant will provide the owner and architect with a Final Commissioning Report of all commissioning activities that occurred during the project.

O. The Final Commissioning Report shall include:

1. Results of functional performance tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. Functional performance test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests that cannot be performed at the time of report preparation due to climatic conditions.

P. Provide technically qualified personnel when scheduled.

Q. The Commissioning Consultant will formally communicate with the HVAC Contractor via approved project channels. It is expected, however, that informal communication and coordination will be conducted directly with the subcontractors; records of all contacts will be sent to the Architect through the normal channels.

R. The Commissioning Consultant is not authorized to release, revoke, alter or expand requirements of Contract Documents, to approve or accept any portion of the work or to perform any duties of the Contractor.

1.7 COMMISSIONING PLAN

A. The Commissioning Plan is a tool through which the commissioning process is described and incorporates the Architect, Trade Contractor(s) and Commissioning Authority roles relative to the commissioning process. Commissioning team members are all contractors, subcontractors and design professionals whose participation is of benefit in the delivery of a fully functioning building to the owner. The plan shall describe the communication, authority and responsibility of commissioning team members. The Commissioning Plan will include the following:

1. The purpose of commissioning.
2. Detail the commissioning process.
3. Commissioning team members' responsibilities.
4. Provide a guideline for acceptance of each piece of equipment or system.
5. Systems to be commissioned.

1.8 COMMISSIONING FIELD NOTEBOOK

A. The Commissioning Field Notebook is assembled by the HVAC Contractor and reviewed by the Commissioning Consultant to identify and track all pertinent commissioning documentation. The HVAC Contractor will maintain and manage completion of this Notebook. The Notebook provides a central location for the Commissioning Consultant to identify and organize all pertinent information and will include the following format:

1. Summary describing Notebook contents and use.
2. Commissioning Plan for contractor field reference.
3. Listing of all specification documentation requirements listed by specification section, with construction completion sign offs for appropriate parties. These types of documents include piping pressure testing, flushing reports, factory start-up reports and any field-testing relative to the project.
4. Copy of final approved submittal / shop drawings for each major piece of equipment involved in commissioning, as well as systems such as controls.
5. Tabs for each specification section with copies of completed, signed off pre-functional checklists and final Functional Performance Tests.
6. Commissioning project reports, resolution logs schedule information or any other documentation provided by the Commissioning Consultant.
7. Provide a .pdf copy of entire completed Commissioning Field Notebook to Commissioning Consultant at conclusion of project for use in developing final Commissioning Report, prepared by the Commissioning Consultant.

B. Internet enabled data sharing applications will be considered for use on this project as the Field Notebook provided the HVAC Contractor or Commissioning Consultant bear the cost for such application, and all stakeholders agree to its use.

1.9 SYSTEMS TO BE COMMISSIONED

A. Systems and Equipment to Be Functionally Tested: The system features are to be functionally tested and other building features will be evaluated for installation quality during construction. The functional performance testing will include the following systems and equipment.

1. Mechanical Systems:

a. Pumps
b. Air volume control boxes with reheat coils
c. Building automation system
d. Service water heating equipment

1.10 COMMISSIONING ACTIVITIES

A. The Commissioning Fragnet Schedule: This schedule defines the milestones and conditions that must be achieved before system testing and other commissioning activities can commence. The schedule also includes the expected duration of the various tasks so that the commissioning process can be incorporated into the overall construction schedule.

B. Commissioning Field Notebook: The HVAC Contractor is required to create, develop and maintain the Commissioning Field Notebook. The HVAC Contractor shall identify and track all pertinent commissioning documentation required during the installation start-up and checkout phases in the Commissioning Field Notebook. The Commissioning Notebook will be kept by the

HVAC Contractor on site and will be made available to all subcontractors for their use. The Notebook provides a central location for the subcontractors and Commissioning Consultant to identify, copy, and organize all pertinent information.

C. Preparation for Testing: To prepare for the system performance testing, the Commissioning Consultant will examine the design and Construction Documents, and develop detailed Functional Test Procedures and data forms. The Contractor must verify that the systems they install comply with the Construction Documents and are fully functional. Commissioning is not intended to be a testing or inspection function that replaces any of the Contractors' obligations for testing and proof of performance. Functional testing will only begin when the TAB process is complete for both air and water balancing, and the controls are completed and all control loops properly tuned.

D. Functional Testing: Functional testing is performed by experienced and qualified technicians of the Contractor(s), responsible for installation as facilitated by the Commissioning Consultant and may be observed by other members of the commissioning team including the Owner. Functional testing will verify proper sequencing, operation and performance of installed equipment and systems under realistic operating conditions. The functional testing will follow with written Functional Test Procedures with test results documented for permanent record.

E. Documentation: In addition to the Functional Test Procedures, written documentation will be maintained for all other commissioning activities. Project communication reports shall be issued by the Commissioning Authority to the Contractor and key members of the commissioning team to document apparent deficiencies identified during examination of design and construction documents, daily activities on-site, construction deficiencies and successful or unsuccessful functional test results. At the end of the commissioning process, all documentation will be assembled and summarized in the Final Commissioning Report.

F. Deficiency Resolution: When an Issues Log, Resolution Log or Field Report is issued to address an identified deficiency, the Contractor shall forward the reports to the appropriate parties to initiate corrective action in an expeditious manner. The designer is relied on for supplemental instructions or design modifications and issuance of final design details and the Contractors are relied on for implementation of that design. Change orders must be issued through proper contract channels.

1.11 FUNCTIONAL TEST PROCEDURES

A. The Functional Test Procedures include, but are not limited to, the following:

1. Verification that testing, adjusting and balancing has occurred.
2. Verification that all HVAC and service water heating equipment is installed in a serviceable manner for maintenance.
3. Verification of all equipment's ability to perform to the design intent.
4. Verification of the performance of sub-systems consisting of combinations of equipment (e.g., refrigeration cycle, pumps and interconnecting piping).
5. Verification of the performance of the automatic controls in all seasonal modes.
6. Verification of the performance of the HVAC system as a whole.
7. Verification of testing, adjusting and balancing performance
8. Verification of the performance of all life safety devices and systems that interface with the HVAC systems. Commissioning of life safety systems by the Commissioning Authority shall be limited to the fire alarm interface with the HVAC systems.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Operating equipment and systems shall be tested in presence of the Commissioning Consultant Architect to demonstrate compliance with specified requirements.

1. Notify the architect in writing, fourteen (14) days prior to tests, twenty-one (21) days prior if a utility shutdown is required, scheduled under requirements of this Section.
2. The Functional Performance Testing shall be completed by the Contractor as a requirement of Substantial Completion. The acceptance of Functional Performance Test by the Architect is a requirement of Final Completion.

B. All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each sub-system, followed by entire system, followed by interaction with other major systems.

C. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment through the installing contractor. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Consultant in the commissioning process.

D. Acceptance Documentation: A copy of the functional performance tests results shall be necessary acceptance documentation along with other specified requirements. Documentation must be signed and dated.

3.2 ACCEPTANCE PROCEDURES

A. Prior to functional performance testing of each system, the Commissioning Consultant shall observe and verify that the physical installation of components and systems being tested is substantially installed in accordance with the Contract Documents.

B. Contractor’s Tests:

1. System shall be checked for proper installation, shall be adjusted and calibrated to verify that it is ready to function as specified.
2. All system elements shall be checked to verify that they have been installed properly and that all connections have been made correctly.
3. All discrete elements and sub-systems shall be adjusted and checked for proper operation.
4. Start-up and operational tests shall be complete, signed and submitted for review by Commissioning Consultant within five (5) days of each activity, prior to starting functional performance testing.

C. The functional performance testing process shall be accomplished for all equipment, sub-systems, systems and system interfaces. The order of functional performance testing shall be reflected in the Commissioning Fragnet Schedule. All must be tested for acceptances and there shall be a separate checklist for each to ensure documentation specific to each is complete.

D. Each system shall be operated through all modes of system operation (e.g. occupied, unoccupied, warm-up, cool-down, etc., as applicable) including every individual interlock and conditional control logic, all control sequences, both full-load and part-load conditions and simulation of all abnormal conditions for which there is a specified system or controls response. The warm-up and cool-down test shall be a performance test, as applicable.

E. Temporary upsets of systems, such as distribution fault, control loss, set-point change, equilibrium upset and component failure, shall be imposed at different operation loads to determine system stability and recovery time.

F. When the functional performance of all individual systems has been proven, the interface or coordinated responses between systems shall be checked. The systems involved may be within the overall HVAC work or they may involve other systems, such as emergency systems for life safety.

G. Corrective Measures: If acceptable performance cannot be achieved, the cause of the deficiency will be identified. If it is determined, that the deficiency was caused by the system or component not being installed per the manufacturer's recommendations or Contract Documents, the necessary corrective measures shall be carried out by the installing Contractor. Every check or test for which acceptable performance was not achieved shall be repeated after the necessary corrective measures have been completed. This re-testing process should be repeated until acceptable performance is achieved. The Contractor will be allowed one retest after initial testing of the equipment. If the retest fails, the Contractor shall be financially responsible, at standard rates, to reimburse the Commissioning Consultant for the additional time taken to achieve acceptable performance.

3.3 TRAINING AND INSTRUCTION

A. Training and instruction of Owner personnel is a part of the commissioning process and essential for the proper operation of the facility. The contractors and vendors providing the training will complete training plans and submit to the Commissioning Consultant for review and approval in conjunction with the Architect.

3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed, regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.

B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. Heating equipment will be tested during winter design conditions. Cooling equipment will be tested during summer design conditions, with a fully occupied building. Each Contractor and supplier will be responsible to participate in the initial and the alternate peak season test of the systems required demonstrating performance.

C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. Each Contactor and supplier will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

D. Commissioning team including contractor, subcontractors, commissioning personnel and COTR shall meet at site roughly ten months after Substantial Completion to review any system issues, and correct any operational concerns covered by warranty. Commissioning Consultant shall lead this site meeting, and shall summarize findings in a site report.

3.5 SCHEDULE

A. The following schedule reflects the probable expected sequence and duration for the various tasks, so that the commissioning process can be integrated with the general construction schedule and refined over the course of the project. Actual sequencing and durations shall be by the General Contractor and Sub-Contractors, coordinated with the Commissioning Consultant.

B. Note: Attention to these scheduling needs are important to prevent conflicts that have been problematic within the commissioning process:

Milestone	Duration	Successor	Predecessor
Commissioning Kick off Mtg.	1 day	All contractors on board including Controls and TAB	Before major MEP installation
Review equipment submittals	2 weeks	After receipt of submittals	Before ordering or installation
Develop Pre-functional Construction Checklists	2 weeks	After equipment submittal review and after receipt of O&M literature	Before MEP installation
Walk contractors through Pre-functional Construction Checklists	1 day	After development of Pre-Functional Checklist documentation	Before MEP installation
Write Functional Tests	3 to 5 weeks	After controls submittal review	3 weeks prior to functional testing
Submit Functional Tests for review by COTR and Contractors	1 week	After development of Functional Tests	Before Functional testing
Complete Pre-functional Construction Checklists (contractor task)	On Going	During installation, startup and test, adjust and balance	Before TAB Backcheck and functional testing
Site Observations (CxA)	on-going	After majority of MEP installation	Before TAB Backcheck and functional testing
Test, Adjust and Balance (contractor task)	See CPM schedule	After Start-up and Pre-functional Construction checks. All walls, windows, doors, ceilings must be installed.	Before TAB Backcheck
Test, Adjust and Balance Backcheck (10%)	1 week	After Start-up and receipt of completed Pre-functional Construction Checklists from contractors	Before functional testing
Functional Testing	2 months	After TAB Backcheck and receipt of completed Pre-functional Construction Checklist have been completed by contractors	Before Government occupancy

Issues Resolution	1 week	After Functional Testing	Before Government occupancy
Final Commissioning Documentation Submittal	2 weeks	After resolution of issues log	2 weeks after resolution of issues log

COMMISSIONING COMPLIANCE CHECKLIST

END OF SECTION 230801

SECTION 230900
AUTOMATIC TEMPERATURE CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. This Section includes control equipment for all HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.3 WORK INCLUDED

A. Automatic Temperature Control (ATC) Subcontractor shall:

1. Tie into the existing Trinity control system and provide a new DDC temperature control system as specified herein.
2. Provide all power wiring, control wiring, and conduit for all DDC panels, Programmable Controllers, programmable controllers and DDC temperature control devices, except as detailed within. Provide all electrical work associated with the BAS control system and as called for on the Drawings including:

    a. Providing all line voltage and low voltage power wiring and conduit in accordance with all local codes, the National Electric Code (latest edition), and Division 26.

        1) Power circuits shall be run from normal/emergency power panel(s).

    b. Providing all line voltage and low voltage control wiring, concealed in conduit or exposed as plenum-rated cable, in accordance with local codes, the National Electric Code (latest edition), and Division 26.

        1) Power circuits shall be run from normal/emergency power panel(s).
        2) All low voltage electrical control wiring throughout the building shall be as described in Part 3 of this Section.

    c. Incorporating and providing surge transient protection in design of system to protect electrical components in all DDC Controllers, Programmable Controllers, and operator interface devices.

3. The ATC Subcontractor shall hardwire from each duct mounted smoke detector to its associated supply and/or return fan. Fan shutdown via software is not acceptable. Provide all wiring and conduit required.

    a. Control circuit shall de-energize fans in the ‘Hand’, as well as the ‘Auto’, position.
    b. DDC system shall monitor all duct detectors.

4. Furnish all automatic air dampers, including actuators. Provide all power wiring, conduit and controls for automatic air dampers installed.
5. Furnish and install all airflow monitoring devices.
6. Furnish all control valves. Provide control wiring and conduit, and any power wiring and conduit (if necessary), for each control valve.
7. Provide a field technician to coordinate work with the Testing and Balancing technicians.
8. Program initial occupied/unoccupied schedules and weekday/weekend/holiday time schedules for each HVAC equipment item and system. Coordinate with the Owner to determine the schedule parameters to be input.
9. Program initial trends for each HVAC equipment item and system. Coordinate with the Owner to determine the points to be trended on each system and the duration of the trends, along with any other required parameters associated with each particular trend.
10. Perform functional performance testing for all controls installed.

B. The HVAC Trade shall:

1. Install all automatic air (outdoor air, return air, exhaust air, ventilation air) control dampers furnished by the ATC Subcontractor.
2. **Install all control valves furnished by the ATC Subcontractor.**
3. Install all openings for all airflow monitoring devices, flow switches and alarms furnished by the ATC Subcontractor.
4. Install all control devices, alarms and monitoring devices for all air and water systems required by the Drawings and the Specifications that is not installed by the ATC Subcontractor.
5. Provide all required access doors.

C. The Electrical Trade will:

1. Provide a minimum of two (2) 120 volt, 20 amp breakers in each normal/emergency power panel for use by the ATC Subcontractor.

1.4 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

D. MS/TP: Master slave/token passing.

E. PC: Personal computer.

F. PID: Proportional plus integral plus derivative.

G. RTD: Resistance temperature detector.

1.5 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum **20** dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum **20** dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

    a. Water Temperature: Plus, or minus 1°F.
    b. Water Flow: Plus, or minus 5 percent of full scale.
    c. Water Pressure: Plus, or minus 2 percent of full scale.
    d. Space Temperature: Plus, or minus 1°F.
    e. Ducted Air Temperature: Plus, or minus 1°F.
    f. Outside Air Temperature: Plus, or minus 2°F.
    g. Dew Point Temperature: Plus, or minus 3°F.
    h. Temperature Differential: Plus, or minus 0.25°F.
    i. Relative Humidity: Plus, or minus 5 percent.
    j. Airflow (Pressurized Spaces): Plus, or minus 3 percent of full scale.
    k. Airflow (Measuring Stations): Plus, or minus 5 percent of full scale.
    l. Airflow (Terminal): Plus, or minus 10 percent of full scale.
    m. Air Pressure (Space): Plus, or minus 0.01-inch wg.
    n. Air Pressure (Ducts): Plus, or minus 0.1-inch wg.
    o. Carbon Monoxide: Plus, or minus 5 percent of reading.
    p. Carbon Dioxide: Plus, or minus 50 ppm.
    q. Electrical: Plus, or minus 5 percent of reading.

1.6 SEQUENCE OF OPERATION

A. Refer to Division 23 Section 230993 “Sequence of Operation for HVAC Controls” for required operating sequences for each HVAC system, equipment item and component.

1.7 GENERAL PRODUCT DESCRIPTION

A. The building automation system shall consist of the following:

1. Stand-alone Application Specific DDC Controllers (PRCs).
2. DDC Network Panel.

B. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, Programmable Controllers and operator devices.

C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

D. The DDC system hardware and software installed for this project must maintain compatibility with systems developed in the future. It is a requirement that the ATC Subcontractor support this "Forward and Backward Compatibility" claim with written company literature and local references of facilities where the company's former DDC system ties into their current DDC system.

1.8 QUALITY ASSURANCE

A. Materials and equipment shall be the catalogued products of the manufacturer. The ATC Subcontractor personnel shall have been regularly engaged in production and installation of automatic temperature control systems for a minimum of 5 years. The control system shall be the manufacturer's latest standard design that complies with the specification requirements.

B. Install system using competent workers who are regularly employed and fully trained by the ATC Subcontractor in the installation of temperature control equipment. The ATC shall provide adequate staff to engineer, supervise, program and commission the control system in a timely manner. In addition, ATC shall maintain fully equipped service trucks to provide full warranty service available 24 hours a day, 7 days a week with a minimum 4-hour response time.

C. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system and shall include debugging and proper calibration of each component in the entire system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Electronic equipment shall conform to the requirements all government regulations.

1.9 SUBMITTALS

A. Manufacturer's Product Data including:

1. Hardware--cutsheets, product descriptions, and engineering information.
2. Engineering--design requirements for initial installations and/or additions to existing systems.
3. Installation--mounting and connection details for field hardware, accessories, and central site equipment.
4. Field hardware set-up, checkout, and tuning techniques.
5. Central site set-up, software loading, and checkout techniques.

B. Shop Drawings

1. Drawings shall show proposed layout and installation of all equipment and the relationship to other parts of the work. Shop drawings shall include the following:

   a. Bill of materials of equipment indicating quantity, manufacturer, and model number.
   b. Schematic flow diagrams of:

      1) Each controlled HVAC central system showing **boilers, pumps, valves,** and control devices.
      2) Each controlled HVAC equipment item showing components coils, dampers, **valves,** and control devices.

   c. Complete wiring diagrams showing all power, signal, and control wiring. Include wire types.
   d. Details of control panel faces, including controls, instruments, and labeling.
   e. Written description of sequence of operation.
   f. Schedule of dampers including size, leakage, and flow characteristics. Include damper size and type, actuator type, torque and damper actuator part numbers.
   g. **Schedule of valves including flow characteristics. Include valve size and type, actuator type, torque and valve actuator part numbers.**
   h. Points list for each HVAC system or HVAC equipment item being controlled.
   i. Tag number of devices and any other details required to demonstrate that the system will function properly.

2. Shop drawings shall clearly indicate intended sequence of operation for all equipment.
3. For DDC system include configuration diagrams showing all panel types and locations. Submittal data shall include descriptions of software, calculations, communications network and workstations. Submit software flowcharts or program printouts to verify compliance with specifications. Include the overall point's list. Revisions made as a result of the submittal process, during the installation, start-up or acceptance portion of the project, shall be accurately reflected in the "as-built" graphic software flow diagrams herein required by this specification.
4. Shop drawings shall include a list of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
5. Scaled drawings showing the location of all wall mounted DDC panels, wall mounted sensors, and similar devices.

C. Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Architect/Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received.

D. Project Specific User Manual to be provided at time of training:

1. System reference material shall contain as a minimum, an overview of the system, its organization, the concepts of networking and central site/field hardware relationships as well as the following:

   a. Activating the central site
   b. Central site screen menus and their definitions
   c. Establishing setpoints and schedules

d. Uploading and downloading software, setpoints, schedules, operating parameters and status between the central site and field hardware
e. Collecting trend data and generating trend plots
f. Enabling alarms and messages
g. Report generation
h. Backing up software and data files
i. Using the central site with 'third party' software

2. Software Documentation:

a. Shall contain a listing of the alarm and message conditions, which may be detected for each piece of controlled equipment and the standard alarm and message texts, which can be displayed when those conditions exist.
b. A graphic flow diagram for each software application program provided as part of this project.
c. Graphics generation.
d. At the completion of the project and after final acceptance of the system, the ATC Subcontractor shall provide a complete backup of all system software on CD. Include:

1) Final “As-Built” version of graphics
2) Final “As-Built” version of DDC controller programming

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Submit operation and maintenance data under provisions of Division 01.
2. Include systems descriptions, set points, and controls settings and adjustments.
3. Include inspection period, cleaning methods, recommend cleaning materials, and calibration tolerances.
4. Provide owner instruction under provisions of Division 01. Use operation and maintenance data as a training manual.

B. Graphics:

1. Submit screen captures of control graphics for each system and each equipment item for approval.

1.11 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division 01.

B. Include systems descriptions, set points, and controls settings and adjustments.

C. Include inspection period, cleaning methods, recommend cleaning materials, and calibration tolerances.

D. Provide owner instruction under provisions of Division 01. Use operation and maintenance data as a training manual.

1.12 SEQUENCING, SCHEDULING, AND COORDINATION

A. Coordinate work under provisions of General and Supplementary Conditions, Division 01 and Division 23, and ensure system is completed and commissioned by Date of Substantial Completion.

B. Coordinate installation of system components with installation and checkout of mechanical systems equipment such as **rooftop units, VAV terminal boxes,** etc.

1.13 WARRANTY

A. Base Bid: All devices and components shall be warranted for a period of **two (2) years** following the date of final acceptance by the Owner. The warranty period shall not start until all systems under project are accepted by the Owner. No partial warranty shall be permitted.

1. This warranty shall include all labor and material. Any defects arising during the warranty period shall be corrected without cost to the Owner. During the warranty period, the contractor's service personnel shall be available to be physically present at the facility within twenty-four (24) hours for emergency repairs.

1.14 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.15 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with Owner and Architect before installation. Obtain approval for final locations from Owner and Architect prior to installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Krueter Controls (furnished and installed by Building Control Systems located at 523 West Main Street, Carnegie, PA).

B. Schneider Electric - Andover Controls (furnished and installed by Combustion Service Equipment Company located at 2016 Babcock Boulevard, Pittsburgh, PA). (SmartStruxure Architecture)

C. Schneider Electric Controls (furnished and installed by FIT Optimized Solutions located at 303 17th St, Windber, PA 15963). (SmartStruxure Architecture)

D. Automated Logic (located at 1011 Alcon Street, Pittsburgh, PA).

E. Siemens (Located at 600 Bursca Drive, Bridgeville, PA).

F. Trane Company (furnished and installed by Pittsburgh Trane, located at 400 Business Center Drive, Pittsburgh, PA).

G. Alerton (furnished and installed by Trinity Automated Solutions 700 Bursca Dr, Suite 705 Bridgeville, PA 15017).

H. Johnson Controls Facility Explorer, Niagara Platform (furnished and installed by OZ Enterprises located at 2415 Kings Lane, Pittsburgh, PA 15241).

I. Carrier Corporation (furnished and installed by Standard Air & Lite Corp. located at 2406 Woodmere Drive, Pittsburgh, PA).

J. American Auto-Matrix, A Cylon Energy Inc. Company (furnished and installed by Pittsburgh Controls & Consulting, Inc., 100 Villani Drive, Bridgeville, PA 15017, Phone: 412.914.0320)

K. Tridium Controls (furnished and installed by Quantum Controls Group, LLC located in Jeannette, PA (724) 523-2122).

L. Honeywell Controls, WEBs version (furnished and installed by Chesapeake Controls Inc., 9001 Marshall Rd, Cranberry Township, PA 16066, (724) 754-3339).

2.2 GENERAL

A. The Owner shall have full rights to all programming software and to all passwords.

B. All DDC controllers must have proportional-integral (PI) or proportional-integral-derivative (PID) algorithms incorporated into their programming.

C. Control signals from the Building Automation System (BAS) to all controlled components must be the analog type signal. Pulse signals, or floating point control signals, are not acceptable.

D. All DDC controls shall be fully BACNet, LONWorks, and/or MODBus compatible and shall be EtherNet compatible.

2.3 DDC NETWORK PANEL

A. Each Network Panel shall have sufficient memory to support its own operating system and databases, including: Control processes; Energy management applications; Alarm management applications including custom alarm messages for each level alarm for each point in the system; historical/trend data for points all hardwired I/O points and all set-points; maintenance support applications; custom processes; operator I/O; web-based communications; and manual override monitoring.

B. DDC Network Panel shall provide at least two RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Network Panel shall allow temporary use of portable devices without interrupting the normal operation of permanently connected printers or terminals.

C. Network Panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

D. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.

E. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

1. Upon restoration of normal power, the DDC controllers shall automatically resume full operation without manual intervention.
2. Should DDC controller's memory be lost for any reason, the user shall have the capability of reloading the DDC controllers via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

F. A single process shall be able to incorporate measured or calculated data from any and all other DDC Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC Controllers on the network.

G. DDC Network Panel shall have the ability to perform any or all the following energy management routines:

1. Time-of-day scheduling, Calendar-based scheduling, Holiday scheduling, temporary schedule overrides
2. Start-Stop Time Optimization, Automatic Daylight Savings Time Switchover, Night setback control
3. Economizer switchover Fan speed/CFM control
4. Peak demand limiting, Temperature-compensated duty cycling

H. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a cell phone or pager.

I. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Network Panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.

J. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for all points identified by the Owner. The ATC Subcontractor shall trend all hardwired I/O points as well as all set points.

1. Provide additional functionality that allows the user to view trended data on trend graph displays. Displays shall be actual plots of both static and/or real-time dynamic point data. A minimum of 4 points may be viewed simultaneously on a single graph, with color selection and line type for each point being user-definable. Displays shall include an 'X' axis indicating elapsed time and a 'Y' axis indicating a range scale in engineering units for each point. The 'Y' axis shall have the ability to be manually or automatically scaled at

the user's option. Different ranges for each point may be used with minimum and maximum values listed at the bottom and top of the 'Y' axis. All 'Y' axis data shall be color-coded to match the line color for the corresponding point.

K. DDC Controllers shall automatically accumulate and store run-time hours for digital input and output points as specified in the point I/O summary. DDC Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis. DDC Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off.

L. DDC Network Panel shall provide optimal start/stop feature that integrates schedules and DDC controller setpoints and temperatures to optimize setpoint temperatures with occupancy and un-occupancy modes. Must include adaptive modeling to self-correct by using historical data of thermal characteristics of building.

M. Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password. Provide a minimum of 5 levels of access control.

N. Reports shall be generated and directed to workstation displays, printers or disk. As a minimum, the system shall allow the user to easily obtain the following types of reports:

1. A general listing of all points in the network
2. List of all points in alarm, in override status, locked out, disabled
3. DDC Controller trend overflow warning
4. List all weekly schedules and holiday programming
5. List of limits and deadbands

O. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:

1. Add/delete/modify stand-alone DDC Network Panels, Programmable Controllers, PC interface.
2. Add/delete/modify points of any type and all associated point parameters, tuning constants, control loops, custom control processes.
3. Add/delete/modify alarm reporting definition, energy management applications, totalization, historical data trending.
4. Add/delete/modify time and calendar-based programming, graphic displays, operator passwords.

P. Provide automatic web-based and dial-up communications as specified. Automatic dial-up communications shall include the following features as a minimum:

1. Dial-Out - Manual dial-out to cell phones and pagers shall be accomplished using only a mouse to select and request the desired remote connection.

Q. Communications cards:

1. Communications cards shall be provided and employed as the means of communications between all DDC control panels and Programmable Controllers.

2.4 PROGRAMMABLE CONTROLLERS (PRC)

A. Each PRC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each PRC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

B. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Provide each central system controller with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM or a minimum of 72-hour battery backup shall be provided. All programs shall be field-customized to meet the user's exact control strategy requirements.

C. Local alarming and trending capabilities shall be provided for convenient troubleshooting and system diagnostics. Alarm limits and trend data information shall be user-definable for any point.

D. Each controller shall have connection provisions for a portable operator's terminal. This tool shall allow the user to display, generate or modify all point databases and operating programs. All new values and programs may then be restored to EEPROM via the programming tool.

E. Each controller performing space temperature control shall be provided with a matching room temperature sensor. The sensor may be either RTD or thermistor type providing the following minimum performance requirements are met:

- ♦ Accuracy: ± 0.5°F
- ♦ Operating Range: 35° to 115°F
- ♦ Set Point Adjustment Range: 55° to 95°F
- ♦ Set Point Modes: Independent Heating, Cooling, Night Setback-Heating, Night Setback-Cooling
- ♦ Calibration Adjustments: None required
- ♦ Installation: Up to 100 ft. from Controller

1. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. In lieu of an internal jack, provide a separate terminal jack mounted on a stainless steel wall plate adjacent to the sensor to facilitate direct access to the controller via the terminal.
2. Each room sensor shall also include the following auxiliary devices: Setpoint Adjustment Dial, Temperature Indicator, and Override Switch.

    a. The setpoint adjustment dial shall allow for modification of the temperature by the occupant. Setpoint adjustment may be locked out, overridden, or limited as to time or temperature through software by an authorized operator at a web-based workstation, DDC Controller, or via the portable operator's terminal.
    b. An override switch shall initiate override of the night setback mode to normal (day) operation when activated by the occupant. The override function may be locked out, overridden or limited as to the time through software by an authorized operator at the central workstation, DDC Controller or via the portable operator's terminal.

3. Provide flush-mount type sensors for all rooms. These shall be Siemens model 540-520 or equivalent.
4. Coordinate the final check-out of the terminal units with the Testing and Balancing Subcontractor.

F. Each controller shall perform its primary control function independent of other DDC controller or if communication is interrupted. Reversion to a fail-safe mode of operation during communications interruption is not acceptable. The controller shall receive its real-time data from the DDC Network Panel time clock to ensure continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all applications. All PID gains and biases shall be field-adjustable by the user via terminals as specified herein. This functionality shall allow for tighter control of space conditions and shall facilitate optimal occupant comfort and energy savings.

2.5 FIELD DEVICES AND EQUIPMENT

A. Temperature Sensors: Temperature transmitters shall be 2-wire, averaging or single point 1000 OHM platinum RTD element with ± .5 degrees accuracy. Room sensors and immersion type sensors shall be the single point type. Duct sensors shall be the averaging type, nickel element, 17 ft. in length evenly strung across the face area of the duct.

1. For units with space sensor or space thermostat, provide the following:

   a. Temperature display showing actual measured temperature and setpoint.
   b. Setpoint adjustment switch for a minimum of ±3 degrees of adjustment.
   c. Override switch to allow switching from unoccupied to occupied mode for a timed period programmed by software.

2. Room Sensor and Room Thermostat Accessories:

   a. Thermostat and Sensor Covers: For all thermostats.
   b. Insulating Bases: For thermostats located on exterior walls.
   c. Thermostat and Sensor Guards: Metal wire guard mounted on separate base for thermostats and sensors located in public areas. Cast aluminum guard with cast aluminum base plate shall be similar to Johnson Controls model GRD10A-601.
   d. Adjusting Key: As required for device.

B. Liquid And Steam Temperature Sensors (RTD), Commercial Grade:
1. Description:

   a. Platinum with a value of 100 or 1000 ohms at 0 deg C and a temperature coefficient of 0.00385 ohm/ohm/deg C.
   b. Encase RTD in a stainless steel sheath with a 0.25-inch OD.
   c. Sensor Length: 4, 6, or 8 inches as required by application.
   d. Process Connection: Threaded, NPS 1/2.
   e. Two-stranded copper lead wires.
   f. Powder-coated steel enclosure, NEMA 250, Type 4.
   g. Conduit Connection: 1/2-inch trade size.
   h. Performance Characteristics:

      1) Range: Minus 40° to 210°F.
      2) Interchangeable Accuracy: Within 0.54°F at 32°F.

C. Thermowells, Commercial Grade:

1. Stem: Straight shank formed from solid bar stock.
2. Material: Brass.
3. Process Connection: Threaded, NPS 3/4.
4. Sensor Connection: Threaded, NPS 1/2.
5. Bore: Sized to accommodate sensor with tight tolerance between sensor and well.
6. Furnish thermowells installed in insulated pipes and equipment with an extended neck.
7. Length: 4, 6, or 8 inches as required by application.
8. Thermowells furnished with heat-transfer compound to eliminate air gap between wall of sensor and thermowell and to reduce time constant.

D. Non-DDC Thermostats:

1. Electric Low Limit Duct Thermostat (Freezestat): Snap-acting, double pole, double throw, manual reset switch which trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint, requiring minimum 20 feet length of bulb. Provide one thermostat for every 20 sq. ft.
2. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type with heat anticipator, integral manual Auto-Off selector switch subbase. UL listed for electrical rating.

E. Other Electronic Sensors:

1. Current Sensing Relays: Provide current status switch for pump and fan status. Must be able to detect belt loss and motor failure. Switch shall be 100% solid state and have adjustable setpoint from 1 to 135 Amps. Veris Industries Hawkeye model H-708 or equivalent.
2. Humidity Sensors: bulk polymer sensor element. Multiple signal and power output including 4-20 ma, 0-10vDC; loop and 24v power.

    a. Space RH Transmitter: With locking cover to match room sensors. ±3%, accuracy from 5 to 95% RH.
    b. Duct and Outside Air RH Transmitter: With element guard and mounting plate. ±3% accuracy from 5 to 95% RH.

3. Carbon Dioxide Sensor and Transmitter:

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

        1) Kele, model KCD-W-V.
        2) Digital Control Systems, model 308 WC.
        3) Airsense, model 310e.

    b. Sensing Technology: Non-dispersive, infrared.
    c. Measurement Range: 0-2000 ppm.
    d. Accuracy: 3% of reading; or ± 40 ppm + 2% of reading.
    e. Repeatability: ± 20 ppm.
    f. Calibration Interval: 5 years.

F. Standard Control Valves:

1. General:

a. Control valves shall be factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
b. Close-Off Pressure Rating: Bubble-tight shutoff (no leakage) at the close-off pressure required for the application and its location in the system in which the valve is installed. It shall be the responsibility of the ATC Subcontractor to determine the required close-off pressure rating for each control valve.

2. Sizing:

a. Hydronic:

1) Two-Position: Line size or size using a pressure differential of 1 psi.
2) Two-Way Modulating: 5 psid or twice the load pressure drop, whichever is greater.
3) Three-Way Modulating: Twice the load pressure drop, but not more than 3 psid.

3. Characterized Control Ball Valves:

a. 3” and Smaller: Nickel-plated forged brass body rated at no less than 400 psi, stainless steel ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-ring packing design, fiberglass reinforced Teflon seats, and a TEFZEL or stainless steel flow characterizing disc.
b. 2-1/2” through 6”: GG25 cast iron body, ANSI 125, class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring package design, PTFE seats, and a stainless steel flow characterizing disc.
c. Valve assemblies shall be maintenance free.

G. Control Valves for System Shut-off or Isolation Service Only:

1. General:

a. Control valves shall be factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
b. Close-Off Pressure Rating: Bubble-tight shutoff (no leakage) at the close-off pressure required for the application and its location in the system in which the valve is installed. It shall be the responsibility of the ATC Subcontractor to determine the required close-off pressure rating for each control valve.

2. Sizing:

a. Hydronic:
1) Three-Way Modulating: Twice the load pressure drop, but not more than 3 psid.

3. Butterfly Pattern Control Valves:

    a. NPS 2 to 12: Valve body shall be full lugged, 200-psig rated ductile iron body with a 304 stainless steel flow characterizing disc, 416 stainless steel shaft; EPDM O-ring, and resilient EPDM seat. The valve shall have an extended neck and shall meet ANSI Class 125/150 flange standards. Disc-to-stem connection shall utilize an internal spline. The shaft shall be supported at four locations by RPTFE bushings. A coated disc shell is not acceptable.
    b. Sizing: Two-Position (on/off) butterfly valves shall be sized using the 900 Cv rating. Modulating butterfly valves shall be sized using the 600 Cv rating.
    c. Flow Characteristics: Modified equal percentage, unidirectional dead end service.

        1) Each 2-way control valve shall have a modified equal percentage type flow characteristic, unidirectional dead end service.

    d. The combination of two 2-way butterfly valves in a tee configuration cross-linked to ensure proper flow orientation shall be permitted. The tee shall be constructed of cast iron/stainless steel.

H. Valve Actuators:

1. Size for torque required for damper seal at maximum design conditions and valve close-off pressure for system design.
2. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle; directly couple and mount to the valve bonnet stem; or ISO-style direct-coupled mounting pad.
3. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
4. Overload protected electronically throughout rotation.
5. Fail Safe Operation: Mechanical fail safe shall incorporate a spring-return mechanism. Electronic fail safe shall incorporate an active balancing circuit to maintain equal charging rates among the super capacitors with a visual indication of the fail safe status on the actuator face, and with the following:

    a. Power fail position field adjustable between 0 to 100% in 10-degree increments
    b. A 2-second operational delay, field adjustable between 0 and 10 seconds
    c. Capability of changing the fail-safe position through an integrated switch without removing the mounted actuator.

6. Power Requirements: 24-volts AC/DC or 120-volts AC
7. Proportional Actuators shall be software configurable through an EEPROM without the use of actuator mounted switches. Programmable functions shall include a scalable operating range from 0.5 - 32.0 volts DC with a 2.0 volt DC (min) span; variable runtime; and data logging.
8. Temperature Rating: -22°F to +122°F
9. Housing: NEMA type 2 for indoor locations and NEMA type 4X for outdoor locations.
10. Actuator shall be UL listed.
11. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
12. Provide binary valve position feedback contacts for 2-position valves and analogue valve position feedback contacts for modulating valves.

I. Damper Actuators:

1. Size for torque required for damper seal at maximum design conditions.
2. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle; directly couple and mount to the valve bonnet stem; or ISO-style direct-coupled mounting pad.
3. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
4. Overload Protection: The actuator shall be overload protected electronically throughout rotation.
5. Fail Safe Operation: Mechanical fail safe shall incorporate a spring-return mechanism. Electronic fail safe shall incorporate an active balancing circuit to maintain equal charging rates among the super capacitors with a visual indication of the fail safe status on the actuator face, and with the following:

    a. Power fail position field adjustable between 0 to 100% in 10-degree increments
    b. A 2-second operational delay, field adjustable between 0 and 10 seconds
    c. Capability of changing the fail-safe position through an integrated switch without removing the mounted actuator.

6. Power Requirements: 24-volts AC/DC or 120-volts AC
7. Proportional Actuators shall be software configurable through an EEPROM without the use of actuator mounted switches. Programmable functions shall include a scalable operating range from 0.5 - 32.0 volts DC with a 2.0 volt DC (min) span; variable runtime; and data logging.
8. Temperature Rating: -22°F to +122°F
9. Housing: NEMA type 2 for indoor locations and NEMA type 4X for outdoor locations.
10. Actuator shall be UL listed.
11. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
12. Provide binary damper position feedback contacts for 2-position dampers and analogue damper position feedback contacts for modulating dampers.

2.6 CONTROL PANEL ENCLOSURES

A. Control panel enclosures shall be NEMA 1 enclosures constructed of minimum 16-gauge steel or minimum 14-gauge aluminum. Control panel enclosures shall have a perforated metal subpanel for mounting of control components and panels. Control panel enclosures shall have a hinged door and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Also, confirm locations of thermostats, humidistats, and other exposed control sensors with Architect and/or Owner prior to rough-in. Install devices 48 inches above the floor to comply with ADA requirements.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

C. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors. Provide sun shield for sensing element.

D. Provide separable sockets for liquids and flanges for air bulb elements.

E. Locate all control panel enclosures within mechanical or electrical equipment rooms.

1. Consideration may be given to locating control panel enclosures in spaces other than mechanical or electrical equipment rooms that are typically unoccupied, such as Storage Rooms, Janitor Closets, etc. The ATC Subcontractor must coordinate and obtain approval for each proposed location with the Architect and/or Owner prior to installation.
2. Under no circumstances shall control panel enclosures be installed in finished rooms or rooms intended for occupancy unless such locations are specifically requested by the Owner.

F. Install guards on thermostats in the following locations:

1. All locations.

G. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

H. Connect and configure equipment and software to achieve sequence of operation specified.

I. Install damper motors on outside of duct in warm areas only. Do not install damper motors in locations exposed to outdoor temperatures.

J. Install labels and nameplates to identify control components in accordance with Division 23 Section 230553 "Identification for HVAC Piping and Equipment."

K. Install hydronic instrument wells, valves, and other accessories in accordance with Division 23 Section 232113 "Hydronic Piping."

3.2 CONTROL VALVE INSTALLATION

A. Install control valves where required by Division 23 Section 230993 "Sequence of Operation for HVAC Controls."

1. Install standard control valves in all locations requiring a control valve except at the hot water and chilled water coils of the air handling units identified above.

3.3 WIRING INSTALLATION

A. Run all line voltage control wiring in conduit in accordance with the National Electric Code and the requirements specified in Division 26, Sections “Basic Electrical Requirements;” “Basic Electrical Materials and Methods,” “Raceways;” “Wires and Cables;” “Cabinets, Boxes, and Fittings;” “Supporting Devices;” and “Electrical Identification.”

B. Power for controls shall be obtained from the nearest normal/emergency power panel.

C. All low voltage power wiring shall be as described below:

1. Provide "plenum-rated" cable for low voltage wiring.

    a. Except where otherwise prohibited by applicable codes, conductors and cables operating at less than 30 volts and having "plenum type" insulation listed for compliance with NEC Article 300-22(c) are permitted to be installed without raceways above accessible suspended acoustic ceilings. Accessible suspended ceilings are defined as those having access panels, unsplined tiles for access purposes, and unclipped lay-in tiles for access purposes, or other approved access means at intervals of not more than 20 feet from one another.
    b. Where conductors or cables are installed in compliance with the above, the cables shall be neatly supported clear of the ceiling system by means of approved pre-formed nylon tie devices. Supports shall be accessible. Maintain a minimum spacing of than 18" between parallel runs of control wiring and wiring of other systems.

2. Run control wiring in EMT conduit in Mechanical rooms and other exposed wall and ceiling locations.

D. Connect manual-reset limit controls independent of manual control switch positions.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 MANUFACTURER'S FIELD SERVICES

A. Commission and start control systems. Use attached Commissioning Forms and submit completed forms to Owner and Engineer before training and final punchlist.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:

    a. Check analog inputs at 0, 50, and 100 percent of span.
    b. Check analog outputs using milli-ampere meter at 0, 50, and 100 percent output.
    c. Check digital inputs using jumper wire.
    d. Check digital outputs using ohmmeter to test for contact making or breaking.
    e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:

    a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    b. Manually operate flow switches to verify that they make or break contact.

6. Pressure:

    a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. Temperature:

    a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Setup the occupied/unoccupied DDC equipment time schedules based upon time schedules. Setup the initial occupied/unoccupied system temperature and humidity setpoints. Setup the initial local temperature adjustment ranges. Coordinate with the Owner to establish the initial values for schedules, setpoints, and ranges.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide a minimum of two (2) visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Provide all verification testing prior to functional performance testing.

B. Provide systems demonstration under provisions of Division 01.

C. Demonstrate complete operation of systems including Sequence of Operation after Date of Substantial Completion. The Owner or his appointed representative shall be given the opportunity to witness the functional performance testing and the successful demonstration of the operating sequences. The ATC Subcontractor shall provide the Owner or his appointed representative a minimum of 14-days notice prior to functional performance testing. Also, the ATC Subcontractor shall provide the Owner or his appointed representative a minimum of 14-days notice prior to demonstration of the operating sequences.

3.7 ON-SITE TESTING

A. Provide Engineer-approved operation and acceptance testing of the complete system. Complete Functional Test Checklist as outlined at end of this section for each piece of mechanical equipment controlled by ATC on this project. The Engineer, the Owner, and/or Owner representative may witness all tests and shall be given sufficient notice prior to any tests being conducted.

B. Field Test: When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the installer. Provide a detailed cross-check of each sensor within the system by making a comparison between the reading at the sensor and a standard traceable to the National Bureau of Standards.

C. Provide a cross-check of each control point within the system by making a comparison between the control command and the field-controlled device. For each DDC Controller test DDC software sequence to confirm a match with design sequence. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. Submit the results of functional and diagnostic tests and calibrations to the Engineer for final system acceptance as shown on Functional Test Checklist.

D. Compliance Inspection Checklist: Submit the requested items of information to the Owner's Representative and Architect/Engineer for verification of compliance to the project specifications. Failure to comply with the specified information shall constitute non-performance of the contract. The Subcontractor shall submit written justification for each item in the checklist that he is unable to comply with. The Owner's Representative and the Architect/Engineer will initial and date the checklist to signify Subcontractor's compliance before acceptance of system.

3.8 SERVICE AND GUARANTEE

A. General Requirements: Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of two years after completion of successful performance test. Provide necessary material required for the work. Minimize impacts on facility operations when performing scheduled adjustments and non-scheduled work. Without additional cost, provide software upgrades issued during the warranty period.

B. Description of Work: The adjustment and repair of the system includes all computer equipment, software updates, transmission equipment and all sensors and control devices. Provide the manufacturer's required adjustments and all other work necessary.

C. Personnel: Provide qualified personnel to accomplish all work promptly and satisfactorily. Owner shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

D. Emergency Service: Owner will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the complete system. Furnish owner with a telephone number where service representative can be reached at all times. Service personnel shall be at the site within 8 hours after receiving a request for service. Restore the control system to proper operating condition within 24 hours.

E. Operation: Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the initial performance test.

F. Systems Modifications: Provide any recommendations for system modification in writing to Owner. Do not make any system modifications, including operating parameters and control settings, without prior approval of Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

G. Software: Provide all software updates during the warranty period and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with the

system operators, and shall be incorporated into the operations and maintenance manuals, and software documentation.

3.9 TRAINING

A. The ATC Subcontractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. It is the intent of the Owner to become thoroughly versed in the operation and programming of the DDC system so as to make full use of system capabilities and be able to revise graphics. All information and documentation necessary to do this work must be provided.

1. Provide 40-hours of on-site training for Owner's operating personnel. Split training into minimum five (5) 8-hour sessions to be completed during the period of warranty. Coordinate/Schedule training sessions with the Owner a minimum of 14-days in advance. Training shall include:

    a. Explanation of drawings, operations, and user manuals
    b. Walk-thru of the job to locate control components
    c. Explanation of manual and automatic control devices
    d. DDC Controller and PRC operation/function
    e. Operation of operator's terminal, Central computer workstation and laptop computer
    f. Hands on training of Central computer workstation menus and commands to include fully functioning system
    g. Operator control functions including graphic generation and field panel programming
    h. Explanation of maintenance manuals
    i. Explanation of adjustment, calibration, and replacement procedures

B. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, the ATC Contractor must make additional training available. If the Owner requires such training, it will be contracted at a later date. Provide description of available local and factory customer training.

C. Prepare the following checklist for each piece of mechanical equipment that is controlled by ATC DDC.

Functional Test Checklist FT-___

Includes installation and wiring checkout, sensor and device calibration, and functional performance testing.

1. Participants

Party	Participation	Date

- *The checklist items are all successfully completed.....___ YES ___ NO*

2. Installation Checks

Check if Okay. Enter comment or note number if deficient. For each Terminal Unit

Check Equip Tag->						Notes
Air Systems						
Fans and Dampers						
Filter pressure differential measuring device installed and functional (magnehelic, inclined manometer, etc.).						
Dampers close tightly and all dampers (OSA, RA, EA, etc.) stroke fully without binding and spans calibrated and BAS reading site verified.						
All damper linkages have minimum play.						
Low limit freeze stat sensor located to deal with stratification & bypass.						
Variable Speed Drive operating properly.						
Electrical and Controls						
Safeties in place and operable						
Control system interlocks installed and functional						
Smoke detectors in place						
All control devices and wiring complete.						
Specified point-to-point checks have been completed.						
Specified sequences of operation and operating schedules have been implemented with all variations documented						

3. Sensor and Actuator Calibration
For each Terminal Unit

Sensor or Actuator & Location	Loc-ation OK	1st Gauge or BAS Value	Instr. Meas'd Value	Final Gauge or BAS Value	Pass Y/N?
DAT					
RAT					
Space Temp					
etc					

Sensor & Location	Loc-ation OK	1st Gauge or BAS Value	Instr. Meas'd Value	Final Gauge or BAS Value	Pass Y/N?

4. Device Calibration Checks. The actuators or devices listed below must be checked for calibration.

Device or Actuator & Location	Procedure / State	1st BAS Value	Site Observation	Final BAS Reading	Pass Y/N
Main OSA damper position**	1. Closed				
	2. Full open				
Return air damper position **	1. Closed				
	2. Full open				

5. Functional Performance Testing Record

Use one test record for each RTU, etc containing DDC Controller by ATC.

Seq. ID	Mode ID	Test Procedure (including special conditions)	Expected Response	Pass Y/N	Note
	FAN OFF	Standby Check. With Units Commanded off by BAS.	Verify by visual inspection that: Return Air Dampers in AHU are Open and Outside Air Dampers and Relief Dampers are Closed, Cooling Coil Valve is Closed, Hot Water Coil - Valve is Open.		
	UNIT STARTUP	With Units Commanded on by BAS.	Supply Fan Starts.		
	TEMPERATURE CONTROL ENTHALPY/ ECONOMIZER	1. Utilizing BAS, Record OSA & RA Temp. and OSA & RA Humidity. 2. Calculate Enthalpy of OSA. 3. Utilizing Enthalpy calculations, modulate dampers such that Enthalpy of OSA is less than Enthalpy of Return Air at revised conditions.	Outdoor Air Dampers and Return Air Dampers should modulate to maintain Enthalpy/Economizer setpoint. Cooling Coil Valves should be closed.		
	DISCHARGE AIR OR SPACE TEMPERATURE	Modulate heating and/or cooling to maintain setpoint.	Verify that AHU System maintains setpoint by modulating/staging HVAC equipment.		

Seq. ID	Mode ID	Test Procedure (including special conditions)	Expected Response	Pass Y/N	Note
	DISCHARGE TEMPERATURE RESET	If reset required, test at different temperatures. Utilizing BAS Trend Logging, at 6 min intervals and record DAT setpoint, DAT.	Verify that Discharge Air Temperature Setpoint is reset at increments according to programmed time intervals to maintain schedule.		
	SMOKE CONDITIONS	Interfacing with EC, simulate a fire mode with the Fire Alarm System.	Verify that AHU System returns to FAN OFF Status, with OSA and Relief Dampers in a Closed Position.		
	WARMUP CONTROL	Place Units' BAS Control Mode into Warm-up. Overwrite RAT Sensor Reading to be 65°F. Then overwrite RAT Sensor Reading to be 72°F.	Verify that dampers assume a 100% Return Air Mode. Then verify that unit returns to Normal Operation Mode.		
	FREEZE CONDITION	Simulate a low temperature condition at low limit detection thermostat of below 35°F.	Verify that system alarms, fan stop, OSA Dampers close, RA dampers open and Heating Valve Opens.		
	FILTER DROP	Reset the Filter Differential Pressure to exceed the setting recommended by the filter manufacturer.	Verify that the BAS reports an alarm.		
	REVIEW	Review schedules, current setpoints and sequences with Sequence of Control and Control Drawings prepared by ATC.	Submit approved differences to be incorporated into As-Builts.		

- END OF TEST -

END OF SECTION 230900

SECTION 230993
SEQUENCE OF OPERATION 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 01 Specification Sections, apply to this Section.

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. ATC: Automatic Temperature Control.

C. BAS: Building Automation System.

D. AI: Analog Input.

E. AO: Analog Output.

F. DI: Digital Input.

G. DO: Digital Output.

H. VAV: Variable air volume.

I. VF: Variable Frequency.

J. AHU: Air Handling Unit.

K. RTU: Rooftop Unit.

L. CO_2: Carbon Dioxide

1.4 MISCELLANEOUS REQUIREMENTS

A. The control strategies described in this section shall be used in conjunction with the Input/Output Summary Tables attached herein for engineering the control systems and preparing the required control drawings.

B. The Input/Output Summary Tables and the sequence have been made to complement one another. The ATC Contractor shall interpret the sequences and the Input/Output Summary Tables such that if a device is called for in one and not the other, it will be treated as if called for in both.

C. Control of all HVAC equipment shall be through the DDC system and by electric control as specified per individual sequence.

D. Whether indicated or not, all temperature setpoints included in the sequences of this Section shall be adjustable.

PART 2 - PRODUCTS

2.1 Refer to Division 23 Section 230900 "Automatic Temperature Control for HVAC" for control equipment and devices.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. The following general applications software shall be required on all appropriate equipment for the purpose of optimizing energy consumption while maintaining occupant comfort:

B. Time of Day Scheduling [TOD]: The system shall be capable of the following scheduling features:

1. Scheduling by building, area, zone, groups of zones, individually controlled equipment and groups of individually controlled equipment. Each schedule shall provide beginning and ending dates and times [hours: minutes]. A weekly repeating schedule, i.e. between 8:00 a.m. and 5:00 p.m., Monday through Friday shall constitute one schedule, not five.
2. Dated schedules shall be entered up to 9 [nine] years in advance.
3. Schedules shall be self-deleting when effective dates have passed.
4. Leap years shall be adjusted automatically without operator intervention.
5. For maximum speed in the communication of schedules, the operator shall have the ability to communicate schedules at the most efficient level with one scheduling command through the mouse interface. This ranges from system wide to individual zones, groups or pieces of equipment.
6. The system shall allow the operator to designate any combination of equipment to form a group that can be scheduled with a single operator command through the mouse interface at the workstation. Any designated group shall have the capability to be a member of another group.
7. The operator shall be able to make all schedule additions, modifications and deletions using the mouse and appropriate dialog boxes. In addition, the operator shall have the capability to edit all schedules off line and then download any or all schedule changes to the control modules with a single operator command through the mouse interface. In the event that a schedule in the control module is different from the workstation, the operator shall have the capability to upload any or all schedules from the control module to the workstation.

8. The operator shall be able to view a color-coded forecast of schedules for instant overview of facilities schedules. Schedule graphic forecast shall include colored coded indication of all types of schedules, i.e. normal, holiday and override.

C. Optimum Start/Stop [OSS]/Optimum Enable/Disable [OED]:

1. Provide software to start and stop equipment on a sliding schedule based on the individual zone temperature and the heating/cooling capacity in øF/hour of the equipment serving that zone. The heating/cooling capacity value shall be operator adjustable. Temperature compensated peak demand limiting shall remain in effect during morning start up to avoid setting a demand peak.

D. Day/Night Setback [DNS]:

1. The system shall allow the space temperature to drift down [up] within a preset [adjustable] unoccupied temperature range. The heating [cooling] shall be activated upon reaching either end of the DNS range and shall remain activated until the space temperature returns to the DNS range.
2. The system shall be capable of closing all outside air and exhaust air dampers during the unoccupied period, except for 100% outside air units.
3. Unoccupied space temperature shall be monitored by the DDC temperature sensors located in the individual zones being controlled or within a representative room in the building if full DDC control is not being affected.
4. User shall be able to define, modify or delete the following parameters.

    a. DNS setpoint temperature[s]
    b. Temperature band for night heating operation
    c. Period when the DNS is to be activated

E. Timed Local Override [TLO]:

1. The system shall have TLO input points that permit the occupants to request an override of equipment that has been scheduled OFF. The system shall turn the equipment ON upon receiving a request from the local input device. Local input devices shall be push button [momentary contact], wind-up timer, or ON/OFF switches as detailed in the I/O summary.
2. If a push button is used the system operator shall be able to define the duration of equipment ON time per input pulse and the total maximum ON time permitted. Override time already entered shall be canceled by the occupant at the input point. If a wind-up timer is used the equipment will stay in override mode until the timer expires. Year to date, month-to-date and current day override history shall be maintained for each TLO input point. History data shall be accessible by the operator at any time and shall be capable of being automatically stored on hard disk and/or printed on a daily basis.

F. Space Temperature Control [STC]: There shall be two space temperature setpoints, one for cooling and one for heating, separated by a dead band. Only one of the two setpoints shall be operative at any time. The cooling setpoint is operative if the actual space temperature has more recently been equal to or greater than the cooling setpoint. The heating setpoint is operative if the actual space temperature has more recently been equal to or less than the heating setpoint. There are two modes of operation for the setpoints, one for the occupied mode [example: heating = 72°F or cooling = 76°F] and one for the unoccupied mode [example: heating = 55°F or cooling = 90°F].

G. The occupied/unoccupied modes may be scheduled by time, date, or day of week.

1. If the actual space temperature is in the dead band between the heating setpoint and the cooling setpoint, the color displayed shall be green for the occupied mode, representing ideal comfort conditions. If in the unoccupied mode, the color displayed shall be gray representing 'after-hours' conditions.
2. If the space temperature rises above the cooling setpoint, the color shall change to yellow.
3. When space temperature falls below the heating setpoint, the color shall change to light blue.
4. All setpoints and offsets shall be operator definable. When in the occupied mode, start-up mode, or when heating or cooling during the night setback unoccupied mode, a request shall be sent over the network to other equipment in the HVAC chain, such as to an AHU fan that serves the space, to run for ventilation. The operator shall be able to disable this request function if desired.
5. When comfort conditions are warmer than ideal, indicated by the color yellow a request for additional cooling shall be sent over the network to other cooling equipment in the HVAC chain, such as a chiller. This information is to be used for optimization of equipment in the HVAC chain. The operator shall be able to disable this function if desired.
6. When comfort conditions are cooler than ideal; indicated by the color light blue, a request for additional heating shall be sent over the network to other heating equipment in the HVAC chain, such as a boiler. This information is to be used for optimization of equipment in the HVAC chain. The operator shall be able to disable this function if desired.
7. The cooling [and heating] setpoints may be increased [decreased] under demand control conditions to reduce the cooling [heating] load on the building during the demand control period. Up to three levels of demand control strategy shall be provided. The operator may predefine the amount of setpoint increase [decrease] for each of the three levels. Each space temperature sensor in the building may be programmed independently.
8. An optimum start-up program transition from the unoccupied setpoints to the occupied setpoints. The optimum start-up algorithm considers the rate of space temperature rise for heating and the rate of space temperature fall for cooling under nominal outside temperature conditions; it also considers the outside temperature; and the heat loss and gain coefficients of the space envelope [AI: Space Temperature].
9. A PID control loop, comparing the actual space temperature to its setpoint, shall modulate the dampers [and heating coil valve or heating stages in sequence] to achieve the setpoint target.

3.2 GLOBAL CONTROL VALVE OPERATION

A. Provide a DDC global control valve point or software program override index signal to enable/ disable the hot water system control valves. This operation shall allow all the control valves in the hot water system to be positioned full open for balancing.

3.3 GLOBAL VAV AND FAN POWERED TERMINAL BOX PRIMARY AIR VALVE OPERATION

A. Provide a DDC global primary air control valve point or software program override index signal to enable/ disable the VAV system primary air valves. This operation shall allow all the primary air valves in the respective VAV system to be positioned full open for balancing.

3.4 HOT WATER SYSTEM

A. The building hot water system shall be controlled via the building DDC system and each boiler's integral controller. The ATC Subcontractor shall provide DDC control components to accomplish the sequence described below.

1. The boiler manufacturer will furnish a boiler control system to control and optimize the operation of the hot water plant in conjunction with the DDC system. The ATC Subcontractor shall coordinate his control requirements with the requirements of the boiler master controller described in Division 23 Section 235223.19 "Cast-Iron Boilers

B. **Two** new boilers shall supply hot water to the areas in the building being renovated via two primary [boiler] pumps - one each per boiler - and two secondary [building] pumps.

C. The ATC Subcontractor shall provide all field labor to install all sensors shipped loose by the boiler manufacturer. In addition, the ATC Subcontractor shall provide all field labor, wiring and conduit to connect all sensors shipped loose to the boiler master controller.

D. The ATC Subcontractor shall provide controls necessary for the DDC system to perform the following:

1. The DDC system shall activate and de-activate the heating system. The DDC system shall send a signal to the boiler control system to activate the heating system whenever any of the following occurs:

a. The building is indexed to Occupied.
b. The building is indexed to Unoccupied, and the outside air temperature drops below 60°F [adjustable]. The DDC system shall send a signal to each boiler's integral controller to de-activate the heating system when building is indexed to Unoccupied, and the outside air temperature rises above 65°F [adjustable].

1) Provide an edit point at the DDC panel and/or at the DDC system operator's workstation to allow an authorized operator to manually override the DDC system to energize or de-energize the heating system. The override shall have an adjustable time period. The override point shall be accessed and addressed at the laptop or through the telephone modem. When this event occurs, a message shall be recorded at the DDC system operator's workstation.

2. When the DDC system sends a signal to the boiler control system to activate the heating system, the DDC system shall start the lead building loop [secondary] hot water pump. When the heating system is deactivated, the lead building loop [secondary] pump shall continue to run for a 30-minute [adjustable] timed period.
3. If the lead building loop [secondary] hot water pump fails to start [or fails during operation] as proven by a current switch, an alarm shall be sent to the DDC system operator's workstation informing the operator of the malfunction. The signal to the original lead building loop [secondary] hot water pump shall be disabled through DDC. The DDC system shall then send a signal for the lag/standby secondary [building] pump to start.

a. The DDC system shall contain a run time program to automatically rotate the lead and lag/standby building loop [secondary] hot water pumps when the accumulated run time exceeds predetermined number of hours. Ensure that the first lead building loop [secondary] hot water pump is stopped before the new lead building

loop [secondary] hot water pump is started. Only one building loop [secondary] hot water pump shall be energized at any one time.

4. When the DDC system indicates that the heating system shall be activated, the boiler control system shall determine which boiler shall be activated. Refer to Division 23 Section 235223.19 “Cast-Iron Boilers” for requirements.

E. The boiler control system will be furnished by the boiler manufacturer for lead-lag control and optimized operation of the boilers, for modulating and on-off burner control, **for control of 3-way valves**, for reset of hot water supply temperature in accordance with outdoor air temperature, for monitoring and alarming high boiler water pressure, and for on-off control of the boiler loop [primary] hot water blend pumps. The boiler control system shall include the following components, functions and capabilities:

1. Sensors for system hot water return temperature, hot water supply temperature at the outlet of each boiler, blended boiler hot water supply temperature to 3-way valves, blended hot water supply temperature to the load [building], and outside air temperature.
2. When it receives a signal from the DDC system to activate the heating system, the boiler control system shall energize the boiler loop [primary] hot water blend pump associated with the lead boiler. Once it determines that flow is proven through the lead boiler, the boiler control system shall energize the lead boiler and control its burner.

    a. The boiler control system shall also determine through its optimization program when lag boilers should be energized.
    b. When a boiler is de-energized by the boiler control system, its boiler loop [primary] hot water blend pump shall continue to operate for a period of 30-minutes [adjustable] before it too is de-energized by the boiler control system.

3. The boiler control system shall extend the burner firing periods to increase seasonal efficiency by reducing burner on-off cycles and avoiding thermal losses with excessive pre-purge and post-purge cycles. The boiler control system shall adjust boiler response to load changes by analyzing return water temperature, outside air temperature, boiler water temperature and blend temperature to the load [building].
4. The boiler control system shall alternate the designation of the lead boiler and the lag/stand-by boilers after 250 hours [adjustable] of cumulative firing time of the lead boiler.
5. The boiler control system shall have a display on the front panel that shall indicate the following conditions:

    a. Heating system enable.
    b. Boiler 1 enable.
    c. Boiler 2 enable.
    d. Boiler #1 down on failure condition.
    e. Boiler #2 down on failure condition.
    f. Primary [boiler] blend pump 1 failure.
    g. Primary [boiler] blend pump 2 failure.
    h. High boiler water pressure.

6. The boiler control system shall generate a line voltage on-off switched signal and a 135 ohm or 4-20 ma modulating signal for each burner.
7. The boiler control system shall energize the lag/standby boilers if the lead boiler has a flame failure or other safety shutdown.

8. The boiler control system shall control the operation and firing of the boilers to control the building loop hot water supply temperature [to load] as follows:

Hot Water Supply Temperature		Outside Air Temperature
180°F[adjustable]		15°F and below [adjustable]
170°F[adjustable]		40°F [adjustable]
155°F[adjustable]		45°F [adjustable]
140°F[adjustable]		50°F [adjustable]
125°F[adjustable]		55°F [adjustable]
110°F[adjustable]		60°F and above [adjustable]

9. The boiler control system shall stage the two boilers on and off in an energy efficient manner.
10. A boiler pressure transducer shall monitor boiler water pressure to avoid relief valve weeping or opening caused by failure of pressure regulating valve on cold water supply line or caused by incorrect pressurization of the bladder-type expansion tank. A common manual reset alarm light shall be provided.

F. The ATC Subcontractor's field technician shall coordinate with the Boiler manufacturer's factory certified technician during startup. The ATC Subcontractor's field technician shall be available to the Boiler manufacturer's factory certified technician during his necessary testing procedure as outlined in Division 23 Section 235223.19 "Cast-Iron Boilers."

G. The ATC Subcontractor shall provide the interlock wiring at the boiler as required by the boiler manufacturer including but not limited to the low water cut-off, high limit, main gas valve proof of closure switch, safety gas valve, high and low gas switches, and to the boiler master controller.

H. Emergency stop buttons, located at each entrance to the boiler room will close a main gas valve, disable all hot water boilers and send an alarm to the BAS any time the buttons are depressed.

I. The boiler manufacturer will furnish a boiler control system that is BACNET compatible. The ATC Subcontractor shall connect the DDC system to the boiler control system to monitor operation of the heating system and to adjust setpoints.

J. In addition to the building-loop [secondary] pumps, each boiler-loop [primary] pump shall be provided with a variable frequency drive. Unlike the building-loop [secondary] pumps, the boiler-loop [primary] pump shall not vary once its speed is determined through the water balancing operation. The boiler-loop [primary] pumps shall operate at constant speed and the variable frequency drives shall be used for balancing purposes only.

K. Makeup Water Meter:

1. Connect to the makeup water meter pulse connection and convert to gallons. Display gallons on the DDC system operator's console. Should 60 gallons [adjustable] flow for any two minute [adjustable] period, send an alarm to the DDC system operator's console and send a text message to the Owner's service technician.

L. The ATC Subcontractor shall provide break glass switches at each exit door. The switches shall be wired to de-energize the boilers and domestic hot water heaters when the switches are in an alarm condition.

M. DDC Points List for Heating System:

1.	AI	Outside Air Temperature
2.	AI	Hot Water Supply Temperature Downstream of The Secondary Pump
3.	AI	Hot Water Supply Temperature, One at Each Boiler [Each Boiler]
4.	AI	Hot Water System Remote Differential Pressure [mounted 2/3 distance from pump to most remote outlet]
5.	AI	Hot Water System Local Differential Pressure [mounted in Boiler Room]
6.	AI	Hot Water Return Temperature in Common Return
7.	AI	Makeup water meter [pulse] gallon reading
8.	AO	Three-Way Valve Control [Each]
9.	DI	Boiler Status [Each]
10.	DI	Hot Water Pump Status [Each]
11.	DI	Boiler Water Flow Switch [Each]
12.	DI	Boiler Emergency Shutdown Alarm
13.	DI	Domestic Hot Water Boiler Status
14.	DI	Boiler Alarm [Each]
15.	DO	Boiler Start/Stop [Each]
16.	DO	Boiler High Stage Control [Each]
17.	DO	Boiler Low Stage Control [Each]
18.	DO	Hot Water Pump Start/Stop [Each]

3.5 VARIABLE AIR VOLUME [VAV] TERMINAL BOXES WITH **HOT** WATER REHEAT COILS

A. New and existing VAV terminal box shall be controlled via the building DDC system. The ATC Subcontractor shall provide DDC control components to accomplish the sequence described below.

B. Each VAV terminal box shall have a primary air damper and a hot water reheat coil. The ATC Subcontractor shall provide DDC control components to accomplish the sequence described below.

C. The ATC Subcontractor shall furnish DDC controls to the VAV terminal box manufacturer for factory mounting and wiring by the terminal box manufacturer.

D. VAV Terminal Box Cool-Down Mode:

1. In the Cool-down Mode the **rooftop unit** shall energize, the VAV terminal box primary air damper shall open to its maximum position, and the **normally open hot water reheat coil control valve shall remain closed.**
2. As space temperature approaches its cooling setpoint of 74ºF [adjustable], the VAV terminal box primary air damper shall be modulated to its minimum occupied position.
3. If space temperature drops below the heating setpoint of 72ºF [adjustable], the VAV terminal box's hot water reheat coil control valve shall be modulated to maintain a minimum space temperature of 72ºF [adjustable].

E. VAV Terminal Box Warm-up Mode:

1. In the Warm-up Mode the **rooftop unit** shall energize and the VAV terminal box primary air damper shall open to its minimum position.
2. If space temperature is below the heating setpoint of 72ºF [adjustable], the VAV terminal box's **hot water reheat coil control valve shall open**. As space temperature

approaches the heating setpoint, the **hot water control valve** shall be modulated to maintain a minimum space temperature of 72ºF [adjustable].

F. VAV Terminal Box Occupied Mode:

1. In the Occupied mode, the VAV terminal box primary air damper shall open to its minimum position. A space temperature sensor shall modulate the primary air damper between its minimum occupied position and its maximum occupied position to maintain cooling temperature setpoint of 74ºF [adjustable].
2. When space temperature drops below the cooling temperature setpoint of 74ºF [adjustable] toward the heating setpoint of 72ºF [adjustable], the VAV terminal box primary air damper shall be modulated to its minimum occupied position. If space temperature drops below the heating setpoint of 72ºF [adjustable], then the VAV terminal box's **hot water reheat coil control valve** shall be modulated to maintain a minimum space temperature of 72ºF [adjustable].
3. When the VAV terminal box's **hot water reheat coil control valve is full open** for more than 180 seconds [adjustable], and the space temperature drops below the heating setpoint of 72ºF [adjustable], then the VAV terminal box shall modulate the primary air damper between its minimum occupied position and its scheduled heating airflow position to maintain heating temperature setpoint of 72ºF [adjustable].

G. VAV Terminal Box Unoccupied/Night Setback Mode:

1. In the Unoccupied/Night Setback mode, the VAV terminal box primary air damper shall be at its minimum position and its **hot water reheat coil control valve shall be closed**. When room temperature drops below the night setback heating setpoint of 65ºF [adjustable], the **rooftop unit** supply fan shall energize, the VAV terminal box primary air damper shall open, and the VAV terminal box **hot water reheat coil control valve shall open**. Once the space temperature rises 2°F [adjustable] above the night setback temperature setpoint, the **rooftop unit** supply fan shall de-energize, the VAV terminal box primary air damper shall close, and the VAV terminal box **hot water reheat coil control valve shall close**.
2. The override button on any of the room sensors shall override the night setback mode and shall place the VAV terminal boxes and its associated **rooftop unit** into the Occupied mode for a timed period of 2-hours [adjustable]. Once the timed period is complete, the system shall revert back to the night setback mode.

H. Each VAV terminal box shall be provided with a discharge air temperature sensor located downstream of the terminal box reheat coil. The sensor will be utilized for trouble-shooting purposes.

I. Coordinate the control system requirements with the requirements as described in Division 23 Section 233600 "Air Terminal Units."

J. DDC Input/Output Points for VAV Terminal Boxes with Hot Water Reheat Coils:

1. AI Space/Zone Temperature
2. AI Discharge Air Temperature
3. AI Space/Zone Airflow Rate
4. AO Terminal Box Damper
5. AO Hot Water Reheat Coil Control Valve
6. DI Local Occupied/Unoccupied Override

3.6 MISCELLANEOUS COMMON POINTS

A. The ATC Subcontractor shall provide the following sensors that shall be common to all sequences:

1. A minimum of two [2] outdoor air temperature sensors shall be provided. These sensors shall be mounted on the north facing side of the building and shall be provided with sun shields [if necessary]. The temperature measurements from the two sensors shall be averaged. If a difference of more than 1°F is measured between the two sensors, an alarm shall be registered at the operator's workstation.
2. A minimum of two [2] outdoor air humidity sensors shall be provided. The humidity measurements from the two sensors shall be averaged. If a difference of more than 2% RH is measured between the two sensors, an alarm shall be registered at the operator's workstation.
3. A minimum of two [2] outdoor air CO2 sensors shall be provided. The CO2 measurements from the two sensors shall be averaged. If a difference of more than 30 ppm is measured between the two sensors, an alarm shall be registered at the operator's workstation.

B. DDC Input/Output Points for Miscellaneous Points

1. AI Outdoor Air Temperature [2 each]
2. AI Outdoor Air Relative Humidity [2 each]
3. AI Outdoor CO2 [2 each]

END OF SECTION 230993

SECTION 232113
HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

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

1. Hot water heating piping.
2. Makeup water piping.
3. Blowdown drain piping.
4. Air vent piping.
5. Safety valve inlet and outlet piping.

1.3 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot Water Heating Piping: 125 psig at 200°F.
2. Blowdown Drain Piping: 200°F.
3. Air Vent Piping: 200°F.
4. Safety Valve Inlet and Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.4 SUBMITTALS

A. Product data - for each type of the following:

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

B. Shop Drawings:

1. Detail, at 1/4 (1:50) scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

2. Diagrams depicting the components and installation of service valves, strainers, control valves, balance valves, P&T taps, air vents, and flexible connectors applicable to each piece of terminal equipment, heat exchanger, or air coil.

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

1.5 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).

B. Wrought-Copper Fittings: ASME B16.22.

C. Copper or Bronze Pressure-Seal Fittings

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

a. Stadler-Viega.

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250°F.

D. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.

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

a. T-DRILL Industries Inc.

E. Wrought-Copper Unions: ASME B16.22.

2.2 JOINING MATERIALS

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

2.3 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section 230523 "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section 230900 "Automatic Temperature Controls for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

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

   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump; a division of ITT Industries.
   c. Flow Design Inc.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gauge Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250°F.

2.4 AIR CONTROL DEVICES

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

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

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/8 (DN 6).
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225°F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/4 (DN 8).

6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240°F.

D. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375°F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Heavy-duty butyl rubber securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air Charge Fittings: Schrader valve, stainless steel with EPDM seats.

E. Coalescing Type High Efficiency Air and Dirt Eliminator:

1. Coalescing type high efficiency air and dirt eliminator shall be manufactured by Spirotherm or approved equal.
2. Pipe size is not a factor and all units should be selected at the point of peak efficiency per the manufacturer's recommendations.
3. Air eliminators / separators shall be fabricated steel, rated for 150 psig working pressure with entering velocities not to exceed 4 feet per second at specified GPM. Designated models specifically designed for high velocity systems may have an entering velocity of up to 10 feet per second.
4. Vessel diameter shall be a minimum of two times pipe size. Vessel height above the nozzle center-line shall be a minimum of 3 times pipe size for standard units and 4.5 times pipe size for high velocity units. Vessel shall extend below nozzle center-line the same distance for dirt separation.
5. Units shall include an internal wire-wound bundle filling the entire vessel to suppress turbulence and provide high efficiency. The bundle shall consist of a copper core tube with continuous wound copper medium permanently affixed to the core. A separate copper medium is to be wound completely around and permanently affixed to each internal element.
6. Each eliminator shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism.
7. Units shall include a valved side tap to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill.
8. Unit shall include a blow down valve at bottom for removal of collected dirt and sediment.
9. Unit shall include a removable flanged lower head for internal inspection.
10. Air eliminator function shall be capable of removing 100% of the free air, 100% of the entrained air, and up to 99.6% of the dissolved air in the system fluid during continuous circulation.
11. Dirt and sediment separator function shall be capable of removing 80% of particles 30 micron and larger within 100 passes. A properly selected strainer (see strainer specification) shall be installed upstream to collect large debris that may be left in the piping.
12. Centrifugal / tangential type air separators may be considered as a substitution, provided the following criteria is met:

    a. Multiple centrifugal / tangential type air separators shall be installed in a header arrangement, each capable of removing 97.5% entrained air.
    b. Centrifugal / tangential alternates shall be a minimum diameter of three times pipe size.
    c. The HVAC Trade shall submit for approval a drawing showing piping arrangement for multiple units and manufacturer's published engineering data which supports air and dirt separation meeting the criteria stated herein. No consideration will be

given to any contractor who claims to have prepared their bid on a substituted air and dirt separator assembly which cannot substantiate the performance specified herein.

d. Included with multiple centrifugal / tangential air separators shall be a full flow top-outlet dirt separator meeting the performance specified herein. By-pass or side-stream filters are not acceptable.

13. Tank: Welded steel; ASME constructed and labeled for 125-psig (860-kPa) minimum working pressure and 375° F maximum operating temperature.
14. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
15. Tangential Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; flanged connections for NPS 2-1/2 (DN 65) and larger.
16. Blow down Connection: Threaded.
17. Size: Match system flow capacity.

2.5 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Stainless steel Bellow, Flexible Connectors:

1. Body: Stainless steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250°F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot water heating piping, aboveground, NPS 2 (DN 50) and smaller, shall be the following:

1. Type **L (B)**, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Makeup water piping, aboveground, shall be the following:

1. Type L (B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

C. Blowdown Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

D. Air Vent Piping:

1. Inlet: Same as service where installed.
2. Outlet: Type K (A), annealed-temper copper tubing with soldered or flared joints.

E. Safety Valve Inlet and Outlet Piping for Hot water Piping: Same materials and joining methods as for piping specified.

F. Pipe Fittings:

1. Elbows: Elbows shall be constructed of the same material as the piping to which they attach. All pipe elbows shall be factory fabricated and shall have a minimum radius equal to 1.5 times the pipe diameter.
2. Tees: Tees shall be constructed of the same material as the largest pipe size to which they attach. Tees shall be factory fabricated.

    a. Option: For copper piping, tees may be permitted to be mechanically formed.

3. Reducing Fittings: Reducers shall be constructed of the same material as the largest pipe size to which they attach. Reducers shall be tapered, having a maximum taper angle of 26.6 degrees. Abrupt-type fittings are not permissible.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Calibrated orifice, balancing valves shall not be used on equipment where pressure independent control valves are installed. Refer to Division 23 Section 230900 "Automatic Temperature Control for HVAC" for locations where calibrated orifice, balancing valves are required to be installed.

E. Install check valves at each pump discharge and elsewhere as required to control flow direction.

F. Install safety valves at hot water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. **pipe drain to nearest floor drain or as indicated on Drawings.** Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

G. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

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

B. Do not install piping in transformer vaults, elevator equipment rooms or electrical equipment rooms unless the piping serves HVAC equipment located in that room and is dedicated to provide cooling and/or heating to that room. Do not install piping adjacent to or above any surface of electrical controls, panels, switches, terminals, boxes or similar electrical equipment. Drip-pan protection shall not be permitted, except where detailed.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

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

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

M. Install drains, consisting of a tee fitting, **NPS 3/4** (**DN 20**) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

N. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

O. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

P. Install branch connections to mains using factory fabricated tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

Q. Install valves according to Division 23 Section 230523 "General - Duty Valves for HVAC Piping."

R. Install unions in piping**,** NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).

T. Verify final equipment locations for roughing-in.

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

V. Identify piping as specified in Division 23 Section 230553 "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section 230529 "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Piping shall be supported directly from the building substrate. Pipes are not permitted to be supported from other pipes, ducts, conduits, or cable tray.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for straight runs of individual horizontal piping less than 100 feet long.
2. Adjustable roller hangers for straight runs of individual horizontal piping 100 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple straight runs of horizontal piping 100 feet or longer, supported on a trapeze.
4. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span 5 feet; minimum rod size, 1/4 inch.
2. NPS 1 (DN 25): Maximum span 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2 (DN 40): Maximum span 8 feet; minimum rod size, 3/8 inch.
4. NPS 2 (DN 50): Maximum span 8 feet; minimum rod size, 3/8 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

F. For grooved piping, provide a pipe hanger at each coupling and on each side of tees and elbows in accordance with the mechanical joint manufacturer’s recommendations.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

1. Cut groove pipe is not acceptable.
2. Grooved joint piping shall only be installed in accessible locations such as in mechanical equipment rooms, above lay-in ceilings, in spaces without ceilings, etc. Grooved joint piping shall not be installed in inaccessible locations such as in chases, shafts, above drywall or plaster ceilings, etc.

G. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

H. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry or Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.7 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from air separator to **drain**.

D. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.

E. Install bladder type expansion tank(s) on the floor on a concrete equipment pad. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements. Before charging bladder tank with the proper air pressure, isolate (valve off) hydronic system from tank and drain all water from tank.

1. The proper air pressure charge in the tank shall be calculated as follows:

a. Calculate/measure the static head above the tank in feet. Convert the height of the system from feet to psi by dividing by 2.31 feet per psi.
b. Add 4 psi to the result calculated in subparagraph 1a above.

3.8 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install shut-off valves and unions at each control valve to isolate for servicing of valve.

D. Install ports for pressure gauges and thermometers at coil inlet and outlet connections for each central station air handling unit, rooftop unit, and elsewhere as noted on the Drawings according to Division 23 Section 230519 "Meters and Gauges for HVAC Piping."

3.9 CHEMICAL TREATMENT

A. Refer to Division 23 Section 232513 “Water Treatment for Closed Loop Hydronic System” for requirements.

3.10 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

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

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.

3. Isolate expansion tanks and determine that hydronic system is full of water.
4. For hydronic systems other than coil condensate drain piping, subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. For coil condensate drain piping, subject piping system to hydrostatic 15-psig test pressure. Test pressure shall not exceed maximum pressure for any component in system under test.
6. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
7. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232123
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Close coupled, in-line centrifugal pumps.
2. Pump specialty fittings.

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 SUBMITTALS

A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves. Also include dimensions, pump and motor weight, pump layout and connections, and drawings with templates for installing foundation and anchor bolts and other anchorages.

1. Include diagrams for power, signal, and control wiring.

B. Operation and Maintenance Data: For pumps to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 CLOSE COUPLED, IN-LINE CENTRIFUGAL PUMPS

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

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group

3. Grundfos Pumps Corporation
4. ITT Corporation; Bell & Gossett
5. Mepco, LLC
6. PACO Pumps
7. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Company
8. Peerless Pump Company

B. Description: Factory assembled and tested, centrifugal, overhung impeller, close coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 175 psig (1204-kPa) minimum working pressure and a continuous water temperature of 225°F.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet**,** replaceable bronze wear rings, and threaded companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper alloy shaft sleeve.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal. Provide silicon carbide mechanical seals on systems circulating glycol solutions.
5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
6. Pump Bearings: Permanently lubricated ball bearings.
7. Provide flush lines on pumps scheduled for variable speed operation.

D. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 23 Section 230513 "Common Motor Requirements for HVAC Equipment."

    a. Enclosure: Open, drip proof. Totally enclosed fan cooled.
    b. Efficiency: Premium efficient.

3. Size: Motor shall be selected for non-overloading duty across the entire pump curve that passes through the design operating point.

E. Capacities and Characteristics: Refer to the schedule on the Drawings.

2.2 SEPARATELY COUPLED, VERTICALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

A. Manufacturers - subject to compliance with requirements, including but not limited to Section 230500 1.9E, provide products by one of the following:

1. Armstrong Pumps Inc.

2. Aurora Pump; Division of Pentair Pump Group.
3. ITT Corporation; Bell & Gossett.
4. Mepco, LLC.
5. PACO Pumps.
6. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Company
7. Peerless Pump Company.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted vertically.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze or stainless steel wear rings, and threaded companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps not frequency-drive controlled, trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
5. Pump Bearings: Permanently lubricated ball bearings.

D. Shaft Coupling: Axially split spacer coupling.

E. Motor: Single speed and rigidly mounted to pump casing with lifting eyebolt and supporting lugs in motor enclosure.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, drip-proof.
b. Motor shall be capable of operating at input frequencies up to 120 hertz.

2.3 PUMP SPECIALTY FITTINGS

A. Suction Diffuser

1. Angle pattern.
2. 175-psig pressure rating, cast iron body and end cap, pump-inlet fitting.
3. Bronze startup and bronze or stainless steel permanent strainers.
4. Bronze or stainless steel straightening vanes.
5. Drain plug.
6. Factory fabricated support.

B. Triple-Duty Valve:

1. Angle or straight pattern.
2. 175 psig pressure rating, cast iron body, pump discharge fitting.
3. Drain plug and bronze fitted shutoff, balancing, and check valve features.
4. Brass gage ports with integral check valve and orifice for flow measurement.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and spring hangers of size required to support weight of in-line pumps.

1. Comply with requirements for spring hangers specified in Division 23 Section 230548.13 "Vibration Controls for HVAC Piping and Equipment."
2. Comply with requirements for hangers and supports specified in Division 23 Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

3.3 CONNECTIONS

A. Where installing piping adjacent to pump, allow space for service and maintenance.

B. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

D. Install triple-duty valve on discharge side of pumps.

E. Install Y-type strainer and shutoff valve on suction side of in-line pumps.

F. Install pressure gages on pump suction and discharge.

G. Ground equipment according to requirements described in Division 26.

H. Connect wiring according to requirements described in Division 26.

3.4 STARTUP SERVICE

A. Engage a factory authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.5 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 232123

SECTION 232513

WATER TREATMENT FOR CLOSED LOOP HYDRONIC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section includes the following water treatment for closed loop hydronic systems:

1. Manual chemical feed equipment.
2. Chemicals.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote control, signaling power limited circuits.

B. TSS: Total suspended solids are solid materials, including organic and inorganic, that are suspended in the water. These solids may include silt, plankton, and industrial wastes.

1.4 PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction. A report shall be supplied to the General Contractor, Architect and Engineer documenting that the Water Treatment Service Provider analyzed the project's incoming site water describing its characteristics.

C. The pre-cleaning and flushing of the systems must be done with the oversight of the Water Treatment Service Provider. It must also be documented in a formal report supplied to the General Contractor, Architect and Engineer, documenting the steps taken during pre-cleaning and flushing, the water analyses done during each of the steps and a final flushing water quality analysis with particle size distribution analyses being conducted on the final flush water.

D. The formal report shall also document the quality of the treated system. The quality of the treated water or glycol fluid must meet the specifications set forth by the HVAC equipment manufacturer, if there are any. If no such specifications exist for the equipment a full analysis must be done, including a particle size distribution analysis that documents the quality of the water/fluid. When glycol is required in the project the full analysis must include organic acidity, glycol degradation products, corrosion inhibitors, scale promoters, contaminants, corrosion by-products and general qualities of the glycol including concentration, type and freeze point.

E. The water chemistry and quality of the chemical treatment program will influence the corrosion rates of the system. These shall be measured by corrosion coupons using un-passivated coupons and following the ASTM procedures for monitoring corrosion rates. A 30 day coupon installed after cleaning, flushing and treatment of the system should yield the following results for the closed loop systems being treated with a formal report being issued to the general contractor and project engineer:

1. Carbon Steel (C101): Less than or equal to 0.2 mpy.
2. Copper (CDA110): Less than or equal to 0.1 mpy.

Note: These rates assume that the metal loss is uniform with no pitting or localized attack including gouging, etching, microbial attack or crevice attack. Conditions such as those are not acceptable. If they are noted the cause should be addressed with follow-up testing to confirm improvement. Localized attack at the coupon holder may be ignored if the treatment is unable to interact with the coupon in this area and no other abnormalities are noted.

F. The water chemistry and quality of the chemical treatment program will influence the biological growth in the system. This shall be measured by Biological Dip Slides, SRB and IRB analyses. All protocols should yield a non-detectable biological growth. A formal report shall be issued to the General Contractor, Architect and Engineer to provide evidence of this.

G. The corrosion rates in the system must be maintained at the above levels for the full year of service. They must be monitored quarterly for the first year and documented in reports sent to the Architect, Engineer and the Owner’s Facility Manager.

H. The biological growth rates in the system must be maintained at non-detectable levels for the full year of service. They must also be monitored quarterly for the first year and documented in reports sent to the Architect, Engineer and the Owner’s Facility Manager.

I. A full water or fluid analysis on each closed loop system must be done semi-annually, including a particle size distribution analysis, during the first year of service. When glycol is required in the project, the full analysis must include organic acidity, glycol degradation products, corrosion inhibitors, scale promoters, contaminants, corrosion by-products and general qualities of the glycol including concentration, type and freeze point. The findings of each analysis shall be documented and submitted in a report sent to the Architect, Engineer and the Owner’s Facility Manager.

1.5 SUBMITTALS

A. Product Data: Include rated capacities; water pressure drops; shipping, installed, and operating weights; and furnished products listed below. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Chemical test equipment.

2. Chemicals.
3. Chemical bypass feeders.
4. Chemical material safety data sheets.

B. Wiring Diagrams: Detail power and control wiring and differentiate between manufacturer-installed and field installed wiring.

C. Water Analysis Provider Qualifications: Verification of experience and capability of HVAC water treatment service provider.

D. Water Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in "Performance Requirements" article.

E. Water Analysis and Formal Reports: Refer to the "Performance Requirements" article in this Section for water analysis and formal report requirements.

F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

G. Operation and Maintenance Data: For sensors, injection pumps, filters, system controls, and accessories to include in emergency, operation, and maintenance manuals specified in Division 01.

1.6 QUALITY ASSURANCE

A. HVAC Water Treatment Service Provider Qualifications: An experienced HVAC water treatment service provider capable of analyzing water qualities, installing water treatment equipment, and applying water treatment as specified in this Section.

1.7 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion and scale formation for hydronic piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion and shall include the following:

1. Initial water analysis and HVAC water treatment recommendations.
2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

PART 2 - PRODUCTS

2.1 WATER TREATMENT SERVICE PROVIDER

A. Acceptable Water Treatment Service Providers - subject to compliance with requirements, provide water treatment services by one of the following:

1. Capitol Technologies, Inc. (located in McKeesport, PA).
2. Chem Aqua
3. Craft Products Company (located in Pittsburgh, PA).
4. GLA Consultants

2.2 MANUAL CHEMICAL FEED EQUIPMENT

A. Bypass Filter Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch (89-mm) fill opening in the top, and NPS 3/4 (DN 20) bottom inlet and top side outlet. Feeder shall have a stainless steel dissolving basket that fully supports the filter bag. The filter bag shall be the 5-micron type with ring top and handle. The feeder shall have a quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel. The filter feeder shall be similar to Neptune model FTF-5DB.

1. Capacity: 5 gallons
2. Working Pressure: 125 psig

B. Water Meter:

1. Service: Water.
2. Wetted Materials:

    a. Body: Brass, polyethylene.
    b. Couplings: Brass.
    c. Measuring Chamber: Polyethylene, ABS plastic, ferrite, acetal.

3. Flow Range: 2 to 30 gpm.
4. Accuracy: Transitional Flow: ±5%; Nominal Flow: ±2%.
5. Temperature Limit: 104°F
6. Pressure Limit: 232 psi (16 bar)
7. Maximum Pressure Drop: 9 psi @ 30 gpm
8. Totalizing Display Maximum: 10,000,000 gallons.
9. Output Signal: Pulse output with frequency proportional to flow rate.
10. Pulse Options: 1 gallon per pulse.
11. Electrical Rating: 0.01 A @ 24 VAC/VDC.
12. Electrical Connections: Color-coded lead wires, 4.5´ long.
13. Mounting Orientation: Horizontal.
14. Maximum Pressure Loss at Design Flow: 3 psig.
15. Registration: Gallons or cubic feet.
16. End Connections: Threaded.
17. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CHEMICAL TREATMENT TEST EQUIPMENT

A. Test Kit: Manufacturer recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, hardness, and percentage of glycol.

B. Four Station - Corrosion Coupon Test Rack and Assembly: Constructed of corrosion resistant material, complete with piping, valves, strainer, flow monitoring gauge, quick disconnect O-ring sealed coupon holders, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly.

2.4 CHEMICALS

A. Chemicals shall be furnished and installed as recommended by the Water Treatment Service Provider that are compatible with piping system components and connected equipment, and that can attain water quality specified in the "Performance Requirements" article in this Section.

B. Hydrostatic Test Inhibitor: All hydrostatic test water shall contain a corrosion inhibitor package and biocide provided by the Water Treatment Service Provider to protect the system from corrosion and biological growth during stagnant periods or draining. This inhibitor package must be added during all hydrostatic testing. (NOTE: THE WATER TREATMENT SERVICE PROVIDER MUST VERIFY THAT THE HYDROSTATIC TESTING INHIBITOR PACKAGE SUPPLIED AND USED IS COMPATIBLE WITH THE EQUIPMENT CONNECTED TO THE SYSTEM.)

C. System Cleaner: System cleaner shall be provided as recommended by the Water Treatment Service Provider and equipment manufacturer(s) to remove grease and petroleum products, flash rusting agents and other particulate in the system. (NOTE: THE WATER TREATMENT SERVICE PROVIDER MUST VERIFY THAT THE SYSTEM CLEANER USED IS COMPATIBLE WITH THE EQUIPMENT CONNECTED TO THE SYSTEM.)

D. Closed loop Water Piping Chemicals: Closed loop water piping chemicals shall be provided as recommended by the Water Treatment Service Provider and equipment manufacturer(s) to reduce deposits, inhibit corrosion and control biological growth. It also must comply with the system water quality performance requirements specified in the "Performance Requirements" article in this Section. This product is for use during the time between flushing and glycol addition to keep the system from corroding and from bacteria from growing. (NOTE: THE WATER TREATMENT SERVICE PROVIDER MUST VERIFY THAT THE SYSTEM CORROSION INHIBITORS AND BIOCIDE ARE COMPATIBLE WITH THE EQUIPMENT CONNECTED TO THE SYSTEM.)

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at the Project site and to determine the type and quantities of chemicals needed to maintain the water quality as specified in "Performance Requirements" article of each closed loop system on the project.

B. Prepare and submit documented reports to the General Contractor, Architect and Engineer as specified in "Performance Requirements" article in this Section.

3.2 INSTALLATION

A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.

B. For each system included in this specification, a water meter shall be used the first time it is filled to determine the exact volume, in gallons, that the system holds. All hydrostatic test water shall contain a corrosion inhibitor and biological treatment to protect the system from corrosion, flash rusting and biological growth during stagnant periods or draining. The volume of each system shall be recorded and provided to the Water Treatment Service Provider, the Architect and the Engineer. In addition, the volume of each system shall be recorded and included in the Operating and Maintenance Manuals.

C. Prior to treating the system, thoroughly and completely clean the entire hot water and chilled water systems of all dirt and debris. Cleaning shall consist of the following procedure:

1. Step 1: Fill the closed loop system with hydrostatic test water. All hydrostatic test water shall contain a corrosion inhibitor to prevent corrosion and biological growth. If any portion of the system is subject to freezing temperatures at the time of the cleaning, postpone the cleaning procedure until weather permits or verify pumps can be kept continuously running during that time period.
2. Step 2: Add cleaning chemicals in sufficient quantity as recommended by the Water Treatment Service Provider.
3. Step 3: Circulate solution throughout entire system for a minimum of 96-hours with filtration. Every 24 hours, check bag filter to determine how much dirt it has collected during that period. Clean or replace bag as necessary. Continue circulation process until bag filter in filter feeder is clean after the prior 24-hour circulation period.
4. Step 4: Drain and flush the system until the cleaner is all removed from the system.
5. Step 5: If the fluid being drained is dirty, repeat step 1 through step 4 until fluid being drained from system is clear. Take sample for laboratory analysis by the Water Treatment Service Provider.
6. Step 6: Fill the entire system with water and the corrosion inhibitor package.
7. Step 7: Remove all air from system.
8. Step 8: Add the proper amount of chemicals as recommended by the Water Treatment Service Provider to reduce deposits, inhibit corrosion, and bring the water quality within the specified limits as recommended by the Water Treatment Service Provider.
9. Circulate the system with filtration on-line to verify the system is clean. After 96-hours take a sample for laboratory analysis by the Water Treatment Service Provider.
10. If glycol is to be added, only drain the system 12-hours before the glycol is to be added to prevent flash rusting. After the glycol is added and all the air is removed, circulate the system with filters installed in the filter feeder. Change the bags in the filter feeder every 24-hours until the bag filters come out clean. Take sample for laboratory analysis by the Water Treatment Service Provider.

D. Install water testing equipment on wall near water chemical application equipment.

E. Install interconnecting control wiring for chemical treatment controls and sensors.

3.3 BYPASS FILTER FEEDER INSTALLATION

A. Install bypass filter feeders in closed hydronic systems, including hot water system.

1. Install full-port ball isolation valves on inlet, outlet, and drain below the feeder inlet.
2. Install a swing check on the inlet after the isolation valve.
3. Install site or flow sensor after filter housing.

3.4 WATER METER INSTALLATION

A. Provide a water meter on the make-up water connection to each make-up system to meter the water used by the following closed loop system(s):

1. Hot water closed loop system.

B. Install full-port ball isolation valves on the inlet and outlet of the water meter.

3.5 CHEMICAL TREATMENT TEST EQUIPMENT INSTALLATION

A. Provide a four-station corrosion test coupon rack for the following:

1. Hot water closed loop system.

a. The piping for the hot water corrosion test coupon assembly shall be schedule 40 steel with threaded ends and malleable iron threaded fittings.

B. Install a full-port ball isolation valve on the inlet of each coupon rack assembly.

3.6 CHEMICAL TREATMENT OF SYSTEMS

A. System Cleaner - provide system cleaner for the following systems:

1. Hot water closed loop system.
2. Chilled water closed loop system.
3. Condenser water closed loop system.

B. Closed loop, Water Piping Chemicals - provide closed loop water piping chemicals for the following systems:

1. Hot water closed loop system.

3.7 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance.

C. Make piping connections between HVAC water treatment equipment and dissimilar-metal piping with dielectric fittings. Comply with requirements in Division 23 Section 232113 "Hydronic Piping."

D. Install shutoff valves on HVAC water treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section 230523 "General-Duty Valves for HVAC Piping."

E. Comply with requirements in Division 22 for backflow preventers required in makeup-water connections to potable-water systems.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Inspect field assembled components and equipment installation, including piping and electrical connections.
2. Confirm that the water system piping has been tested and is free of leaks before cleaning system piping.
3. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water treatment system.
4. Place HVAC water treatment system into operation and calibrate controls during the preliminary phase of hydronic systems' startup procedures.
5. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
6. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
7. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
8. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
9. Repair leaks and defects with new materials and retest piping until no leaks exist.

C. Equipment will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article for each required characteristic. Sample boiler water at eight-week intervals following the testing noted above to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section.

F. At eight-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" article.

G. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Acidity and Alkalinity: ASTM D 1067.
3. Iron: ASTM D 1068.
4. Water Hardness: ASTM D 1126.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain HVAC water treatment systems and equipment. Include the following in the training:

1. Review procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and closed water systems.
2. Review manufacturer's safety data sheets for handling of chemicals.
3. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service. Refer to Division 1.

B. Schedule at least four (4) hours of training with Owner, through the Architect, with at least seven days' advance notice.

END OF SECTION 232513

SECTION 233113
METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

1.3 PERFORMANCE REQUIREMENTS

A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in the "Duct Schedule" article in this Section.

1.4 SUBMITTALS

A. Product Data - for each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings - plans, drawn to scale at a minimum of ¼" = 1'-0", on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory and shop fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire rated and other partitions.

10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.
13. Suspended ceiling components.
14. Structural members to which duct will be attached.
15. Size and location of ceiling grid modules for acoustical tile.
16. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Bulkheads.
    g. Perimeter moldings.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black and galvanized steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4 inch minimum diameter for lengths 36 inches or less; 3/8 inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

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

a. CertainTeed Corporation; Insulation Group
b. Johns Manville
c. Knauf Insulation
d. Owens Corning

2. Thickness and Minimum R-Value:

    a. Ductwork Installed Indoors:

        1) Minimum thickness: 1½-inches.
        2) Minimum Installed R-value: 5.0 at 75°F mean temperature.
        3) The minimum thickness may be reduced provided the manufacturer's literature indicates, for the thickness supplied, an R-Value which meets or exceeds 6.0 at 75°F mean temperature when tested in accordance with ASTM C 518.

3. Antimicrobial Erosion Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

B. Insulation Pins and Washers:

1. Cupped Head, Capacitor discharge weld Pins: Copper or zinc coated steel pin, fully annealed for capacitor discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1½ -inch galvanized carbon steel washer.
2. Insulation Retaining Washers: Self-locking washers formed from 0.016-inch (0.41-mm) thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1½-inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Secure liner with mechanical fasteners 4-inches from corners and at intervals not exceeding 12 inches transversely; at 3-inches from transverse joints and at intervals not exceeding 18-inches longitudinally.
7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.

8. Terminate inner ducts with buildouts attached to fire damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface burning characteristics for sealants and gaskets shall be a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested according to UL 723; certified by an NRTL. Also, sealants and gaskets shall conform to UL 181A for metal ducts and UL 181B for flexible air ducts and flexible air connectors.

1. Closure systems uses to seal ductwork listed and labeled in accordance with UL 181A shall be marked “181A-P” for pressure sensitive tape, “181A-M” for mastic, or “181A-H” for heat sensitive tape. Closure systems uses to seal flexible air ducts and flexible air connectors shall comply with UL 181B shall be marked “181B-FX” for pressure sensitive tape, or “181B-M” for mastic.

B. Water Based Joint and Seam Sealant:

1. Type: Vinyl Acetate.
2. Solids Content: 69.2 percent.
3. Weight: 11.6 .2 lbs./gallon
4. Color: Grey.
5. Odor: Mild/Wet; Bland/Dry.
6. VOC: 22 gms./ltr.
7. Viscosity: 140,000-180,000 CPS # 7 Brookfield, 20 RPM at 70°F.
8. Flammability: Non-Flammable.
9. Effect of Freezing: No damage - 3 Cycles.
10. Service: Indoor and outdoor use.
11. Storage Life: 6 Months at 70°F.
12. Cure Time: 48 hours.
13. Method of Application:

    a. Brush, trowel, putty knife or caulking gun.

14. Product: Sealant shall be equivalent to Duro Dyne DDS-181.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports:

1. Supports for Galvanized steel Ducts: Galvanized steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCTWORK - GENERAL

A. Dimensions of ductwork shown/noted on the Drawings indicate inside clear dimensions and do not account for duct liner. When duct liner is indicated to be provided in accordance with this Section of the Specifications and/or in accordance with Division 23 Section 230713 “Duct Insulation,” the size of the duct shall be increased to accommodate the thickness of the duct liner.

B. Do not install ductwork in transformer vaults, elevator equipment rooms or electrical equipment rooms unless the ductwork serves HVAC equipment located in that room and is dedicated to provide cooling and/or heating to that room. Do not install ductwork adjacent to or above any surface of electrical controls, panels, switches, terminals, boxes or similar electrical equipment. Drip-pan protection shall not be permitted, except where detailed.

3.2 PROTECTION OF DUCT

A. Immediately after fabrication, the duct shall be cleaned of all dirt, dust and debris. The ends of the duct section shall then be securely covered with plastic and strapping tape. The duct shall then be completely covered with cloth or plastic.

B. When each duct section transported to the job site, the covering over the ends of each duct shall be maintained to prevent the entrance of dirt, dust and debris. In addition, all ducts shall be covered with plastic or cloth.

C. Immediately after the duct arrives at the job site and prior to being installed, the covering over the ends of each duct shall be maintained to prevent the entrance of dirt, dust and debris. In addition, all ducts shall be covered with plastic or cloth.

D. When each duct is installed, the plastic covering shall be removed. Once installed, the duct section shall be inspected for the existence of dirt or dust; if discovered, the duct section shall be cleaned of all dirt and dust. Unless the next section of duct is in the process of being installed, the end of the duct shall be securely covered with plastic and strapping tape.

3.3 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory or shop fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a minimum clearance of 1 inch plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.4 DUCT SEALING

A. Seal ducts for duct static pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Closure systems used to seal metal ductwork shall be installed in accordance with the manufacturer’s installation instructions.

C. Unlisted duct tape is not permitted as a sealant on any metal ducts.

D. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened.

1. Mechanical fasteners for use with flexible non-metallic air ducts shall comply with UL 181B and shall be marked “181B-C.”

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Ducts shall be supported directly from the building substrate. Ducts are not permitted to be supported from other ducts, pipes, conduits, or cable tray.

C. Building Attachments: Structural-steel fasteners **or concrete inserts** appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

D. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

E. Hangers Exposed to View: Threaded rod and angle or channel supports.

F. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

G. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.7 DUCT SCHEDULE

A. Duct Material - fabricate ducts with galvanized sheet steel.

B. Duct Pressure Class, SMACNA Seal Class, and SMACNA Leakage Class: Fabricate ducts for the following pressure, seal and leakage classes:

1. Supply air Ducts, Constant Air Volume System:

a. Pressure Class: Positive 2-inches wg.
b. Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Supply air Ducts, Variable Air Volume System, Upstream of Terminal Boxes:

a. Pressure Class: Positive 3-inches wg.
b. Seal Class: B.

c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Supply air Ducts, Variable Air Volume System, Downstream of Terminal Boxes:

a. Pressure Class: Positive 2-inches wg.
b. Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Intermediate Reinforcement:

1. Galvanized steel Ducts: Match duct material.

D. Duct Liner Application: Fabricate ducts with duct liner except as otherwise indicated on the Drawings and as described below. Refer to Division 23 Section “HVAC Insulation” for additional requirements.

1. Supply air Ducts downstream of terminal boxes.

END OF SECTION 233113

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Flange connectors.
3. Turning vanes.
4. Duct mounted access doors.
5. Flexible ducts.

1.3 SUBMITTALS

A. Product Data - submit manufacturer's published data for each type of product indicated.

1. Manual volume dampers.
2. Flange connectors.
3. Turning vanes.
4. Duct mounted access doors.
5. Flexible ducts.

B. Coordination Drawings: Refer to Division 23 Sections 230500 "Common Work Results for HVAC" and Section 233113 "Metal Ducts" for coordination drawing requirements. Show all duct accessories on coordination drawings. Also, include access panels and access doors required for access to duct accessories on coordination drawings.

C. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers

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

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. Elgen
d. Flexmaster U.S.A., Inc.
e. McGill AirFlow LLC.
f. METALAIRE, Inc.
g. Nailor Industries Inc.
h. Pottorff; a division of PCI Industries, Inc.
i. Ruskin Company.
j. Vent Products Company, Inc.

2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:

a. Hat-shaped, galvanized steel channels, 0.064-inch minimum thickness.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel or stainless steel.
7. Bearings:

    a. Oil impregnated bronze bearings, molded synthetic bearings or stainless steel sleeve.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

2.3 FLANGE CONNECTORS

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

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gauge and Shape: Match connecting ductwork.

2.4 TURNING VANES

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

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall.

2.5 DUCT MOUNTED ACCESS DOORS

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

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Elgen
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation
7. McGill AirFlow, LLC
8. Nailor Industries Inc.
9. Pottorff; a division of PCI Industries, Inc.
10. Ventfabrics, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
d. Access Doors Larger than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.6 FLEXIBLE DUCTS

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

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.

2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10° to plus 160°F.

C. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized steel accessories in galvanized steel and fibrous glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Install volume dampers a minimum of 5-feet from the diffuser, register or grille in which it is controlling airflow. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Volume damper shall be constructed of the same material as the duct in which it is to be installed.

D. Install turning vanes in all mitered rectangular duct elbows with an angle greater than 45°.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Downstream from **manual volume dampers,** control dampers, backdraft dampers, and equipment.
2. At each change in direction and at maximum 50-foot spacing.
3. Upstream from turning vanes.
4. Control devices requiring inspection.

G. Install access doors with swing against duct static pressure.

H. Access Door Sizes: Access doors shall be sized as large as possible and practical, but shall not be less than 12 x 6 inches and shall not be greater than 25 x 25 inches.

I. Label access doors according to Division 23 Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

J. Connect each diffuser to duct directly or with maximum 96-inch length of flexible duct clamped or strapped in place. The flexible duct shall be permitted to have a total maximum change of direction not exceeding 90-degrees.

K. Connect flexible ducts to metal ducts with nylon draw bands.

L. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 233600
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Shutoff, single duct air terminal units.

1.3 SUBMITTALS

A. Product Data: For air terminal units, including rated capacities, furnished specialties, sound-power ratings, and accessories. Also, include plans, elevations, sections, details, and attachments to other work. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. In addition, include the following:

1. Wiring Diagrams: For power, signal, and control wiring.
2. Liners and adhesives. Include product data.
3. Sealants and gaskets. Include product data.
4. Hangers and supports. Include methods for duct and building attachment, and vibration isolation.

B. Field quality control reports.

C. Operation and Maintenance Data: For air terminal units, include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.5 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction including light fixtures, electrical conduit and equipment, HVAC piping and equipment, plumbing piping and equipment, fire suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 SHUTOFF, SINGLE DUCT AIR TERMINAL UNITS

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

1. Anemostat Products; a Mestek Company
2. Environmental Technologies, Inc.
3. Krueger
4. METALAIRE, Inc.
5. Nailor Industries Inc.
6. Price Industries
7. Titus
8. Trane; a business of American Standard Companies
9. Tuttle & Bailey

B. Configuration: Volume damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch steel or 0.032-inch aluminum, single wall.

1. Casing Lining:

a. Polyurethane Foam Insulation: Adhesive attached, 1-inch thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
b. Natural Fiber Insulation: Adhesive attached, 1-inch matte faced natural fiber insulation complying with UL 181 and NFPA 90A. The liner shall have an anti-bacterial and anti-fungi coating complying with ASTM G21 and ASTM G22 for bacterial and fungi resistance. All exposed edges shall be coated with NFPA approved sealant to prevent entrainment of fibers in the airstream.

2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Inlet Sensor: The air inlet sensor shall be the pitot tube type that measures both total inlet pressure and static inlet pressure. The inlet air sensor shall be the center averaging type and shall have multiple ports on the upstream side and multiple ports on the downstream side of the measurement chamber.
4. Air Outlet: S-slip and drive connections.
5. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally closed.

E. Reheat Coil:

1. Hot Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200-psig and a maximum entering-water temperature of 220° F. Include manual air vent and drain valve. The coil shall be leak tested to a minimum pressure of 500-psig in the factory. Coil shall be integral with the terminal box and shall be factory installed.

F. Electrical: The unit shall incorporate a single point control connection. All electrical components shall be enclosed in a single control box with access panel mounted on the side of the assembly. All controls shall be sealed from primary air flow. Units shall be ETL listed.

G. DDC Controls:

1. Single package unitary controller and actuator specified in Division 23 Section 230900 “Automatic Temperature Control for HVAC.” Also, refer to Division 23 Section 230900 “Automatic Temperature Control for HVAC” for additional control requirements.

a. DDC controls shall be furnished by the ATC Subcontractor and shall be factory-mounted and wired by VAV terminal box manufacturer.
b. DDC controls shall be furnished and field-installed by the ATC Subcontractor.

2. Control Sequence: Refer to Division 23 Section 230993 “Sequence of Operation for HVAC Controls” for operating control sequence requirements.

H. Capacities and Characteristics: Refer to the schedule on the Drawings.

2.2 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

C. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.3 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units' level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

A. Connect ducts to fan powered air terminal units according to Division 23 Section 233113 "Metal Ducts."

B. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Install piping adjacent to machine to allow service and maintenance.

D. Unless otherwise indicated, install union and gate or ball valve on supply water connection and union and calibrated balancing valve on return water connection of fan powered air terminal units. Hydronic specialties are specified in Division 23 Section 232113 "Hydronic Piping."

E. Comply with safety requirements in UL 1995.

F. Ground equipment according to Division 26.

G. Connect wiring according to Division 26.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Inspect, test, and adjust field assembled components and equipment installation, including connections. Report results in writing.

B. Tests and Inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan powered air terminal units **and** shut-off, single duct air terminal units. Refer to Division 01.

END OF SECTION 233600

SECTION 233713
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All Division 23 Specification Sections also apply to this Section.

1.2 SUMMARY

A. This Section includes ceiling and wall mounted diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data - for each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
3. Color Chart: For diffusers, registers, and grilles with factory applied color finishes for color and finish selection by Architect.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, performance, and dimensional requirements of diffusers, registers and grilles, and are based on the specific equipment indicated. Refer to Division 01 for additional requirements.

PART 2 - PRODUCTS

2.1 DIFFUSER OUTLETS

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

1. Anemostat; a Mestek Company
2. Krueger
3. Price Industries
4. Titus
5. Tuttle & Bailey
6. Nailor

B. Square Cone Diffusers:

1. Material: Steel.
2. Finish: Baked enamel, color selected by Architect.
3. Face Size: 24 by 24 inches.
4. Face Style: Three cone.
5. Mounting: Surface or T-bar. Coordinate with Drawings.
6. Pattern: Fixed.
7. Dampers: None.
8. Accessories:

    a. Equaling grid.

2.2 REGISTERS

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

1. Anemostat; a Mestek Company.
2. Krueger.
3. Price Industries.
4. Titus.
5. Tuttle & Bailey.

B. Fixed Blade Louvered Return/Exhaust Register:

1. Material: Steel.
2. Finish: Except for the following areas, all registers shall have a baked enamel finish in a custom color selected by the Architect.

    a. Registers shall be brushed stainless steel in the Locker/Shower area.
    b. Registers attached to exposed ductwork shall have a primed finish compatible for field painting.

3. Duct Connection: Refer to the Drawings.
4. Face Blade Arrangement: Fixed horizontal spaced 3/4 inch apart.
5. Frame: 1-1/4 inches wide.
6. Mounting: Countersunk screw or lay in. Coordinate with plans.
7. Damper Type: Opposed blade.
8. Accessories: None.

2.3 GRILLES

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

1. Anemostat; a Mestek Company
2. Krueger
3. Price Industries
4. Titus
5. Tuttle & Bailey

B. Fixed Blade Louvered Return/Exhaust Grille:

1. Material: Steel.
2. Finish: Except for the following areas, all grilles shall have a baked enamel finish in a custom color selected by the Architect.

    a. Grilles shall be brushed stainless steel in the Locker/Shower area.
    b. Grilles attached to exposed ductwork shall have a primed finish compatible for field painting.

3. Duct Connection: Refer to the Drawings.
4. Face Blade Arrangement: Fixed horizontal spaced 3/4 inch apart.
5. Frame: 1-1/4 inches wide.
6. Mounting: Countersunk screw or lay in. Coordinate with plans.
7. Damper Type: None.
8. Accessories: None.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 235123
GAS VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Listed double-wall vents.

1.3 ACTION SUBMITTALS

A. Product Data - for each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.

B. Shop Drawings - for vents.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of hangers and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Welding Qualifications - qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.

B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

C. All products furnished under this Section shall conform to the requirements of The National Fuel Gas Code, ANSI Z223.1 to the Canadian Standard ULC-S636, as a Class IIA, IIB and IIC, Type BH vent system. Components coming in direct contact with products of combustion shall carry the appropriate ULC listing.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN BOILER, KN-4 BY MESTEK

A. Manufacturer.

1. EZ Seal Saf-T Vent by Heat-fab

2.2 LISTED SPECIAL GAS VENTS for use with other boiler manufacturers,

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

1. Heat-Fab Inc.
2. Jeremias
3. Metal-Fab, Inc.
4. Schebler Chimney Systems.
5. Security Chimneys International.
6. ProTech Systems (Simpson Dura-Vent Company, Inc.)

B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480°F continuously, with positive or negative flue pressure complying with NFPA 211.

C. Construction: Inner shell and outer jacket separated by at least a 1/2-inch airspace.

D. Inner Shell: ASTM A959, Type 29-4C stainless steel.

E. Outer Jacket: **Stainless** steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
2. Termination: Exit cone with drain section incorporated into riser.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Listed Special Gas Vent: Condensing gas appliances.

3.3 VENT SYSTEM LAYOUT

A. The vent system shall be routed to maintain minimum clearance to combustibles as specified by the manufacturer.

B. Vent installation shall conform to the manufacturer’s installation instructions, its ULC listing and local codes.

C. The vent system and breechings shall be inspected and cleaned before the final connection to the appliances.

3.4 INSTALLATION OF LISTED VENTS

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

D. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

E. Lap joints in direction of flow.

3.5 MECHANICAL EQUIPMENT

A. If dampers or fans are installed in conjunction of the vent system, such equipment shall be supported independently from the vent system. Protect the vent system from twisting or movement due to fan torque or vibration.

3.6 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION 235123

SECTION 235223
CAST IRON 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 SUMMARY

A. This Section includes gas-fired, condensing cast iron boilers for heating hot water.

1.3 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, and method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer installed and field installed wiring.

C. Source Quality Control Tests and Inspection Reports: Indicate and interpret test results for compliance with performance requirements before shipping.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: Include in the maintenance manuals specified in Division 1. Include parts list, maintenance guide, and wiring diagrams for each boiler.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.

1. The Terms “Listed” and “Labeled”: As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” as defined in OSHA Regulation 1910.7.

B. ASME Compliance: Boilers shall bear ASME “H” stamp and be National-Board listed.

C. Comply with NFPA 70 for electrical components and installation.

D. ARRA Compliance: Total overall percentage of US origin materials used in manufacturing of the boilers shall be 100% and 100% assembly of these products shall be completed in the US - Buy American compliant.

1.5 COORDINATION

A. Coordinate size and location of concrete bases.

1.6 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of

other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents. Installing contractor shall provide one year of warranty parts and labor.

B. Special Warranty: Submit a written warranty, executed by the contractor for the heat exchanger.

1. Warranty Period: Manufacturer’s standard, but not less than 25 years from date of Substantial

C. Completion on the heat exchanger. Warranty shall be non-prorated and not limited to thermal shock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Manufacturer shall be a company specializing in manufacturing the products specified in this section with minimum five (5) year’s experience. Subject to compliance with requirements, manufacturers offering boilers that may be incorporated into the Work include, but are not limited to, the following:

1. Design: Boilers shall be CSA design certified as a condensing boiler. Boilers shall be designed for a minimum of 5:1 continuous turn down with constant CO2 over the turndown range. The boiler shall operate with natural gas or propane and have a CSA International certified input rating as noted on the drawings, and a thermal efficiency rating up to 99% at minimum input. The boiler shall be symmetrically air-fuel coupled such that changes in combustion air flow or flue flows affect the BTUH input without affecting combustion quality. The boiler will automatically adjust input for altitude and temperature induced changes in air density. The boiler will use a proven pilot direct spark ignition system. The boiler shall use a UL approved flame safeguard ignition control system using flame rod detection. The design shall provide for silent burner ignition and operation. The boiler shall be down fired counter flow such that formed condensate always moves toward a cooler zone to prevent re-evaporation. A stainless steel corrosion resistant condensate drain designed to prevent pooling and accessible condensate trap shall be provided. In some jurisdictions, a means of neutralizing the condensate Ph levels may be required. Boiler shall be able to vent a horizontal distance of 100 equivalent feet, 30.5m with a vent diameter equivalent to the combustion chamber outlet diameter.

2. Service Access: The boilers shall be provided with access covers for easily accessing all serviceable components. The boilers shall not be manufactured with large enclosures, which are difficult to remove and reinstall. All accesses must seal completely as not to disrupt the sealed combustion process. All components must be accessible and able to adjust with the removal of a single cover or cabinet component.
3. Indicating lights: Each boiler shall include a diagnostic control panel with a full text display indicating the condition of all interlocks and the BTUH input percentage. Access to the controls shall be through a completely removable cover leaving diagnostic panel intact and not disrupted.

B. Manufacturers: Advanced Thermal Hydronics (a Mestek Company) is the basis of design. Listed acceptable manufacturers shall be subject to compliance with requirements. Provide boilers by one of the following:

1. Viessmann Vertomat

2.2 COMPONENTS

A. Combustion Chamber: The combustion chamber shall be constructed of cast iron. It shall be a down fired design utilizing light weight refractory around the burner housing.

B. Heat Exchanger: Boilers shall be a cast iron sectional unit designed for pressure firing and shall be constructed and tested for 100 P.S.I water working pressure, in accordance with the A.S.M.E.

C. Section IV Rules for the Construction of Heating Boilers. Individual sections will have been subjected to a hydrostatic pressure test of 250 PSIG at the factory before shipment and they shall be marked, stamped or cast with the A.S.M.E. Code symbol. Boilers with less than 250-psi pressure test will not be acceptable for this project. The sections shall be of a down fired counter flow single-pass design.

D. Water ports will be sealed with steel push nipples connectors. The sections will be fully machined for metal-to-metal sealing of the gas side surfaces. The design will provide for equal temperature rise through all sections. The heat exchanger shall be designed to prevent fluid boiling. The iron shall have a minimum thickness of ¼". The heat exchanger design should have no limitations on temperature rise or restrictions to inlet water temperature and a Cv of 20 (KN-2) and 40 (KN-4).

E. Jackets: Powder Coated.

F. Gas Burner: The burner shall be metal fiber mesh construction, allowing high turndown of the fuel-air mixture. The burner flame shall burn horizontally and be of the pre-mix type with a forced draft fan. Burner shall fire to provide equal distribution of heat throughout the entire heat exchanger. The burner shall be easily removed for maintenance without the disruption of any other major component of the boiler. A window view port shall be provided for visual inspection of the boiler during firing.

G. The gas distribution components and burner shall be enclosed with a cast-aluminum housing.

H. Ignition components: The ignition hardware shall consist of Alumina ceramic insulated ignition electrodes and camphol flame rod sensing permanently arranged to ensure proper ignition electrode alignment.

I. Rated Capacity: The boiler shall be capable of operating at rated capacity with pressures as low as 2" W.C. at the inlet to the burner pressure regulator.

J. The burner shall be capable of 99% efficiency without exceeding a NOx reading above 12 ppm.

K. The burner and gas train shall be provided with the following trim and features:

1. Burner Firing: Full modulation with 5:1 turndown @ Continuous CO2
2. Burner Ignition: Interrupted spark
3. Safety Controls: Energize ignition, limit time for establishing flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, and allow gas valve to open.
4. Flue Gas Collector: Enclosed combustion chamber with integral combustion air blower and single venting connection.
5. Gas Train: Redundant Dung's gas valve with manifold and line pressure tapings.
6. Safety Devices: Blocked air-flow switch, and blocked flue detection switch, high temperature auto reset. All safeties to be factory mounted.

2.3 BOILER TRIM

A. Controls: The boiler control package shall be a MTI HeatNet or equivalent, integrated boiler management system. The control system must be integral to each boiler, creating a control network that eliminates the need for a "wall mount" stand-alone boiler system control. Additional stand-alone control panels, independent of a Building Management System (BMS), shall not be allowed to operate the boiler network.

B. The Heat-Net control shall be capable of operating in the following ways:

1. As a stand alone boiler control system using the Heat-Net protocol, with one "Master" and
2. multiple "Member" units.
3. As a boiler network, enabled by a Building Management System (BMS), using the HeatNet protocol, with one "Master" and multiple "Member" units.
4. As "Member" boilers to a Building Management System (BMS) with multiple input control
5. methods.
6. Failsafe mode - When a Building Automation System is controlling set point, if communications are lost, the boiler/system will run off the Local set point.
7. Adaptive Modulation - Lowers the modulation rate of all currently operating boilers before a newly added boiler enters operation.
8. Priority Firing - Allows mixing of condensing, non-condensing base-load and/or other combination of (2) functional boiler types utilizing (2) priority levels.
9. Available priority start/stop qualifiers shall be done using any combination of: A) Modulation Percentage B) Outdoor Air Temperature or C) Return Water Temperature.
10. Base Loading - Provides the ability to control (1) base load boiler with enable/disable and 4-20mA modulating signal (if required).

C. Master:

1. A boiler becomes a Master when a resistance type 10K sensor is connected to the J10 "SYS/DHW HEADER" terminals. The sensor shall be auto detected. The Master senses and controls the header/loop temperature utilizing a system setpoint. It uses any boilers it finds "HeatNet Members" or those defined in the control setup menus to accomplish this. The "Master" shall also have the option of monitoring Outside Air Temperature "OA" to

provide full outdoor air reset functionality. Only one master shall be allowed in the boiler network.

2. When operating as a “Master”, the HeatNet control provides a stand alone method using a PID algorithm to regulate water temperature. The algorithm allows a single boiler “Master” or multiple “Master + Member” boilers in a network of up to 16 total boilers.
3. The control algorithm is based upon a control band, at the center of which is the setpoint. While below the control band, boilers are staged on and modulated up until the control band is entered. Once in the control band, modulation is used to maintain setpoint. Optimized system efficiency is always accomplished by setting the Modulation Maximum “Mod-Max” setting to exploit each boiler in the network’s inverse efficiency curve. The control shall operate so that the maximum number of boilers required, operate at their lowest inputs until all boilers are firing. Once all boilers are firing, the modulation clamp is removed and all boilers are allowed to fire above this clamped percentage up to 100%. This “boiler efficiency” clamp is defaulted to 80% and thus limits all the boilers individual outputs to 80% until the last boiler fires. The 80% default must be field adjustable for varying operating conditions. All boilers modulate up and down together always at the same modulation rate. Boilers are shut down only when the top of the band is breached, or before the top of the band, if the control anticipates that there is a light load. Timers shall also be included in each control in the network to prevent any boiler from short cycling.

D. Member:

1. Additional boilers in the network always default to the role of member. The lack of sensors connected to the J10 terminals “SYS/DHW Header” on each additional boiler shall ensure this. Each “Member” shall sense its supply outlet water temperature and modulate based on signals from a Building Management System (BMS) or “Master” boiler. When operating as a member, starting, stopping, and firing rate shall also be controlled by the “BMS” or “Master” boiler.
2. When using the HeatNet protocol, the system setpoint shall be sent from the “Master”, along with the modulation value to control firing rate. It also receives its command to start or stop over the HeatNet cable. Each “Member” will continuously monitor its supply outlet temperature against its operating limit. If the supply temperature approaches the operating limit temperature (adjustable), the boilers input control rate is limited and its modulation value decreases to minimize short cycling. If the operating limit is exceeded, the boiler shall shut off.

E. Each HeatNet control in the boiler network shall have the following standard features:

1. Digital Communications Control.

F. Boiler to Boiler: HeatNet

G. Building Management System (BMS): MODBUS standard protocol.

H. Building Management System (BMS): BACnet, LONWORKS and N2 optional protocols.

1. Analog 4:20 supported.
2. Distributed control using Heat-Net protocol for up to 16 total boilers.
3. System/Boiler operating status in English text display.
4. Interlock, Event, and System logging with a time stamp.
5. Advanced PID algorithm optimized for specific boilers.
6. Four dedicated temperature sensor inputs for: Outside Air Temperature, Supply (Outlet) Temperature, Return Temperature (Inlet), and Header Temperature.

7. Automatically detects the optional temperature sensors on start up.
8. Menu driven calibration and setup menus with a bright 2-line Vacuum Fluorescent Display.
9. (3) Dedicated 24vac interlock monitors used for diagnostics and providing feedback of faults and system status.
10. Boiler pump or motorized boiler valve control modes.
11. Combustion Air Damper control with proof time.
12. Optional USB/RS485 network plug-in to allow firmware updates or custom configurations.
13. Optional BACnet, LONWORKS and N2 interface.
14. Alarm contacts.
15. Runtime hours.
16. Outdoor Air Reset with programmable ratio.
17. Time of Day clock to provide up to four (4) night setback temperatures.
18. Failsafe mode when a Building Management System (BMS) is controlling setpoint. If communications are lost, the boiler/system shall run off the Local Setpoint.
19. Support for domestic hot water (DHW) using a 10k sensor or a dry contact input from a tank thermostat and a domestic hot water relay (pump/valve).
20. Continuous Daily Runtime Restart feature that monitors the runtime of each boiler and if any in the network have exceeded 24 hours of continuous runtime, the boiler is restarted to protect the UV flame scanner.
21. Allows for selection of any boiler in the network to act as Lead Boiler.
22. Adaptive Modulation feature in which the Master boiler adjusts the system modulation rate to a lower value when a new boiler in the network is started to compensate for the added BTUs to the system. Once the newly added boiler fires and the adjustable timer expire, the Master resumes control of the system modulation to maintain setpoint temperature.
23. Priority firing - Allows mixing of condensing and non-condensing, base load and/or other combination of (2) functional boiler types utilizing (2) priority levels.
24. Available priority start/stop qualifiers shall be done using any combination of: A) modulation percentage B) outdoor air temperature (or) C) return water temperature.
25. Base Loading - Provides the ability to control (1) base load boiler with enable/disable and 4-20mA modulating signal (if required).

I. Safety Relief Valve: ASME rated, factory set to protect boiler and piping as per schedule/drawings.

J. 100 psi maximum allowable working pressure.

K. Gauge: Combination water pressure and temperature shipped factory installed. LCD outlet temperature readout to be an integral part of the front boiler control panel display to allow for consistent easy monitoring of temperatures factory mounted and wired.

L. Burner Controls: Boiler shall be provided with a Fenwal series flame safe guard with flame rod rectification.

M. High Limit: Temperature control with auto reset limits boiler water temperature in series with the operating control. High Limit shall be factory mounted and sense the outlet temperature of the boiler through an immersion sensor.

N. Provide the Following Standard Trim:

1. Stainless steel condensate receiver pan
2. Blocked flue detection switch
3. Modulation control

4. Temperature/Pressure gauge
5. Auto reset high limit
6. Air inlet filter
7. Supply outlet temperature display
8. Full digital text display for all boiler series of operation and failures
9. Combustion air fan with safety interlock
10. Condensate drain

2.4 MOTORS

A. Boiler Blower Motor: Blower motor shall be externally mounted for ease of service. There shall be no requirement to remove gas train components to remove the blower motor.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect boilers according to the ASME Boiler and Pressure Vessel Code, Section IV. Boilers shall be test fired in the factory with a report attached permanently to the exterior cabinet of the boiler for field reference.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive boiler for compliance with requirements for installation tolerances and other conditions affecting boiler performance. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install boilers level and plumb, according to manufacturer’s written instructions and referenced standards.

B. Install gas-fired boilers according to NFPA 54.

C. Support boilers on a minimum 4 inch thick concrete base, 4 inches larger on each side than base of unit.

D. Install electrical devices furnished with boiler, but not specified to be factory mounted.

3.3 CONNECTIONS

A. Connect gas piping and individual regulator (if above 14" W.C.) full size, to boiler gas train inlet with union.

B. Connect hot water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

C. Install piping from safety relief valves to nearest floor drain.

D. Connect breeching to boiler outlet, full size of outlet. The boiler shall operate under positive (Category IV) or negative (Category II) stack pressure. Vent material must be listed AL29-4C Stainless Single or Double Wall Stack for condensing appliances.

E. Electrical: Comply with applicable requirements in Division 26 Sections.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to supervise the field assembly of components and installation of boilers, including piping and electrical connections.

B. Report results in writing.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Boiler shall be commissioned by factory authorized technician. Contact local representative for factory authorized technician information.

C. Manufacturer's representative shall supply a factory authorized service technician to start up the boilers.

3.5 CLEANING

A. Flush and clean boilers on completion of installation, according to manufacturer's written instructions.

B. After completing boiler installation, including outlet fittings and devices, inspect exposed finish.

C. Remove burrs, dirt, and construction debris.

3.6 COMMISSIONING

A. Engage a factory-authorized service representative to provide startup service. Start up to be performed only after complete boiler room operation is field verified to offer a substantial load, and complete system circulation. One-year warranty shall be handled by factory authorized tech.

B. Verify that installation is as indicated and specified.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections. Do not proceed with boiler startup until wiring installation is acceptable to equipment Installer.

C. Complete manufacturer's installation and startup checklist and verify the following:

1. Boiler is level on concrete base.
2. Flue and chimney are installed without visible damage.
3. No damage is visible to boiler jacket, refractory, or combustion chamber.
4. Pressure reducing valves are checked for correct operation and specified relief pressure.
5. Adjust as required.
6. Clearances have been provided and piping is flanged for easy removal and servicing.
7. Heating circuit pipes have been connected to correct ports.
8. Labels are clearly visible.
9. Boiler, burner, and flue are clean and free of construction debris.
10. Pressure and temperature gauges are installed.
11. Control installations are completed.

D. Ensure pumps operate properly.

E. Check operation of gas pressure regulator device on gas train if used, including venting.

F. Check that fluid level, flow switch (optional), and high temperature interlocks are in place.

G. Start pumps and boilers, and adjust burners to maximum operating efficiency.

1. Fill out startup checklist and attach copy with Contractor Startup Report.
2. Check and record performance of factory-provided boiler protection devices and firing
3. sequences.
4. Check and record performance of boiler fluid level, flow switch (optional), and high temperature interlocks.
5. Operate boilers as recommended or required by manufacturer.

H. Perform the following tests for maximum and minimum firing rates for modulating burner. Adjust boiler combustion efficiency at maximum and minimum modulation rates. Perform combustion flue gas test at minimum and maximum modulation rate. Measure and record the following:

1. Combustion air temperature at inlet to burner.
2. Flue gas temperature at boiler discharge.
3. Flue gas carbon dioxide, oxygen, and carbon monoxide concentration.
4. Flue gas NOx emissions where applicable.
5. Natural flue draft.

I. Measure and record temperature rise through each boiler.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Operate boiler, including accessories and controls, to demonstrate compliance with requirements.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and
shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."

4. Review data in the maintenance manuals. Refer to Division 1 Section “Operation and
5. Maintenance Data.”
6. Schedule training with Owner with at least 7 days’ advance notice.

END OF SECTION 235233.19

SECTION 260000
ELECTRICAL INDEX

SECTION 260100
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

C. Division 09 FINISHES Sections.

D. Division 31 EARTHWORK Sections.

1.2 SUMMARY

A. This Section includes general administrative, procedural requirements, construction materials and construction methods for electrical installations. The following requirements are included in this Section to expand the requirements specified in Division 01 - reference individual sections for further expansion of these requirements:

1. Abbreviations and Acronyms
2. Definitions
3. Permits, Codes, and Inspections
4. Visiting Premises
5. Project Drawings and Specifications
6. Nameplate Data
7. Soil Materials
8. Coordination
9. Substitutions
10. Excavation, Backfill and Restoration
11. Submittals
12. Quality Assurance and Testing
13. Temporary
14. Delivery, Storage, and Handling
15. Cutting and Patching
16. Installations
17. Final Cleaning
18. Warranties
19. Maintenance Manuals
20. Record Documents
21. Demonstration and Training

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
2. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
3. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
4. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
5. AIA - American Institute of Architects (The); www.aia.org.
6. AISC - American Institute of Steel Construction; www.aisc.org.
7. AISI - American Iron and Steel Institute; www.steel.org.
8. ANSI - American National Standards Institute; www.ansi.org.
9. APA - Architectural Precast Association; www.archprecast.org.
10. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
11. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
12. ASSE - American Society of Safety Engineers (The); www.asse.org.
13. ASTM - ASTM International; www.astm.org.
14. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
15. AWEA - American Wind Energy Association; www.awea.org.
16. BICSI - BICSI, Inc.; www.bicsi.org.
17. CDA - Copper Development Association; www.copper.org.
18. CEA - Consumer Electronics Association; www.ce.org.
19. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
20. CSA - CSA Group; www.csa.ca.
21. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
22. CSI - Construction Specifications Institute (The); www.csinet.org.
23. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
24. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
25. DHI - Door and Hardware Institute; www.dhi.org.
26. DOE - Department of Energy; www.energy.gov.
27. ECA - Electronic Components Association; (See ECIA).
28. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
29. ECIA - Electronic Components Industry Association; www.eciaonline.org.
30. EIA - Electronic Industries Alliance; (See TIA).
31. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
32. EPA - Environmental Protection Agency; www.epa.gov.
33. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
34. ESTA - Entertainment Services and Technology Association; (See PLASA).
35. ETL - Intertek (See Intertek); www.intertek.com.
36. FAA - Federal Aviation Administration; www.faa.gov.
37. FM Approvals - FM Approvals LLC; www.fmglobal.com.
38. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
39. GSA - General Services Administration; www.gsa.gov.
40. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
41. HUD - Department of Housing and Urban Development; www.hud.gov.
42. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
43. ICBO - International Conference of Building Officials; (See ICC).
44. ICC - International Code Council; www.iccsafe.org.
45. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
46. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
47. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
48. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
49. IESNA - Illuminating Engineering Society of North America; (See IES).
50. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.

51. ISO - International Organization for Standardization; www.iso.org.
52. ITU - International Telecommunication Union; www.itu.int/home.
53. LPI - Lightning Protection Institute; www.lightning.org.
54. MCA - Metal Construction Association; www.metalconstruction.org.
55. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
56. MHIA - Material Handling Industry of America; www.mhia.org.
57. MPI - Master Painters Institute; www.paintinfo.com.
58. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
59. NBI - New Buildings Institute; www.newbuildings.org.
60. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
61. NCMA - National Concrete Masonry Association; www.ncma.org.
62. NECA - National Electrical Contractors Association; www.necanet.org.
63. NEMA - National Electrical Manufacturers Association; www.nema.org.
64. NETA - InterNational Electrical Testing Association; www.netaworld.org.
65. NFHS - National Federation of State High School Associations; www.nfhs.org.
66. NFPA - National Fire Protection Association; www.nfpa.org.
67. NICET - National Institute for Certification in Engineering Technologies.
68. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
69. NSPE - National Society of Professional Engineers; www.nspe.org.
70. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
71. OSHA - Occupational Safety & Health Administration; www.osha.gov.
72. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
73. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
74. RoHS – Restriction of Hazardous Substances
75. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
76. SIA - Security Industry Association; www.siaonline.org.
77. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
78. SPIB - Southern Pine Inspection Bureau; www.spib.org.
79. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
80. SSINA - Specialty Steel Industry of North America; www.ssina.com.
81. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
82. STI - Steel Tank Institute; www.steeltank.com.
83. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
84. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
85. UL - Underwriters Laboratories Inc.; www.ul.com.
86. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
87. USGBC - U.S. Green Building Council; www.usgbc.org.
88. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
89. WASTEC - Waste Equipment Technology Association; www.wastec.org.

1.4 DEFINITIONS

A. Basic Contract definitions are included in the Conditions of the Contract.

1. Approved: When used to convey Architect's action on Contractor's submittals, applications, and requests, 'approved' is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
2. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than 2 inches in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

3. Concealed: Embedded in masonry or other construction, installed behind wall furring or within double partitions or installed within hung ceilings.
4. Conduit: The inclusion of all fittings, hangers, supports, sleeves, etc.
5. Contractor: As stated herein shall mean Electrical Contractor.
6. Directed: A command or instruction by Architect. Other terms including 'requested,' 'authorized,' 'selected,' 'required,' and 'permitted' have the same meaning as 'directed.'
7. Equal: Equivalent as approved by the Architect or their representative.
8. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
9. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including 'shown,' 'noted,' 'scheduled,' and 'specified' have the same meaning as 'indicated.'
10. Install: Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
11. Project Site: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
12. Provide: Furnish and install, complete and ready for the intended use.
13. Regulations: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
14. Sub-base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.
15. Subgrade: Compacted soil immediately below the slab or pavement system.
16. Wiring: The inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such work.

1.5 PERMITS, CODES, AND INSPECTIONS

A. Contractor shall obtain and pay for all permits and inspections required by laws, ordinances, rules and regulations having jurisdiction for work included under this Contract, and shall submit approval certificates to the Architect.

B. The electrical installation shall comply fully with

1. All local, county and state laws, ordinances and regulations having jurisdiction and as applicable to the electrical installations.
2. All requirements of electric, telephone, and CATV utility companies.
3. All approved published instructions set forth by equipment manufacturers.

C. The Electrical installation and all components shall be in compliance with the code and/or standard requirements of the latest revision or state-adopted edition of:

1. American Society for Testing and Materials (ASTM)
2. Americans with Disabilities Act (ADA)
3. FM Global (Factory Mutual) Approval Guide
4. Institution of Electrical and Electronic Engineers (IEEE)
5. International Building Code (IBC)
6. International Fire Code (IFC)
7. International Energy Conservation Code (IECC)
8. Legislative Act 235 (1965) - Handicapped
9. Legislative Act 287 (1974) - Excavation
10. National Electric Code (NEC)

11. National Electrical Contractor's Association (NECA)
12. National Electrical Manufacturer's Association (NEMA)
13. National Electrical Safety Code (NESC)
14. National Fire Protection Association (NFPA)
15. National Safety Code
16. Occupational Safety and Health Act (OSHA)
17. Underwriter's Laboratories, Inc. (UL)

D. Submit certificates issued by approved authorized agencies to indicate conformance of all work with the above requirements, as well as any additional certificates as may be required for the performance of this contract work.

E. Should any change in Drawings or Specifications be required to comply with governmental regulations, the Contractor shall notify Architect prior to execution of the work. The work shall be carried out according to the requirements of such code in accordance with the instruction of the Architect and at no additional cost to the Owner.

F. Certificate of Inspection: The Contractor shall procure and pay for the Certificate of Inspection from the municipality-approved inspection agency and deliver it to the Architect before final payment is made.

1.6 VISITING PREMISES

A. The Bidder shall visit the project site before submitting his bid, in order to familiarize himself with existing conditions that may affect his work. It is the Contractor's responsibility to analyze existing conditions. Sufficient allowances shall be provided in the Contractor's bid to cover work, due to existing conditions, that will be required to complete this contract work.

B. By submission of a bid, the Contractor is attesting that responsible personnel did in fact visit the site during the bidding period and verified all existing pertinent conditions.

C. Contractor shall verify all measurements and dimensions at the site prior to submitting a bid.

1.7 PROJECT DRAWINGS AND SPECIFICATIONS

A. Contractor shall carefully examine the Drawings and Specifications of all trades and report all discrepancies to the Architect in writing to obtain corrective action. No departures from the Contract Documents will be made without prior written approval from the Architect.

B. Questions or disputes regarding the intent or meaning of Contract Documents shall be resolved by the interpretation of the Architect. The Architect's interpretation is final and binding.

C. The Drawings and Specifications are not intended to define all details, finish materials, and special construction that may be required or necessary. The Contractor shall provide all installations complete and adequate as implied by the project documents.

D. Drawings are diagrammatic only and do not show exact routes and locations of equipment and associated wiring. The Contractor shall verify the work of all other trades and shall arrange his work to avoid conflicts. In the event of a conflict, the Contractor shall obtain corrective action from the Architect.

E. All work shall be considered new, unless noted otherwise.

F. Prior to the submitting of bids, the Contractor shall familiarize himself with all conditions affecting the proposed installation of equipment by all trades that will require electrical connections and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph shall in no way relieve the Contractor of performing all necessary work required for final electrical connections and equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment for which Underwriter's Laboratories have established standards shall bear a UL label of approval.

B. When two or more items of same material or equipment are required, they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, and similar items used in work, except as otherwise indicated.

C. Provide products that are compatible within systems and other connected items.

D. In all cases where a device, function or item of equipment is herein referred to in the singular, such reference shall apply to as many such items as are required to complete the installation.

E. All listed materials and equipment shown on drawings and/or specified herein, are indicative of complete and whole units and shall be furnished as such.

F. In certain instances specific manufacturer/model/type and catalog numbers are set out herein or on the drawings for the purpose of indicating required criteria for quality, function, sound level and acceptable physical size. Specifications, performance data, and descriptive data published by the designated manufacturer shall be taken as minimum requirements for the item to be provided.

G. Comply with manufacturer's printed instructions and recommendations as minimum criteria for the installation of equipment.

H. Where proprietary names are used, whether or not followed by the words "or as approved", they shall be subject to substitution only as approved by the Architect.

I. All materials and equipment provided under this Contract shall be completely satisfactory and acceptable in operation, performance and capacity. No approval, either verbal or written, of any drawing, descriptive data or samples of such materials, equipment and/or appurtenances, shall relieve this Contractor of his responsibility to turn over all items in perfect working order at completion of the work.

J. All material and equipment to be furnished under this contract shall be new and shall conform to the grade, quality and standards specified herein. Items of equipment shall be the latest standard product as advertised in printed catalogues by reputable manufacturers for the purpose intended and shall have replacement parts available.

2.2 NAMEPLATE DATA

A. Provide factory-installed, permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.

2.3 SOIL MATERIALS

A. Provide in accordance with Division 31 EARTHWORK Sections.

PART 3 - EXECUTION

3.1 GENERAL

A. All construction under this contract shall be completed in a neat and craftsman-like manner. Work that, in the judgement of the Architect, is not satisfactorily installed shall be removed and replaced to the Architect's satisfaction, at the Contractor's expense.

B. Throughout construction, all work areas and storage areas shall be kept clean. The Contractor shall keep all items clean of dirt, rust, dust and fingermarks.

C. The Contractor shall furnish, set, erect, and maintain all scaffolding, aerial equipment and ladders required in the installation of this Contract work.

D. Install temporary platforms so as to be supported only by the existing steel truss framework.

E. Painting: Provide in accordance with Division 09 FINISHES Sections and as stated below.

1. Except in Mechanical Rooms, Electrical Rooms, attics, and chase spaces all exposed items provided or installed under this Contract shall be painted.
2. Unless painting is provided by others as elsewhere specified, all painting for items furnished or installed under this Contract shall be the responsibility of this Contractor.
3. Factory-painted equipment cabinets and trim shall not be field-painted except for touching up scratches or damage where necessary to achieve like-new finish. Touching up shall be done after equipment is in its final location.
4. Paint for metal surfaces shall be Rust-o-leum or as approved, one prime coat and two finish coats of color selected by Architect.
5. Items to be painted shall be cleaned and degreased and shall be free of dirt, rust and corrosion prior to application of paint. All paint shall be applied in accordance with all the manufacturer's recommendations (i.e. temperature, dew point, ventilation).
6. All patchwork performed under this Contract shall be painted. Color shall match the color of adjacent walls, ceilings and floors in which patchwork occurs. Area to be painted shall extend a minimum of 24" all around patchwork; however, final limit shall be set by the Architect. Blend new paint work with existing painted surfaces. Where existing finish is stained or varnished woodwork, all damaged or patched surfaces shall be restored to match the existing adjacent surface, as approved. Paint, stain, varnish and method of application shall be as set out in the specifications for General Construction, or as otherwise approved. Except where painting of patchwork is provided by others, as elsewhere specified, all painting of patchwork required under this Contract shall be the responsibility of this Contractor.

3.2 COORDINATION

A. Sequence of Work

1. Provide in accordance with Division 01 Section SUMMARY.

B. Utility

1. The Contractor shall cooperate fully with local utility companies with respect to their services.
2. The Contractor shall be responsible for all coordination and scheduling of construction with all utility companies as necessary for the performance of this Contract work.
3. The actual amount of the charges will be determined by the electric utility company at the time of the installation, and shall be paid directly by the Owner.
4. Coordinate the shut-off and disconnection of electrical service with the Owner and the utility company.

C. Outages and Disruptions

1. Continuity of operation of all essential HVAC, plumbing and electrical items, including electrical service, lighting, outlets, power and controls for heating and cooling equipment, auxiliary systems, fire alarm, emergency lighting and power, program, sound, alarms and telephones shall be provided as required for occupancy of the premises during the construction period.
2. Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

    a. Notify Owner no fewer than fourteen days in advance of proposed interruption of electric service.
    b. Indicate method of providing temporary electric service.
    c. Do not proceed with interruption of electric service without Owner's written permission.

3. Provide temporary wiring and connections to maintain existing systems in service during construction.
4. The schedule and timing of any interruption of water, gas or electrical service or disruption of occupied areas that may affect use of the premises by the Owner and the public, shall be coordinated with the Owner and Architect. Temporary or interim use feeders and facilities shall be provided by the Contractor, as approved and/or directed, to minimize the duration and extent of outages or interruptions.
5. In areas where the construction work will interfere unduly with use of the premises, the Owner may direct that construction work be performed during time periods other than indicated above or on Saturdays, Sundays, or Holidays. Judgment as to whether such undue interference may exist shall rest solely with the Owner. Also, the Owner may require that temporary or interim use feeders and facilities shall be provided by the Contractor as approved and/or directed, to minimize the duration and extent of outages or interruptions.
6. Preparatory work shall be performed as completely as possible in each instance prior to scheduled service outages.
7. Contractor shall be responsible for any and all premium time/overtime required to perform outages and cutovers of services. Coordinate with Owner and Architect.
8. Contractor shall be responsible for any and all premium time/overtime required to complete the work in the various areas within the allotted time, as well as any premium/overtime required to install work through unaffected or remote areas from the work as necessary to

maintain continuity of services and occupancy of the existing buildings, as required. Coordinate with Owner and Architect.

D. New Work

1. Coordinate electrical equipment installation with other building components.
2. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work.
3. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.
4. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
5. Coordinate installation of large equipment requiring positioning prior to closing in the building.
6. Coordinate connection of electrical services with equipment provided under other sections of the specifications.
7. Coordinate requirements for access panels and doors where electrical items requiring access are concealed behind finished surfaces. Verify all dimensions by field measurements.
8. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
9. Coordinate the cutting and patching of building components to accommodate installation of electrical equipment and materials.
10. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.

E. Cooperation and Coordination With Other Trades

1. This Electrical Contractor must cooperate completely and coordinate work with the contractors of other trades providing equipment under this division and other divisions of the specifications. This is particularly important in connection with Divisions 21, 22, and 23 - Mechanical.
2. Interference drawings shall be prepared as a combined effort of all trades. The Electrical Contractor shall prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations on mylar backgrounds prepared by the Mechanical Contractor. The Mechanical Contractor shall start their drawings immediately upon award of contract. Drawings shall be at 1/4" = 1'0" scale based on sheet size and plan location and orientation as shown on the architectural drawings. All interference drawings shall be capable of being overlaid to coordinate interferences and for printing. All congested areas and mechanical room plans shall be drawn at 3/8" = 1'0" scale.
3. After the Mechanical Contractor has finished, electronic files will be forwarded to the Plumbing trade who will show and coordinate the plumbing work with the other trades. After the Plumbing trade has finished, electronic files will be forwarded to the Electrical trade who will show and coordinate their work on the combined plans.
4. Interference plans and elevations shall show in detail the location of the following items that require coordination because of size and proximity to other equipment and systems. Drawings shall show in order of installation priority within the allotted space the items prioritized in the following paragraph entitled "Space Priority".

    a. In addition, show electrical work in equipment rooms.
    b. On the interference drawings, show all electrical conduits that are 1-1/2" and larger.

c. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the work.
d. Proposed locations of major systems, equipment and material.
e. Work in pipe spaces, chases, and trenches.
f. Exterior wall penetrations.
g. Fire-rated wall and floor penetrations.
h. Ceilings that contain piping, ductwork, or equipment in congested arrangement.
i. Equipment connections and support details.
j. Exterior underground lines in common excavation.
k. Sizes and location of required concrete pads and bases.
l. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
m. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
n. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communications systems components, sprinklers, and other ceiling-mounted devices.
o. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.

5. Electronic files of the finished interference drawings shall be submitted to the Architect for record before actual installation work begins. Each trade shall make completed interference drawings available to their craft for installation of the work.
6. Individual trade interference drawings may be used as shop drawings and/or as record drawings at the completion of the project.
7. The coordination drawings shall be reviewed and approved by the Owner and Architect, and shall be signed by both the Owner and the Architect.

F. Cooperation and Coordination With Subcontractors

1. The Electrical Contractor shall give their subcontractors the option to attend construction and coordination meetings to aid in overall electrical construction coordination.

G. Space Priority

1. Ensure equitable use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

a. Gravity flow piping systems
b. Vent piping systems
c. Ceiling recessed lighting fixtures
d. Concealed air terminal units, fans
e. Air duct systems
f. Sprinkler systems piping
g. Forced flow piping systems
h. Electrical conduit, wiring, control wiring

2. Order of priority does not dictate installation sequence. Installation sequence shall be as mutually agreed by all affected trades.
3. Change in order of priority is permissible by mutual agreement of all affected trades.
4. The work of a particular trade shall not infringe upon the allocated space of another trade without permission of the contractor for the affected trade.
5. The work of a particular trade shall not obstruct access for installation, operation and maintenance of the Work, materials and equipment of another trade.

3.3 SUBSTITUTIONS

A. Provide in accordance with Division 01 Section SUBSTITUTION PROCEDURES and as stated below.

B. Where the contractor proposes substitute equipment, contractor to submit complete product data indicating compliance with all requirements of the documents, including performance rating, size and resistance to wear and deterioration equivalent to the specified item at least ten (10) days prior to the bid date. In instances where substituted equipment requires additional material or work beyond that shown or required by the specified item, said additional material or work shall be the responsibility of this Contractor, regardless of the trade involved.

3.4 EXCAVATION, BACKFILL, AND RESTORATION

A. Provide in accordance with Division 31 EARTHWORK Sections and as follows.

B. Conditions Affecting Excavations - the following project conditions apply:

1. Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information. Contact specific utility company immediately for instructions regarding uncharted or incorrectly charted utilities.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
3. Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.
4. Maintain and protect existing building services that transit the area affected by excavation.
5. Remove existing underground utilities indicated to be removed.
6. Use of explosives is not permitted.
7. Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
8. Where surface excavation cannot be used, provide directional boring or horizontal directional drilling for routing conduit below grade. Provide auger type boring machine for soil removal during boring process.

3.5 SUBMITTALS

A. Provide in accordance with Division 01 Section SUBMITTAL PROCEDURES and as stated below.

B. Submit for approval a complete Material Source of Supply and Subcontractor list for all electrical work required under this project. Shop drawing submittals will not be reviewed until a complete Material Source of Supply and Subcontractor list is received. Submit this listing as a part of the submittal requirement specified in Division 01.

C. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the Contractor. Data submitted from subcontractors and material suppliers directly to the Architect will not be processed.

D. Prepare and submit detailed shop drawings for materials, systems and equipment as listed herein, including locations and sizes of all openings in floor decks, walls and floors.

E. The work described in any shop drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper coordination with all trades on the job. Each submitted shop drawing shall include a certification that all related job conditions have been checked and that no conflict exists.

F. All shop drawings shall be stamped by the Contractor, indicating approval, and space shall be provided for the Engineer's stamp and the Architect's stamp.

G. All drawings shall be submitted sufficiently in advance of field requirements to allow ample time for checking and resubmittal as may be required. All submittals shall be complete and contain all required and detailed information.

H. Acceptance of any submitted data or shop drawings for material, equipment apparatus, devices, arrangement and layout shall not relieve the Contractor from responsibility of furnishing all items of proper dimensions, weight, capacities, sizes, quantity and quality as intended by the Contract. Such acceptance shall not relieve Contractor from responsibility for errors, omissions or inadequacies of any sort on submitted data or shop drawings.

I. Each shop drawing shall contain job title and reference to the applicable drawing and specification article, including the contractor’s drawings, specifications and verification of compatibility with the systems involved.

J. Individual shop drawing submittals shall be provided for each specific material, system or equipment as identified herein. Submittals provided in other than this manner will be return without review.

K. All nameplate data shall be complete at time of equipment submittals - refer to other sections for identification requirements.

L. For each room or area of the building containing switchboards, panelboards, transformers, and/or emergency generators, coordination drawings are required to be submitted for review and acceptance at the time of the equipment submittal.

M. Equipment shall not be ordered or purchased until the shop drawing approval is received.

N. Shop Drawings shall show conformance with specified electrical characteristics, or Contractor shall assume responsibility for all deviations including all additional costs involved for the deviations.

O. The following is a list of some important material, equipment and systems that require shop drawing approval, refer to each section of this specification for additional submittal requirements:
1. Low Voltage Electrical Power Cables
2. Grounding and Bonding Equipment
3. Hangers and Supports
4. Raceways and Boxes
5. Lighting Controls
6. Panelboards
7. Wiring Devices
8. Fuses
9. Enclosed Switches and Circuit Breakers
10. Light Fixtures

P. Product Options:

1. The product manufacturers listed in each section are either the product the design is based on or a product that the Engineer feels would be an acceptable substitution if that product can meet the intent of the written specifications and the scheduled capacities. The Electrical Contractor is responsible for ensuring that the substituted product complies with the intent of the specifications, the scheduled capacities and the drawings. Substitutions of manufacturers not listed are not permitted unless prior approval is obtained from the Engineer as required by Part 3.3, SUBSTITUTIONS, of this specification section.
2. It will be the responsibility of the Electrical Contractor to pay any and all costs associated with any approved substitutions that impact the architectural layout, structure, electrical system(s), mechanical systems, and/or the plumbing systems, due to an increase in physical dimensions, weight, electrical requirements, connection sizes, etc., between the approved substitution item and the equipment item scheduled and/or indicated as the basis of design.

3.6 QUALITY ASSURANCE AND TESTING

A. Provide in accordance with Division 01 Section QUALITY REQUIREMENTS.

B. Provide products that are listed and labeled by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Refer to all Division 26 specification sections for additional testing requirements.

3.7 TEMPORARY

A. Provide in accordance with Division 01 Section TEMPORARY FACILITIES AND CONTROLS and as stated below.

B. The Electrical Contractor shall provide temporary electric services to the construction areas at locations acceptable to the General Contractor. The service to be provided shall be from the existing electrical system and shall be 1 phase, 3 wire, 240/120V, 100 ampere minimum with the necessary distributing facilities. The service shall be installed within fifteen (15) days after written request has been made to the Electrical Contractor, with copies to the Architect and Owner by any contractor requiring such service.

C. The Electrical Contractor shall provide temporary electric services to the construction trailers at locations acceptable to the General Contractor. The service to be provided shall be from the existing electrical system and shall be 1 phase, 3 wire, 240/120V, 100 ampere minimum with the necessary distributing facilities. The service shall be installed within fifteen (15) days after written request has been made to the Electrical Contractor, with copies to the Architect and Owner, by any contractor requiring such service.

D. Power consumption shall not disrupt Owner's need for continuous service.

E. The Contractor shall provide power outlets for construction operations, branch wiring, distribution boxes. Each individual contractor will provide flexible power cords as required.

F. Power required for tools and operating equipment used for the installation of equipment, that exceeds the power available, shall be temporarily installed and removed by the Contractor requiring it.

G. Provide wiring and connections for temporary heating equipment required for construction purposes and to prevent building freeze up.

H. Distribution wiring and equipment/devices used for temporary services shall not be installed as part of the permanent building distribution system.

I. Permanent distribution wiring and equipment/devices shall not be used for temporary services.

J. The Contractor shall provide temporary lights and all associated wiring as required by the individual prime contractors.

K. Contractor to remove all temporary wiring and temporary lighting.

3.8 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with Division 01 Section PRODUCT REQUIREMENTS and as stated below.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for distinct identification; adequately packaged and protected to prevent damage during shipment, storage and handling.

D. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

E. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.9 CUTTING AND PATCHING

A. Provide in accordance with Division 01 Section EXECUTION.

3.10 INSTALLATIONS

A. Provide in accordance with Division 01 Section EXECUTION and as stated below.

B. Verify all dimensions by field measurements.

C. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

D. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

E. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible.

F. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

G. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.

H. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.

I. Install access panel or doors where units are concealed behind finished surfaces.

J. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

K. Obtain written approval of locations of all electrical devices from the Owner and Architect prior to rough-in. The owner reserves the right to move any or all electrical devices prior to rough-in, at no additional cost.

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

M. Obtain approval from the Architect before drilling or cutting structural members.

N. Holes cut into reinforced concrete beams or in concrete shall not cut reinforcing bars. If the Contractor cuts into any reinforcing bars, stop work and notify the Architect immediately.

O. Refer to equipment specifications in Divisions 02 through 33 for rough-in requirements for equipment furnished under other contracts.

P. Door swings may vary from plans. Make note of actual door swings at time of rough-in. Do not install switches or other items behind the swing of any door.

Q. The installation shall be subject to such revisions as may be necessary to overcome building obstructions.

R. Provide connections to all electrically operated equipment furnished under other sections and/or divisions of this project specification. Verify all power connections with submitted manufacturer’s written recommendations prior to installation and prior to energizing circuit.

S. Inspect areas and conditions under which electrical connections for equipment that will be installed and notify the Architect in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Contractor.

T. Verify that equipment is ready for electrical connection, wiring, and energization.

U. Install all in-line power control, protection, and disconnection devices furnished by others that are not an integral part of the equipment. These devices shall be located in accordance with the Contractor furnishing the devices and the requirements of the NEC.

V. Provide for proper rotation of all three phase motors.

W. Work improperly placed because of Contractor's failure to obtain the above information shall be relocated and reinstalled as directed, without additional costs to the Contract. No charges shall be made in location of equipment without prior written approval.

3.11 FINAL CLEANING

A. Provide in accordance with Division 01 Section CLOSEOUT PROCEDURES.

3.12 WARRANTIES

A. Provide in accordance with Division 01 Section CLOSEOUT PROCEDURES and as stated below.

B. Refer to individual equipment specifications for additional warranty requirements. If a contradiction exists, the most demanding requirements shall prevail.

C. Compile and assemble the warranties specified in Division 26 into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

D. Provide complete warranty information for each item to include date of beginning of warranty or bond; duration of warranty or bond; and names, address, and telephone numbers and procedures for filing a claim and obtaining warranty services.

E. Submit a single warranty stating that all portions of the work are in accordance with Contract requirements. Warrant all work against faulty and improper material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, such longer term shall apply. Within 24 hours after notification, correct any deficiencies that occur during the warranty period at no additional cost to Owner, all to the satisfaction of the Owner and Architect. Obtain similar warranties from subcontractors, manufacturers, suppliers and sub-trade specialists.

F. Any material, equipment or appurtenance whose operation or performance does not comply with the requirements of the Contract Documents or that are damaged prior to acceptance will be held as defective and shall be removed and properly replaced at no additional cost to the Owner.

3.13 MAINTENANCE MANUALS

A. Provide in accordance with Division 01 Section OPERATION AND MAINTENANCE DATA and as stated below.

B. Include the following information for equipment items:

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

4. Servicing instructions and lubrication charts and schedules.
5. Provide a cover sheet for each manual including the project name, Architect's name and contact information, Engineer's name and contact information, and Division 26 contractor's name and contact information.
6. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.
7. Manufacturer's data of each piece of equipment including:

    a. Installation instructions.
    b. Drawings and Specifications.
    c. Parts list, including recommended items to be stocked.
    d. Complete wiring diagrams.
    e. Marked or changed prints locating all concealed parts and all variations from the original system design.
    f. Test and inspection certificates.

3.14 RECORD DOCUMENTS

A. Provide in accordance with Division 01 Section PROJECT RECORD DOCUMENTS and as stated below.

B. Indicate installed conditions for the following:

1. Raceway systems, size and location, for both exterior and interior.
2. Locations of control devices.
3. Distribution and branch electrical circuitry.
4. Fuse and circuit breaker size and arrangements.
5. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
6. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
7. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified in Division 01 to record the locations and invert elevations of underground installations.

3.15 DEMONSTRATION AND TRAINING

A. Provide in accordance with Division 01 Section DEMONSTRATION AND TRAINING and as stated below.

B. After the tests and adjustments have been made, approved factory-authorized system representatives and the Contractor shall fully instruct Owner in all details of operation and maintenance of equipment installed under this Contract. Dates and times of such instructions shall be as directed by Owner, including any necessary weekend or after-hours instruction.

C. The following is a list systems that require Demonstration and Training, refer to the individual specification sections for additional training requirements:

1. Lighting Controls
2. Panelboards
3. Enclosed Switches and Circuit Breakers

END OF SECTION 260100

SECTION 260519

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal clad cable, Type MC, rated 600 V or less.
3. Connectors, splices, and terminations rated 600 V and less.

1.3 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product Data: Submit manufacturer's data for electrical wires, cables and connectors.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated, drawn copper current-carrying conductor with an overall insulation layer and jacket, rated 600 V or less.

B. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Cerro Wire
1. Colonial Wire and Cable Company
2. Encore Wire Corporation
3. General Cable Corporation
4. Nehring Electrical Works Company
5. Okonite Company
6. Service Wire Company
7. Southwire Company

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type THHN/THWN-2: Comply with UL 83.

2.2 METAL CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. AFC Cable Systems
2. Encore Wire Corporation
3. Okonite Company
4. Service Wire Company
5. Southwire Company

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits: Single circuit and multi-circuit with color-coded conductors as required.

E. Conductors for branch circuits, #8AWG and smaller: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors

F. Conductors for feeders, #6 and larger: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors

G. Ground Conductor: Insulated.

H. Conductor Insulation: Type THHN/THWN-2: Comply with UL 83.

I. Armor: Steel, interlocked.

J. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use. Use connectors with temperature ratings equal to or greater than those of the wires upon that are used.

B. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. 3M Electrical Products
2. AFC Cable Systems
3. Burndy
4. Hubbell Power Systems
5. Ideal Industries
6. ILSCO
7. NSi Industries
8. O-Z/Gedney
9. TE Connectivity
10. Thomas and Betts Corporation

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Match conductor material.
2. Termination: Compression.

2.4 COLOR CODING

A. Color Coding of Conductors - factory applied the entire length of conductors, provide the following:

1. 208/120V through 240V Conductors:

a. Phase A: Black
b. Phase B: Red
c. Phase C: Blue
d. Neutral: White

2. Travelers for 3 way/4 way switches shall be purple.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. Each length, bundle, or reel of wire and cable delivered to job site shall bear manufacturer's name, catalog number and trademark, UL label, type letters, size, length and manufacturing date.

B. Deliver wire and cable properly packaged in factory fabricated type containers, or wound on NEMA specified type wire and cable reels.

C. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris, and traffic.

D. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

3.2 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper, stranded.

B. Feeders: Copper for feeders smaller than No. 6 AWG.

C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

D. Branch Circuits: Copper, stranded.

3.3 CONDUCTOR INSULATION AND MULTI-CONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Feeders:

1. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
2. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
3. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Metal clad cable, Type MC.
4. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

B. Branch Circuits:

1. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
2. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway and /or Metal clad cable, Type MC. Provide Type MC cable only for concealed branch circuit wiring in drywall partitions and above accessible ceilings. MC cable shall terminate in a junction box above the finished ceiling of space served by circuiting. All homeruns from branch panelboards shall be routed to space served in EMT conduit, unless otherwise specified. MC cable will not be used as the homerun from space served to panelboard of origin, unless otherwise specified.
3. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Provide wire and cable suitable for temperature, conditions and location; and install in compliance with the NEC.

C. Minimum wire size shall be #12 AWG for all wiring, with the following exceptions:

1. If the distance between the panelboard and the first circuit load is greater than 100 feet, the minimum wire size shall be #10 AWG.
2. All emergency lighting circuit wiring shall be #10 AWG or larger.
3. Conductors and cables for communications and signal systems shall be as described in respective specification sections and as recommended and approved by manufacturer.

D. Provide dedicated neutrals for all single-phase branch circuits.

E. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

F. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

G. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

H. Pull conductors simultaneously where more than one is being installed in same raceway.

I. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

J. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

K. MC cable shall be neatly trained and supported clear of ceiling tile and ceiling grid by means of metallic straps or clips. The use of nylon tie wraps to support MC cable from the structure is prohibited. Supports for MC cable shall be independent from supports for other systems (i.e. light fixtures, ceiling grid, mechanical systems) and the supports for the MC cable shall be directly connected to the structure.

L. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

M. Conductor/cable supports for vertical runs shall be provided in top cabinet or pull box of all feeders in accordance with NEC requirements.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Splices:

1. Keep conductor splices to minimum.
2. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3. Splicing of #10 wires and smaller shall be made with Scotchlok or as approved.
4. Splicing of #8 wire and larger shall be made by means of compression type connectors and installed with a proper tool and then insulated to same dielectric value as the original insulation with plastic tape.
5. Splices are not permitted in conductors larger than #10, except where specifically called for.
6. All splicing shall be made in outlet boxes or junction boxes.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

3.7 SLEEVE AND SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Seals for Electrical Systems".

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 260544 "Sleeves and Seals for Electrical Systems".

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform each of the following visual and electrical tests:

1. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
2. Test bolted connections for high resistance using one of the following:

    a. A low-resistance ohmmeter.
    b. Calibrated torque wrench.
    c. Thermographic survey.

3. Inspect compression-applied connectors for correct cable match and indentation.
4. Inspect for correct identification.
5. Inspect cable jacket and condition.
6. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
7. Continuity test on each conductor and cable.
8. Uniform resistance of parallel conductors.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

1.3 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product data for ground rods, connectors and connection materials, and grounding fittings.
2. Qualification Data: For testing agency and testing agency's field supervisor.
3. Field quality control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Materials: Copper with 98% conductivity.

2.2 MANUFACTURERS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. B-Line Systems Inc.
2. Burndy Corporation
3. Erico International
4. ILSCO
5. O-Z/Gedney
6. Thomas and Betts Corporation

2.3 CONDUCTORS

A. Comply with Division 26 Section 260519 " Low Voltage Electrical Power Conductors and Cables".

B. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction, green insulation.

C. Bare Copper Conductors: Stranded Conductors: ASTM B 8.

D. Copper Bonding Conductors:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
3. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

E. Grounding Bus: Pre-drilled rectangular bars of annealed copper, 24 inch long, 1/4 inch by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors:

1. Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
2. Manufacturers - subject to compliance with requirements, provide products of one of the following:

a. nVent ERICO Cadweld
b. Hubbell Continental Industries thermOweld

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar or compression type, copper or copper alloy, with two wire terminals.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Bonding Strap: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

G. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gauge bare copper wire; 3/4" wide, 9-1/2" long. Protect braid with copper bolt hole ends with holes sized for 3/8" diameter bolts.

H. Water Pipe Clamps: Mechanical type, die-cast zinc alloy, two pieces with stainless steel bolts.

I. Conduit Hubs: Mechanical type, terminal with threaded hub.

2.5 GROUNDING ELECTRODES

A. Ground Rods: 13-mil copper-bonded steel, 3/4 inch by 8 feet.

2.6 ACCESSORIES

A. Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Equipment Grounding

1. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

    a. Feeders and branch circuits.
    b. Lighting circuits.
    c. Receptacle circuits.
    d. Single-phase motor and appliance branch circuits.
    e. Three-phase motor and appliance branch circuits.
    f. Flexible raceway runs.
    g. Metal-clad cable runs.

2. Air Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping. Install bonding jumper to bond across flexible duct connections to achieve continuity.
3. Water Heater Cables: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

4. Poles Supporting Outdoor Lighting Fixtures: In addition to grounding conductor installed with branch circuit conductors, install a grounding electrode at each pole connected to ground lug in pole handhole.

B. Grounding and Bonding for Gas Piping: Bond each above-ground portion of gas piping system downstream from equipment shutoff valve.

C. Telecommunications Grounding

1. Install ground bus in rooms housing service equipment and elsewhere as indicated on drawings. Install horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Provide a #3/0 AWG green insulated copper conductor, unless noted otherwise, from the grounding electrode system to each ground bus location.

D. Fence Grounding

1. Metallic Fences: Comply with requirements of IEEE C2.
2. Fence Grounding: Install at maximum intervals of 300 feet except as follows:

    a. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 100 feet.
    b. Barbed Wire: Strands shall be bonded to the grounding conductor.

3. Gates and Other Fence Openings: Ground fence on each side of opening.

    a. Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.
    b. Connect flexible bonding jumper between gate post and gate frame.

4. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.
5. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
6. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

E. Service Grounding

1. Connect equipment grounding conductors and grounding electrode conductors to the ground bus.
2. Install a main bonding jumper between the neutral and ground buses.
3. Metallic Water Service Pipe:

    a. Provide insulated copper ground conductors, sized as indicated, from the building main service equipment, or the ground bus, to main metallic water service entrances to the building. Connect ground conductors to the main metallic water service pipes by means of ground clamps. Where a dielectric main water fitting is installed, connect the ground conductor to the street side of the fitting. Do not install a grounding jumper around dielectric fittings.
    b. Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

4. Grounding Triad: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

F. Overhead Line Grounding

1. Comply with ANSI C2, "National Electrical Safety Code" for "Single-Grounded Systems," using two electrodes in parallel if a single electrode resistance to ground exceeds 25 ohms.
2. Provide No. 4 AWG minimum, soft-drawn copper conductor, unless noted otherwise.
3. Grounding Conductor Protection: Protect grounding conductors running on the surface of wood poles with molding of a type manufactured for this purpose. Extend from grade level up to and through communications and transformer spaces.
4. Drive ground rods to a depth of 12 inches below finished grade in undisturbed earth. Use exothermic welds for underground connections and connections to rods.
5. Lightning Arresters: Separate arrester grounds from other ground conductors.
6. Secondary Neutral and Tank of Transformer: Interconnect and connect to ground.

G. For raceways used as the ground path, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing.

3.2 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Terminate insulated equipment grounding conductors with pressure-type grounding lugs.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment. Use braided type bonding jumpers for flexible bonding and grounding connections.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

C. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
6. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and

bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

7. Exothermic Welded Connections:

    a. Comply with manufacturer's written recommendations.
    b. Use for connections to structural steel and for underground connections.
    c. Install at connections to ground rods.
    d. Comply with AWS Code for procedures, appearance, and quality of welds; and methods used in correcting welding work.
    e. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

8. Provide connections as follows:

    a. Equipment Grounding Conductor Terminations: Bolted connectors.
    b. Pipe Grounding Conductor Terminations: Bolted connectors.
    c. Underground Connections: Welded connectors.
    d. Connections to Structural Steel: Welded connectors.
    e. Connections to Ground Rods at Test Wells: Bolted connectors.

D. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. Use exothermic welds for all below-grade connections.

E. Underground Grounding Conductors: Install bare copper conductor, No. 3/0 AWG, unless noted otherwise. Bury at least 24 inches below grade.

F. Cleaning And Adjusting: Restore surface features at areas disturbed by excavation and reestablish original grades except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other Work to their original condition. Include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching. Restore disturbed paving as required.

3.3 FIELD QUALITY CONTROL

A. Independent Testing Organization: Arrange and pay for the services of a qualified independent electrical testing organization to perform tests described below.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at service disconnect enclosure grounding terminal at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural

drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.
c. Prepare test and inspection reports.
d. Excessive Ground Resistance: If resistance to ground exceeds 5 ohms, notify Engineer promptly and include recommendations to reduce ground resistance.
e. Provide approved method to reduce ground resistance and retest.

C. Grounding system will be considered defective if it does not pass tests and inspections.

END OF SECTION 260526

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

1.3 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Manufacturers - subject to compliance with requirements, provide products of one of the following:

a. B-Line/Eaton
b. Caddy/Pentair
c. Flex-Strut, Inc.

d. G-Strut/Gregory Industries, Inc.
e. Haydon Corporation
f. Jet Stream International
g. Madison Electric Products
h. Minerallac Company
i. Power-Strut/Atkore
j. Superstrut/Thomas & Betts
k. Unistrut/Aatkore
l. Westrut/Wesanco

2. Standard: Comply with MFMA-4 factory fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: Steel.
4. Channel Width: Selected for applicable load criteria.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Connect with machine bolts to form rigid supports.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Manufacturers - subject to compliance with requirements, provide products of one of the following:

a. B-Line/Eaton
b. Empire Industries
c. Hilti, Inc.
d. MKT Anchoring Systems
e. Ramset/ITW
f. Rawlplug
g. Red Head/ITW
h. Simpson Strong-Tie Company

2. Powder Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
3. Mechanical Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
4. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
5. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

6. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F 3125/F 3125M,Grade A325 (Grade A325M).
7. Toggle Bolts: Stainless steel springhead type.
8. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

B. Boxes, Enclosures and Cabinets:

1. Install surface mounted cabinets with minimum of four anchors.
2. In wet and damp location use steel channel supports to stand cabinets one inch off wall.
3. Use sheet metal channel to bridge studs above and below cabinets recessed in hollow partitions.

C. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

D. Use vibration and shock resistant fasteners for attachments to concrete slabs.

E. Provide vibration and shock resistant fasteners for all moving equipment where the energy of the vibration is of sufficient magnitude to produce perceptible vibration or structure transmitted noise in occupied areas. Isolation equipment shall be selected, installed and adjusted in accordance with manufacturer's recommendations. All equipment and material shall be installed so as to operate without objectionable noise or vibration as determined by Architect and Owner. Should such objectionable noise or vibration be produced and transmitted to occupied portions of the building by apparatus, piping or other parts of this work, any necessary changes as approved shall be made by the Contractor.

3.2 SUPPORT INSTALLATION

A. Unless otherwise indicated, fasten all electrical items and their supporting hardware securely to the building structure.

B. Coordinate with the building structural system and other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Raceway Support Methods:

1. In addition to methods described in NECA 1, conduit may be supported by openings through structure members, according to NFPA 70.
2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 pounds, provide additional strength until there is a minimum of 200 pounds safety allowance in the strength of each support.
3. Support individual horizontal raceways by separate pipe hangers.
4. Support parallel runs of horizontal raceways together on trapeze-type hangers.

5. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways.
6. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
7. Secure raceways to steel slotted supports with spring nuts using spring friction action for retention in support channel.
8. Spring steel fasteners may be used only for 3/4" raceways above suspended ceilings. For hanger rods with spring steel fasteners, use 1/4 inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
9. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals. Install simultaneously with installation of conductors.

D. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 pounds.

E. Mounting and Anchorage of Surface Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. Instead of expansion anchors, powder actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
5. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

F. Install hangers, supports, clamps and attachments to support raceways, boxes, enclosures and cabinets properly from building structure.

G. Install supports with spacings indicated and in compliance with NEC requirements.

H. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

I. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

J. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures.

K. The use of clips or clip-on type supports is not acceptable.

3.3 CONCRETE BASES

A. Unless otherwise indicated, construction of all concrete equipment foundations required for equipment furnished under Division 26 of specifications shall be this Contractor's responsibility. Foundations shall be sufficient size to suit equipment furnished, as approved.

B. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

C. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete.

D. All exposed surfaces, except those that have steel protection, shall be finished with cement mortar, troweled smooth, with chamfered corners.

E. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099113 "Exterior Painting", Section 099123 "Interior Painting" and/or Section 099600 "High-Performance Coatings for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

C. Division 08 Section “OPENINGS” for Access Doors.

1.2 SUMMARY

A. This Section includes raceways for electrical wiring. Types of raceways in this section include the following:

1. Conduits and fittings
2. Boxes, enclosures, and cabinets
3. Surface raceways
4. Handholes and boxes for underground cabling
5. Access doors

1.3 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

1. Product Data - submit manufacturer’s data for the following:

a. Conduits and fittings
b. Boxes, enclosures, and cabinets
c. Surface raceways
d. Handholes
e. Access doors

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. AFC Cable Systems/Konkore
2. Allied Tube & Conduit
3. Anamet Electrical, Inc.
4. Arlington
5. Bridgeport

6. Calconduit
7. Crouse-Hinds/Eaton
8. Electri-Flex
9. Flexotek
10. KonKore
11. Korkap
12. NEC, Inc.
13. O-Z/Gedney
14. Patriot Aluminum Products
15. Perma-Cote
16. Phoenix
17. Picoma Industries, Inc.
18. Plasti-Bond
19. RACO/Hubbell
20. Republic Conduit
21. Southwire Company
22. Teddico Electrical Products
23. Thomas & Betts/ABB
24. Topaz Electric
25. Western Tube
26. Wheatland Tube

B. Metallic Conduit: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. Electrical Metallic Tubing (EMT): Comply with ANSI C80.3 and UL 797.
2. Flexible Metal Conduit (FMC): Comply with UL 1; zinc-coated steel.
3. Liquid-tight Flexible Metal Conduit (LFMC): Flexible steel conduit with PVC jacket and complying with UL 360.
4. Rigid Metal Conduit (RMC): Comply with ANSI C80.1 and UL 6.
5. Intermediate Metal Conduit (IMC): Comply with ANSI C80.6 and UL 1242.
6. PVC-Coated Rigid Steel Conduit: Comply with NEMA RN 1. Minimum 0.040 inch thick PVC coating.

C. Metal Fittings: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT: Steel, compression type.
2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
3. Fittings for FMC:

    a. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
    b. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

4. Fittings for LFMC: Cadmium plated, steel fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.
5. Fittings for RMC: Threaded.
6. Fittings for IMC: Threaded.
7. Fittings for PVC-Coated Conduit: PVC coated, minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

8. Joint Compound for IMC and RMC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. AFC Cable Systems
2. Allied Tube & Conduit
3. Anamet Electrical, Inc.
4. Cantex, Inc.
5. Electri-Flex
6. FRE Composites
7. Heritage Plastics
8. JM Eagle
9. Kraloy
10. National Pipe & Plastics
11. RACO/Hubbell
12. Southern Pipe, Inc.
13. Teddico Electrical Products
14. Thomas & Betts, Corporation
15. Topaz Electric
16. United Fiberglass

B. Nonmetallic Conduit: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1. Rigid Nonmetallic Conduit (RNC): Type EPC-40-PV or EPC-80-PV, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
2. Liquidtight Flexible Nonmetallic Conduit (LFNC): Comply with UL 1660.
3. Electrical Nonmetallic Tubing (ENT): Comply with NEMA TC 13 and UL 1653.

C. Nonmetallic Fittings: Listed and labeled for type of conduit, location, and use.

1. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
2. Solvents and Adhesives: Provide product and installation as recommended by conduit manufacturer.

2.3 SURFACE RACEWAYS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Hubbell, Inc.
2. MonoSystems, Inc.
3. Panduit Corp.
4. Wiremold/Legrand

B. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

D. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

E. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Adalet
2. Appleton Electric/Emerson
3. Cope
4. Crouse-Hinds/Eaton
5. FSR Inc.
6. Hoffman/Pentair
7. Kraloy
8. Milbank Manufacturing
9. OZ/Gedney
10. RACO/Hubbell
11. Spring City Electrical Manufacturing
12. Steel City/Thomas & Betts Company
13. Topaz Electric
14. Wiegmann/Hubbell

B. Device Boxes:

1. Provide size as required by drawings, minimum 2-1/8 inches deep. Boxes shall be one-piece type, gangable boxes are prohibited.
2. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
3. Cast Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
4. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 pounds. Outlet boxes designed for attachment of luminaires weighing more than 50 pounds shall be listed and marked for the maximum allowable weight.

C. Pull and Junction Boxes:

1. Sheet Metal Pull and Junction Boxes: NEMA OS 1.
2. Cast Metal Pull and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
3. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.

D. Accessories:

1. Provide accessories as required for each installation.

2. Provide box supports, mounting ears and brackets, box extension rings, fixture studs, cable clamps and metal straps for supporting boxes, that are compatible with boxes being used to fulfill installation requirements for individual wiring situations.
3. Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes to suit respective installation requirements and applications.
4. Provide stainless steel screws and hardware unless noted otherwise.

2.5 HANDHOLES AND BOXES FOR UNDERGROUND WIRING

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Armorcast
2. Martin Enterprises
3. NewBasis
4. Oldcastle Enclosure Solutions
5. Quazite/Hubbell

B. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover:

1. Material: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
2. Standard: Comply with SCTE 77.

    a. For installations in parking lots, roadways, etc., provide Tier 15 enclosure
    b. For all other installations, provide Tier 5 enclosure.

3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, refer to drawings for labeling.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Dimension: Minimum 11 inches wide by 18 inches long x 24 inches deep, unless noted otherwise on the drawings.

2.6 ACCESS DOORS

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

1. Babcock-Davis
2. JL Industries, Inc.
3. Karp Associates, Inc.
4. Milcor

5. Nystrom, Inc.

B. General:

1. Provide access door and frame assemblies manufactured as integral units ready for installation.
2. Provide factory fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
3. Refer to Section 083113 'Access Doors and Frames' for additional requirements.

C. Materials:

1. Face of door flush with frame, with exposed flange and concealed hinge.
2. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory finished.
3. Frame Material: Same material and thickness as door.
4. Latch and Lock: Cam latch, screwdriver operated
5. Fire Rated Units:

a. Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
b. Fire-Resistance Rating: Not less than that of adjacent construction.
c. Provide with UL label.

PART 3 - EXECUTION

3.1 APPLICATION

A. Raceways:

1. Minimum Raceway Size: 3/4-inch trade size.
2. Indoor Installations: Apply raceway products as specified below unless otherwise indicated:

a. Exposed: EMT.
b. Concealed in Ceilings and Interior Walls and Partitions: EMT or MC cable. Provide Type MC cable only for concealed branch circuit wiring in drywall partitions and above accessible ceilings. MC cable shall terminate in a junction box above the finished ceiling of space served by circuiting. All homeruns from branch panelboards shall be routed to space served in EMT conduit, unless otherwise specified. MC cable will not be used as the homerun from space served to panelboard of origin, unless otherwise specified.
c. Concealed in masonry walls: PVC.
d. Final connection to recessed and semi-recessed lighting fixtures, not to exceed 72": FMC.
e. Damp or Wet Locations: RMC.
f. Corrosive Environments: LFMC.
g. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

3. Outdoor Installations - apply raceway products as specified below unless otherwise indicated:

    a. Exposed Conduit: RMC.
    b. Concealed Conduit, Aboveground: RMC.
    c. Underground Conduit: RNC, Type EPC-40-PVC, direct buried or concrete encased.
    d. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

4. Raceway Fittings: Compatible with raceways and suitable for use and location.

    a. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
    b. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
    c. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
    d. Damp or Wet Locations: Watertight fittings.
    e. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

B. Boxes, Enclosures, and Cabinets

1. Provide boxes, enclosures and cabinets and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements, unless drawings indicate a more stringent requirement:

    a. Interior Dry Locations: Sheet steel, NEMA type 1.
    b. Locations Exposed to Weather or Dampness: Cast metal, NEMA type 3R, with threaded hub(s) and gasketed weatherproof cover.

C. Access Doors:

1. Where installed in a fire-rated wall or ceiling, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

3.2 INSTALLATION

A. General

1. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems".
2. Complete installation of raceways, boxes, enclosures, and cabinets before starting conductor installation.
3. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
4. Support conduit within 12 inches of boxes, enclosures or cabinets to which attached and within 12 inches of change of direction.
5. Do not install aluminum boxes or fittings in contact with concrete or earth.

6. Install raceways square to boxes, enclosures and cabinets and terminate with locknuts. Install locknuts hand tight plus 1/4 turn more.
7. Do not rely on locknuts to penetrate nonconductive coatings on boxes, enclosures and cabinets. Remove coatings in the locknut area prior to assembling conduit to ensure a continuous ground path.
8. Prevent foreign matter from entering raceways, boxes, enclosures and cabinets by using temporary closure protection.
9. Upon completion of installation of raceways, boxes, enclosures and cabinets, inspect interiors and clear all blockages and remove burrs, dirt, and construction debris.

B. Raceways

1. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed.
2. Make bends in raceway using either large-radius preformed elbows or field bending. Use only equipment specifically designed for material and size involved. Make bends and offsets so the inside diameter is not effectively reduced.
3. Run parallel raceways together.
4. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
5. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200 pound tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
6. Do not run raceways exposed on floors.
7. Do not run raceways exposed on roofs.
8. Where raceways terminate at locations subject to moisture, provide insulating bushings to protect conductors.
9. Where terminations are subject to vibration, use bonding bushings or wedges to ensure electrical continuity.
10. Indoor Raceways:

    a. Conceal conduit within finished walls, ceilings, and floors except in equipment rooms and attics/crawl spaces, unless otherwise indicated.
    b. Do not fasten conduits onto the bottom side of a metal deck roof.
    c. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
    d. Install conduits parallel or perpendicular to building lines.
    e. Where a ceiling is scheduled to be exposed to structure, all conduit shall be secure to structure to provide a clean, organized appearance. Where routed between structural elements, install conduit as high as practical.
    f. Where conduit is installed concealed in masonry walls, transition PVC conduit within masonry wall to otherwise-specified interior or exterior raceway.
    g. Terminations:

        1) Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box.
        2) Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.
        3) Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder.
        4) Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

h. Stub-Ups to Above Recessed Ceilings:

1) Use EMT for raceways.
2) Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

i. Expansion Joint Fittings:

1) Install in each run of EMT conduit that is located where environmental temperature change may exceed 100°F and that has straight-run length that exceeds 100 feet.
2) Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

a) Indoor Spaces Connected with Outdoors without Physical Separation: 125°F temperature change.
b) Attics: 135°F temperature change.

3) Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per degree F of temperature change for metal conduits.
4) Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5) Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

11. Underground Raceways (including conduits under concrete floor slab):

a. Install at a minimum depth of 3'-0" below finished grade to top of raceway unless noted otherwise.
b. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
c. Provide conduit rack in trench prior to concrete pour or backfill.
d. Where indicated on the drawings, provide a minimum 3" concrete encasement for PVC conduit for underground raceways. Provide concrete encasement reinforced with a minimum of four No. 4 reinforcing steel rods spaced 2" in from each corner under roadways or any area subject to vehicular traffic. Reinforcing rods shall extend continuously throughout the width of the raceway in order to avoid raceway shear.
e. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
f. Where underground raceways end in a 90 degree bend and a vertical riser conduit, the 90 degree bend and riser conduit shall be PVC. PVC conduit shall rise to 6” above finished floor or finished grade then transition to specified exposed raceway. Arrange stub-ups so curved portions of bends are not visible above finished slab.
g. Provide watertight connections.

h. Provide underground warning tape in accordance with Section 260553 "Identification for Electrical Systems."
i. Where underground raceways are installed for electrical systems operating at 600 volts or greater, underground raceways shall be field heated and bent, concrete-encased, with a minimum radius of 10 feet.

12. Raceway Sealants:

a. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
b. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1) Where an underground service raceway enters a building or structure.
2) Conduit extending from interior to exterior of building.
3) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
4) Where otherwise required by NFPA 70.

13. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
14. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

C. Boxes, Enclosures and Cabinets:

1. Locations shown on Contract Drawings are approximate unless dimensioned.
2. Mount at heights indicated on Drawings. If mounting heights are not individually indicated, give priority to ADA requirements. Install with height measured to top of box unless otherwise indicated.
3. Provide support of junction and pull boxes from building structure. Do not support boxes by conduits.
4. Position recessed boxes, enclosures and cabinets to allow for surface finish thickness.
5. Mount boxes, enclosures and cabinets with fronts straight and plumb.
6. Install surface-mounted cabinets with minimum of four anchors.
7. Locate and install to allow access. Where installation is otherwise inaccessible, coordinate locations and sizes and provide required access doors.
8. Coordinate masonry cutting to achieve neat openings.
9. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
10. Locate so that cover or plate will not span different building finishes.
11. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation. Provide minimum 24 inch separation in acoustic-rated walls.
12. Coordinate mounting heights and locations of wall outlets mounted where counters, benches, and backsplashes are to be installed. Install outlets 6" above tops of counters and benches.
13. Coordinate mounting heights and locations of wall outlets where wall-mounted heating units are to be installed.
14. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

15. Mount outlet boxes for switches and receptacles with the long axis vertical unless noted otherwise. Three or more gang boxes shall be mounted with the long axis horizontal.
16. Electrically ground metallic boxes, enclosures and cabinets.
17. Where wiring to an item that includes a grounding conductor, provide a grounding terminal in the interior of the box, enclosure or cabinet.

D. Surface Raceways:

1. Install surface raceways only where indicated on Drawings.
2. Install surface raceway with a minimum 2-inch radius control at bend points.
3. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

E. Installation of Underground Handholes and Boxes:

1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
2. Unless otherwise indicated, support units on a 6” deep level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
3. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
4. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

F. Installation of Access Doors

1. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
2. Adjust hardware and panels after installation for proper operation.

G. Sleeve and Sleeve Seal Installation for Electrical Penetrations

1. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Seals for Electrical Systems".
2. Install firestopping at penetrations of fire rated floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Seals for Electrical Systems".

3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to painted finishes using matching corrosion inhibiting touch-up coating recommended by the manufacturer.
3. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544
SLEEVES AND SEALS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

C. Division 07 THERMAL AND MOISTURE PROTECTION Sections.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors
2. Sleeve seal systems and fittings
3. Grout
4. Sealants
5. Firestopping

1.3 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data for the following products:

a. Sealants
b. Firestopping

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw fastening the sleeve to the board.

2.2 SLEEVE SEAL SYSTEMS AND FITTINGS

A. Description: Provide modular mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates that cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

B. Material:

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

C. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Advance Products and Systems Inc.
2. Calpico
3. GPT Industries
4. MetraFlex

2.3 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.4 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Color: As selected by the Architect from manufacturer's standard colors.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

C. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. 3M
2. Adfast
3. Dow Corning Corporation
4. GE Construction Sealants

5. Pecora Corporation
6. Rectorseal
7. Sika Corporation
8. Soudal USA
9. Tremco, Inc.

2.5 FIRESTOPPING

A. General:

1. Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
2. Equipment used shall be in accordance with the firestop manufacturer’s written installation instructions.
3. Color: Red.

B. Performance Requirements

1. Fire Test Response Characteristics:

a. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
b. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
c. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2) FM Global in its "Building Materials Approval Guide."

C. Penetration Firestopping Systems

1. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
2. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg .

a. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

3. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

a. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
b. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
c. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

4. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

    a. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

5. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
6. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

    a. Permanent forming/damming/backing materials.
    b. Substrate primers.
    c. Collars.
    d. Steel sleeves.

D. Fill Materials

1. Cast-in-Place Firestop Devices: Factory assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
2. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
3. Firestop Devices: Factory assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
4. Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced intumescent elastomeric sheet bonded to galvanized steel sheet.
5. Intumescent Putties: Non-hardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
6. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
7. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
8. Pillows/Bags: Reusable heat expanding pillows/bags consisting of glass fiber cloth cases filled with a combination of mineral fiber, water insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel reinforcing wire mesh to protect pillows/bags from being easily removed.
9. Silicone Foams: Multicomponent, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
10. Silicone Sealants: Single-component, silicone based, neutral curing elastomeric sealants.

E. Mixing

1. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

F. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. 3M
2. A/D Fire Protection Systems
3. Emerson/Nelson
4. Hilti
5. Nuco Inc.
6. PFP Partners
7. RectorSeal
8. Specified Technologies Inc.
9. Tremco, Inc.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall provide sleeves where raceways pass through walls, floors, and ceilings.

B. Where piping or raceways pass through waterproofed floors or walls, design of sleeves shall be such that waterproofing can be flashed into and around the sleeves.

C. Where items pass through roofs, coordinate the installation with the roofing installer and provide an approved penetration to maintain the roof warranty.

3.2 SLEEVE INSTALLATION

A. Sleeves for Conduits Penetrating Above-Grade Concrete and Masonry Unit Floors and Walls

1. Interior Penetrations of Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall/floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
3. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during construction of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
4. Install sleeves for floor penetrations. Extend sleeves installed in floors 6 inches above finished floor level. Install sleeves during construction of floors.

B. Sleeves for Conduits Penetrating Gypsum Board Assemblies

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

C. Roof Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

D. Aboveground, Exterior Wall Penetrations: Seal penetrations using stainless steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

E. Underground, Exterior Wall and Floor Penetrations: Install cast iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.3 SLEEVE SEAL SYSTEMS AND FITTINGS INSTALLATION

A. Provide sleeve seal system for below-grade sleeves through exterior walls.

B. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

C. Install sleeve-seal fittings in new walls and slabs as they are constructed.

D. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates in accordance with manufacturer’s recommended values to ensure that sealing grommets expand to make watertight seal.

E. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

F. Secure nailing flanges to concrete forms.

G. Using grout, seal the space around outside of sleeve seal fittings.

3.4 SEALANTS

A. General

1. Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
2. Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Preparation

1. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

    a. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant

manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

b. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

c. Remove laitance and form-release agents from concrete.

d. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

2. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

H. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.5 FIRESTOPPING

A. General

1. Where conduits, conduit sleeves, wireways and other electrical raceways or cables pass through fire partitions, fire walls, fire floors, or smoke walls, provide a fire or smoke stopping that provides an effective barrier against the spread of fire, smoke or gases.
2. Provide firestopping with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs.
3. Install materials in accordance with printed instructions of the UL Fire Resistance Directory and per manufacturer's published instructions.
4. All cables that are installed in conduit sleeves or in wireways through fire or smoke floors or partitions shall be provided with an equally rated re-enterable UL listed fire and smoke rated silicone RTV foam in the opening.
5. Keep areas of work accessible until inspection by applicable code authorities.

B. Preparation

1. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

    a. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
    b. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
    c. Remove laitance and form-release agents from concrete.

C. Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

D. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

E. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

F. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

G. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 260544

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Cable/Conductor Identification Bands
2. Laminated Acrylic or Melamine Plastic Labels
3. Self-Adhesive Labels
4. Underground Line Warning Tape
5. Metal Tags

1.3 SUBMITTALS

A. Product Data for each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION PRODUCTS

A. Manufacturers - subject to compliance with requirements, provide products of one of the following:

1. Brady Corporation
2. Champion America
3. Emedco
4. Grafoplast
5. Hellerman Tyton
6. Ideal Industries
7. LEM Products, Inc.
8. Marketing Services, Inc.
9. Panduit

B. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

C. Cable/Conductor Identification Bands: Provide manufacturer's standard aluminum wrap-around cable/conductor markers, of size required for proper application with stamped or embossed legend, and numbered to show circuit identification.

D. Laminated Acrylic or Melamine Plastic Labels:

1. Engraved with black letters on white face, unless noted otherwise.
2. Thickness:

    a. For signs up to 20 sq. in. minimum 1/16 inch thick.
    b. For signs larger than 20 sq. inch, 1/8 inch thick.

3. Fasteners for Laminated Acrylic or Melamine Plastic Labels:

    a. Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers. Where screws cannot or should not penetrate substrate, provide contact type permanent adhesive.

E. Self-Adhesive Labels:

1. Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

F. Underground Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend indicating type of underground line.

G. Metal Tags:

1. Brass, 2 by 2 by 0.05 inch, with stamped identification, punched for use with self-locking cable tie fastener.
2. Fasteners for Metal Tags:

    a. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

        1) Minimum Width: 3/16 inch.
        2) Tensile Strength at 73°F according to ASTM D 638: 12,000 psi.
        3) Temperature Range: Minus 40° to plus 185°F.
        4) Color: Black.

PART 3 - EXECUTION

3.1 GENERAL

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

B. Verify identity of each item before installing identification products.

C. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

D. Apply identification devices to surfaces that require finish after completing finish work.

E. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

3.2 APPLICATION AND INSTALLATION

A. Accessible Fittings for Raceways: Using permanent marker, identify the covers of each junction and pull box with the panelboard and circuit number(s) of installed conductors.

B. Receptacle Faceplates: Using self-adhesive labels applied to face of plate, identify panelboard and circuit number feeding device. Label shall be clear with black lettering.

C. Cable/Conductor Identification Bands: Apply cable/conductor identification bands indicating circuit number on each cable/conductor in each panelboard.

D. Contactors: Using permanent marker, identify controlled circuits in contactors.

E. Labels

1. General

    a. Attach labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
    b. Before applying self-adhesive electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
    c. Apply labels to exterior of door or cover. In finished areas, install labels to inside face of doors.
    d. Provide labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
    e. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on minimum 1-1/2 inch high sign; where two lines of text are required, use signs minimum 2 inches high.

2. Warning labels - provide the following:

    a. Workspace Clearance Warning at all panelboard locations: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

3. Emergency Operating Labels: Provide laminated acrylic or melamine plastic labels with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.
4. Equipment Identification Labels: Provide laminated acrylic or melamine plastic equipment identification labels for each device in the following categories of electrical equipment. Text shall match terminology and numbering of the Contract Documents and shop drawings.

    a. Contactors.
    b. Disconnect switches
    c. Enclosed circuit breakers
    d. Panelboards

F. Underground Line Warning Tape: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install underground-line warning tape for direct-buried cables and cables in raceways.

END OF SECTION 260553

SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600V and less for the following types:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. ICS: Industrial Control Systems

E. MCOV: Maximum continuous operating voltage.

F. RFI: Radio frequency interference.

1.4 SUBMITTALS

A. Product Data - for each type of panelboard, overcurrent protective device, accessory, and component indicated, include:

1. Dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings - for each panelboard, include:

1. Dimensioned plans, elevations, sections, and details.
2. Enclosure types and details for types other than NEMA 250, Type 1.
3. Bus configuration, and current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.

C. Maintenance Manuals - in addition to requirements specified in Division 01 and 26, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

D. Overcurrent Protective Device Coordination Study: Provide in accordance with Section 260573.

E. Layout Drawings: Prepare layout drawing for each room or area of the building containing panelboards and submit for review at the time of the equipment submittal. Layout drawings shall be based on actual submitted equipment dimensions. Indicate working clearances for each panelboard.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E. Firm with at least 5 years of successful installation experience on projects utilizing panelboards similar to those required for this project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver panelboard interiors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Remove loose packing and flammable materials from inside panelboards.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Keys: Furnish six spares of each type for panelboard cabinet locks.

B. Touch-up Paint: For surface mounted panelboards - one half-pint container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - subject to compliance with requirements, provide panelboards of the following manufacturer:

1. Eaton
2. GE by ABB
3. Schneider Electric/Square D
4. Siemens Industry, Inc.

2.2 GENERAL

A. Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Refer to Panelboard Schedules on drawings for additional panelboard requirements, including but not limited to, mains type and size, mounting, branch circuit breaker sizes and quantities, SCCR rating, options, etc.

C. Enclosures

1. Provide flush and surface mounted enclosures as indicated on the drawings.
2. Standard panel dimensions: 6” deep x 20” wide x 84” high (maximum height).

3. Rated for environmental conditions at installed locations:

   a. Indoor Dry Locations: Steel, Type 1

4. Backbox Finish:

   a. Flush-mounted cabinets: Galvanized steel.
   b. Surface-mounted cabinets: Same finish as panel cover.

D. Incoming Mains

1. Main breaker or main lugs as indicated on drawings.
2. Location shall be convertible between top and bottom.
3. Main lug interiors shall be field convertible to main breaker.

E. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

   a. Plating shall run entire length of bus.
   b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. All bus work shall be rated to withstand short circuit stresses at specified voltage as described on the panelboard schedules shown on the drawings.

4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
5. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

F. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75°C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs (where indicated on drawings): Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

G. Panelboard Short-Circuit Current (SCCR) Rating:

1. Fully rated to interrupt symmetrical short-circuit current available at terminals. Panelboards with a Series Short Circuit Rating are not acceptable.
2. Assembly shall be UL listed for 100 percent interrupting capacity.
3. Minimum short circuit current rating of panelboard shall be as specified on the panelboard schedules shown on the drawings. No device within panelboard shall be lower than this rating.

H. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.

2.3 DISTRIBUTION PANELBOARDS

A. NEMA PB 1, distribution type.

B. Branch overcurrent protective devices shall be bolt-on circuit breakers or plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

C. Doors/Covers:

1. Secured with flush latch with tumbler lock; keyed alike.

a. For doors more than 36 inches high, provide two latches, keyed alike.

2. Finish:

a. Indoor Dry Locations: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

2.4 IGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

A. NEMA PB 1, lighting and appliance branch-circuit type.

B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

C. Doors/Covers:

1. Hinged Front Cover: Door-in-door construction with concealed hinges. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.EZ Trim as manufactured by Eaton is not acceptable.

2. Secured with flush latch with tumbler lock; keyed alike.

a. For doors more than 36 inches high, provide two latches, keyed alike.

3. Finish:

a. Indoor Dry Locations: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breaker (MCCB) with interrupting capacity to meet available fault currents.

1. General

a. Circuit breakers shall have quick-make, quick-break operating mechanisms and silver alloy contacts.
b. The operating handle shall indicate ON, TRIPPED, and OFF positions.
c. Multi-pole units enclosed in a factory assembled to operate as a single unit.
d. Circuit breakers shall be electrically and mechanically trip free.
e. Circuit breakers shall be UL489 listed.
f. Circuit breakers and terminals shall have a UL 60/75°C rating.
g. UL listed for reverse connection without restrictive line or load ratings.
h. Tandem circuit breakers shall not be used.
i. Mechanical style lugs, suitable for number, size, trip ratings, and material of conductors.
j. Three-pole breakers with ampere ratings greater than 250 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
k. Unless indicated otherwise, circuit breakers 800A frame and below shall have thermal-magnetic trip units and inverse time-current characteristics.

1) Provide all labeling as required by NEC.

2. Thermal Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.

c. Adjustable Trip Circuit Breakers:

1) Provide adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2) Field-adjustable trip settings for magnetic trip element shall be front-mounted.

3. Electronic Trip Circuit Breakers:

a. RMS sensing.
b. Field-replaceable rating plug or electronic trip.
c. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
d. Digital display of settings, trip targets, and indicated metering displays.
e. Multi-button keypad to access programmable functions and monitored data.
f. Integral test jack for connection to portable test set or laptop computer.
g. Field-Adjustable Settings:

1) Instantaneous trip.
2) Long- and short-time pickup levels.
3) Long and short time adjustments.
4) Ground-fault pickup level, time delay, and I squared T response.

4. Molded Case Circuit Breaker Options and Accessories:

a. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position for circuit(s) feeding fire alarm control and extender panel(s).
b. Subfeed Circuit Breakers: Vertically mounted.
c. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
d. GFCI Circuit Breakers: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
e. GFEP Circuit Breakers: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. Class B ground-fault protection (30-mA trip).
f. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
g. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
h. Key Interlock Kit: Externally mounted to prohibit circuit breaker operation; key shall be removable only when circuit breaker is in off position.
i. Communication Capability: Communication module with functions and features compatible with power monitoring and control system.

2.6 PANELBOARD OPTIONS

A. Integral Surge Protective Device (SPD)

1. UL 1449, Type 2 SPD (Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device).
2. Factory installed integral to electrical distribution equipment.
3. Direct bussed connected or breaker fed.
4. UL labeled with 200kA Short Circuit Current Rating (SCCR).

5. UL labeled with 20kA I-nominal (I-n) (verifiable at UL.com).
6. Protection modes shall be as follows: Line to Neutral, Line to Ground, and Neutral to Ground.
7. Minimum single-impulse current rating shall be as follows:

   a. Line to Neutral: 160,000 A.
   b. Line to Ground: 160,000 A.
   c. Neutral to Ground: 160,000 A.

8. UL 1449 Voltage Protection Ratings shall not exceed the following:

VOLTAGE	L-N	L-G	N-G	L-L	MCOV
208Y/120	700V	700V	700V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

9. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
10. The protection status of every surge protective element shall monitored including elements connected across neutral to ground. Diagnostics shall change state if any surge protective element reaches end of life.
11. SPD shall be equipped with the following diagnostics:

    a. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
    b. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
    c. Form C dry contacts

12. SPD shall have a 10 year warranty.

2.7 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Computer-generated circuit directory card inside panelboard door, mounted in metal frame with transparent protective cover. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Service Equipment Label: Panelboards with main service disconnecting devices (maximum of 6) shall be UL labeled for use as service equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Mounting:

1. Panelboards shall be installed such that the center of the grip of the operating handle of any overcurrent devices (switch or circuit breaker) located in the panelboard, when in its highest position, is not more than 6’-7” above finished floor or working platform.
2. Mount panelboard cabinet plumb and rigid without distortion of box.
3. Mount panelboards with minimum of four anchors.
4. Mount surface-mounted panelboards to steel slotted supports 1-5/8 inch in depth. Orient steel slotted supports vertically.
5. Mount flush-mounted panelboards with fronts uniformly flush with wall finish and mating with back box.
6. Install flush-mounted panelboards with an overlapping trim set tight to the wall surface.
7. Use sheet metal channel to bridge studs above and below panelboards recessed in hollow partitions.

C. Maintain required workspace clearances per NEC 110.26.

D. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

E. Make grounding connections and bond neutral for services and separately derived systems to ground.

F. Install filler plates in unused spaces.

G. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch empty conduits from panel into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits below floor deck (where applicable).

H. Wiring in Panel Gutters: Arrange conductors neatly in groups and bundle and wrap with wire ties after completion of load balancing.

I. Install Handle Clamp(s) on circuit breaker(s) feeding fire alarm control and extender panel(s).

J. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

A. Identify field installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section 260553 "Identification for Electrical Systems."

B. Panelboard Directory

1. Create a directory to indicate installed circuit loads.
2. All panelboard directories shall reflect the as built electrical configuration of the job, including the approved changes required to balance the panel loads.
3. Each directory entry shall include a description of the connected load(s) and the room number, which corresponds to the location(s) of the connected loads.
4. Incorporate Owner's final room designations.
5. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
6. Obtain approval before installing.
7. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate in accordance with Nameplate Detail - Panelboards shown on the drawings.

D. Distribution Panelboard Device Nameplates: Label each branch circuit device in Distribution Panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Inspect for defects and physical damage.

B. Check panelboard mounting, area clearances, and fit of components.

C. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

D. Test continuity of each circuit.

E. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.

F. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

G. For circuit breakers 200 amps and larger, perform each visual inspection, mechanical inspection, and electrical test indicated in NETA ATS, Section 7.6. Engage a qualified independent testing agency to perform specified testing and certify compliance with test parameters.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing - after Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
5. Make changes to color-coded phase wires as required to reflect installed condition.

C. Set field adjustable switches and circuit breaker trip ranges as indicated on drawings or as specified in Section 260573 “Overcurrent Protective Device Coordination Study”.

3.6 CLEANING

A. Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 262813
FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes cartridge fuses, rated 600 V and less, for use in switches, panelboards, switchboards, controllers, and motor control centers; and spare fuse cabinets.

1. Class L Time Delay Fuses.
2. Class RK1 Time Delay Fuses
3. Class RK5 Time Delay Fuses
4. Spare Fuse Cabinet.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:

B. Product Data - include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current limiting characteristics.
3. Time current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

C. Ambient Temperature Adjustment Information. If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses adjusted.

1. For each adjusted fuse, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

D. Maintenance Data: For tripping devices to include in maintenance manuals specified in Division 01.

E. Coordination Study: Where fuses of a manufacturer other than those designated herein are selected, submit a full coordination study showing graphically that the substitute fuses coordinate selectively with both upstream and downstream components. Prepare the study under the supervision of a registered professional engineer in accordance with ANSI/IEEE Standard 242-1986, "Recommended Practice for Protection and Coordination of Industrial and Commercial

Power Systems." Include single line diagram, coordinated time/current characteristics, fuse performance curves, and fault current calculations adequate to demonstrate satisfactory component protection and selective coordination of protective devices.

F. Shop drawing of spare fuse cabinet showing dimensions and features including storage provision for fuse cartons.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide fuses from a single manufacturer.

B. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

C. ANSI Compliance: Comply with applicable requirements of ANSI C97 "Low Voltage Cartridge Fuses 600 Volts or Less".

D. UL Listing and Labeling: Items provided under this Section shall be listed and labeled by UL.

E. Comply with NEMA FU 1.

F. Nationally Recognized Testing Laboratory Listing and Labeling (NRTL): Items provided under this Section shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver spare fuses stored in locked spare fuse cabinet after cabinet has been installed.

1.8 EXTRA MATERIALS

A. Maintenance stock - fuses: For types and ratings required, furnish spare fuses, amounting to one unit for every 5 installed units, but not less than one set of 3 of each kind.

B. Provide three fuse pullers with the spare fuse cabinet.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - subject to compliance with requirements, provide products by the following:

1. Bussmann Division, Cooper Industries, Inc.
2. Shawmut Division; Gould Inc.
3. Littlefuse, Inc.

2.2 FUSES - GENERAL

A. General: Provide fuses of types, classes, and current ratings as indicated. Voltage ratings shall be consistent with the circuits on which used.

2.3 CARTRIDGE FUSES

A. General: Comply with ANSI/IEEE Standard FU1, "Low Voltage Cartridge Fuses." Provide nonrenewable cartridge type fuses.

1. Fuses shall be all of the same manufacturer.
2. Class L Fuses: Comply with UL 198C, "High Interrupting Capacity Fuses, Current Limiting Type.
3. Class RK1 Dual Element Time Delay Fuses: Comply with UL 198E, "Class R Fuses."

2.4 SPARE FUSE CABINET

A. Cabinet: Wall mounted, 18 gage minimum steel unit with full-length, recessed piano-hinged door with key coded cam lock and pull.

B. Size: Provide for orderly storage of all spare fuses of this project plus 15 percent spare capacity, minimum.

C. Finish: Gray baked enamel.

D. Cabinet Door: Bear the legend in stenciled 1-1/2 inch high letters, "SPARE FUSES."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION OF FUSES

A. Fusible Switches - apply the following class and types:

1. 30-600 Amperes: Class RK1, time delay.
2. 601-1,200 Amperes, Motor or Transformer Circuit: Class L, time delay.

B. Bolted Pressure Switches: Class L, time delay.

C. Service Protectors: Class L, time delay.

D. Fusible Switch Panelboards: Class RK1, time delay.

E. Combination Starters: Class RK1, time delay.

F. Combination Starters in Motor Control Centers: Class RK1, time delay.

G. Switches in Switchboards - apply the following classes and types:

1. 60-600 Amperes: Class RK1, time delay.
2. 601 Amperes and Above: Class L, time delay.

3.3 INSTALLATION

A. Provide fuses in all fuse gaps of all equipment provided under this Contract.

B. Install fuse so that ratings are readable without removing fuse.

C. Fuses shall not be installed until equipment is ready to be energized.

D. Install spare fuse cabinet wall mounted where indicated.

3.4 FIELD QUALITY CONTROL

A. Prior to energization of fusible devices, test devices for continuity of circuitry and for short-circuits. Replace malfunctioning units with new units, and then demonstrate compliance with requirements.

3.5 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fusible device.

END OF SECTION 262813

SECTION 262816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 26.

B. All Division 26 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes circuit and motor disconnects.

B. Extent of circuit and motor disconnect switch work is indicated by drawings and schedules.

C. Types of circuit and motor disconnect switches in this section include the following:

1. Equipment disconnects
2. Appliance disconnects
3. Motor circuit disconnects
4. Contactors

D. Wires/cables, raceways, and electrical boxes and fittings required in connection with circuit and motor disconnect work are specified in other Division 26 sections.

1.3 SUBMITTALS

A. Product Data: For each type of switch, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Maintenance data for circuit and motor disconnects, for inclusion in Operation and Maintenance Manual specified in Division 01 and Division 26 Section 260100.

C. Shop Drawings: Submit shop drawings of electrical circuit and motor disconnect switches showing accurately scaled switches, their layouts, and proximity to associated equipment.

D. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short circuit current rating.
4. UL listing for series rating of installed devices.
5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

E. Maintenance Data: For enclosed switches and components to include in maintenance manuals specified in Division 01. In addition to requirements specified in Division 01 Section "Closeout Procedures," include the following:

1. Routine maintenance requirements for components.
2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.4 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of circuit and motor disconnect switches of types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing circuit and motor disconnect work similar to that required for this project.

C. NEC Compliance: Comply with NEC requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.

D. UL Compliance: Comply with requirements of UL98, "Enclosed and Dead Front Switches". Provide circuit and motor disconnect switches that have been UL listed and labeled.

E. UL Compliance: Comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials that are UL-listed and labeled.

F. NEMA Compliance: Comply with applicable requirements of NEMA Standards Pub No. KS 1, "Enclosed Switches" and 250, "Enclosures for Electrical Equipment (1000 volts maximum).

G. Product Selection for Restricted Space: Drawings indicate the location where enclosed switches are to be installed. Verify the suitability for installation in this location, including clearances between enclosures, and adjacent surfaces and other items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide circuit and motor disconnects of one of the following:

1. Square D Company
2. Eaton Corporation
3. General Electric Company
4. Siemens
5. ASCO (Contactors only)

2.2 FABRICATED SWITCHES

A. Heavy Duty Safety Switches

1. Provide surface mounted, heavy duty type, sheet steel enclosed safety switches of types, sizes and electrical characteristics indicated on the drawings.
2. Provide switches with quick-make, quick-break type operation, with switchblades that are visible in the 'OFF' position with door open.
3. Operating handle shall be an integral part of the enclosure base the operating position shall be easily recognizable and pad-lockable in OFF position.
4. Current carrying parts shall be constructed of 98% conductivity copper, with silver-tungsten type switch contacts and positive pressure type reinforced fuse clips.
5. Provide disconnect switches having the capability to have auxiliary contacts mounted as required.

B. Fusible Switches: Heavy duty safety switches as described above, with positive pressure type reinforced fuse clips and fuses of classes and current ratings indicated. See Division 26 Section 262813 “Fuses” for specifications. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses.

C. Enclosures shall meet environmental conditions of installed location.

1. Indoor Locations: NEMA 250, Type 1
2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

D. Finish shall be manufacturer’s standard gray finish unless otherwise noted on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECTS

A. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Install circuit and motor disconnect switches as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA and NECA's "Standard of Installation" and in accordance with recognized industry practices.

C. Coordinate circuit and motor disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

D. Install disconnect switches for use with motor driven appliances, and motors and controllers within sight of the controller position unless otherwise indicated.

E. Coordinate layout and installation of switches and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

F. Install power wiring. Install wiring between switches and control, and indication devices.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.2 NEUTRAL BAR

A. When a neutral conductor is required for the load connected to a safety switch, the Contractor shall provide a copper neutral bar in the safety switch. This copper neutral bar shall be furnished by the manufacturer of the disconnect switch and shall be designed to be installed within the particular disconnect switch installed.

3.3 GROUNDING

A. Install equipment grounding connections for switches with ground continuity to main electrical ground bus.

B. Provide an equipment grounding kit with all disconnect switches.

C. Connections shall be tightened in accordance with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors".

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, component, and control circuit.
2. Test continuity of each line- and load-side circuit.

B. Testing Agency: The Contractor shall perform the following testing or engage a qualified independent testing agency to perform testing.

C. Testing: After installing enclosed switches and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches 200 amps and larger. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. Upon completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262816

Building Code Summary

A. International Existing Building Code 2018

1. **Type II B Construction**
2. **Level 2 Alterations**
3. **Less than 50% of the Ground floor & First floor**
   a) Total Ground floor square footage = 4,877 sq. ft.
      - Renovation of Ground floor square footage = 1,413 sq. ft. or less than 50%
   b) First floor square footage = 6,773 sq. ft.
      - Renovating of first floor 76 sq ft or less than 50%
4. **Occupancy Group, I 1 , 2018 IBC, Section 308.2 , 308.2.1**
5. **Occupancy within an existing building that has a Certificate of Occupancy**
   a) 2 hour fire barriers, IBC Table 707.3.10
   b) Occupancy area shall be fully equipped with a sprinkler system.
6. **Means of egress sizing**
   a) For existing stair towers , there door are 6'0" clear width with an exit capacity for 360 people, (72 x 0.2 = 14.4)
   b) The means of egress occupancy being #306. The exiting capacity is adequate.
   c) Areas' calculations
      1) Ground Floor 4,877 (36 x 0.2 = 7.2 x 6 Doors = 43 divided by 4,877 = 113 people.
      2) First Floor 6,773 (36 x 0.2 = 7.2 x 5 Doors = 35 divided by 6,773 = 193 people.
7. **Total occupants for the building = 306**

B. 2018 International Fire Code

1. Occupancy Classification with Separation , Section 1011.1.2
2. Fire Sprinkler System, 2018 IBC,1011.2.1
3. Fire Alarm Detection System, 2018 IBC, 1011.2.2
4. Means of Egress Capacity, IBC 2018, Section 1011.4.3

C. 2018 International Mechanical Code

1. The HVAC installation and all components shall be in compliance with all applicable codes and ordinances adopted by the local authority having jurisdiction.
   Unless noted otherwise in the applicable codes and ordinances adopted by the local authority having jurisdiction, requirements of the latest or state-adopted edition of the following Standards shall apply.
   a) Pennsylvania Department of Health
   b) American Society for Testing and Materials (ASTM)
   c) Americans with Disabilities Act (ADA)
   d) International Building Code (IBC)
   e) International Fire Code (IFC)
   f) International Energy Conservation Code (IECC)
   g) National Electric Code (NEC)
   h) National Fire Protection Association (NFPA)
   i) National Safety Code
   j) Occupational Safety and Health Act (OSHA)
   k) Sheet Metal & Air Conditioning Contractors National . Association Standards (SMACNA)
   2. Underwriter's Laboratories, Inc. (UL)

D. 2018 International Electrical Code

1. The Electrical installation and all components shall be in compliance with the code and/or standard requirements of the latest revision or state-adopted edition of:
   a) American Society for Testing and Materials (ASTM)
   b) Americans with Disabilities Act (ADA)
   c) FM Global (Factory Mutual) Approval Guide
   d) Institution of Electrical and Electronic Engineers (IEEE)
   e) International Building Code (IBC)
   f) International Fire Code (IFC)
   g) International Energy Conservation Code (IECC)
   h) Legislative Act 235 (1965) - Handicapped
   i) Legislative Act 287 (1974) - Excavation
   j) National Electric Code (NEC)
   k) National Electrical Contractors Association (NECA)
   l) National Electrical Manufacturer's Association (NEMA).
   m) National Electrical Safety Code (NESC)
   n) National Fire Protection Association (NFPA)
   o) National Safety Code
   p) Occupational Safety and Health Act (OSHA)
   q) Underwriter's Laboratories, Inc. (UL)

Comply with International Commercial Building Code, 2018

CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD	WIND SPEED (mph)	SEISMIC DESIGN CATEGORY	WEATHER-ING for CONCRETE	FROST LINE DEPTH	TERMITE	DECAY	WINTER DESIGN TEMP	ICE SHEILD UNDER-LAYMENT REQUIRED	FLOOD HAZARDS	CLIMATE ZONE 6a &6B	RADON CONTROL REQUIRED
30 PSF	90	C	Severe	36"	Mod. to Heavy	Slight to Mod	0 Deg. F	Yes	Check FEMA Maps	IRC 5	Yes

STRUCTURAL DESIGN CRITERIA

NO Item	Dead Load	Live Load
1. Rooms other than sleeping rooms	20	40
2. Roof rafter	20	30

Pennsylvania Commercial Energy Code Requirements for Climate Zone 12A for the Counties of:
Allegheny, Beaver, Fayette, Green, Washington

THESE ARE THE MINIMUM REQUIREMENTS FOR INSULATION

INTERNATIONAL ENERGY CONSERVATION CODE 2018, TABLE 502.2.4(4) Prescriptive building envelope equirements, 18% of gross exterior wall area.

ITEM	REQUIRED R VALUE	BATT INSULATION THICKNESS Maximum Glazing U-Factor
Windows(Glazing)	U=0.35	Owens Corning: 8"T @ R-25, plus 3½"T @ R-13, R=38
Roof	R-38	Owens Corning: 8"T = R-25
Exterior Wall	R-20	Owens Corning: 8"T = R-25
Floor	R-30	Owens Corning: 3½"T = R-13
Basement Wall	R-10	Dow: Highload 60, 1"T rigid insulation = R-5
Slab Perimeter	R-18, 2ft	Dow: Highload 60, 2"T rigid insulation = R-10
Crawl Space Walls	R-17	Owens Corning: 8"T = R-25

HACP - Bedford Dwellings EnVision Center

Bedford Dwelling EnVision Center
2305 Bedford Ave.
Pittsburgh, PA 15219

Drawing List:

Architectural

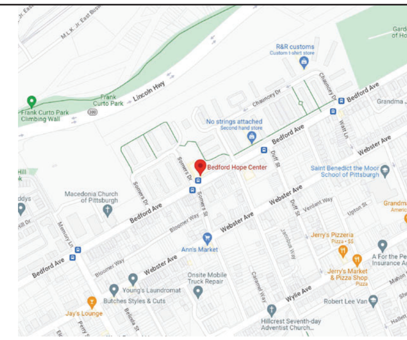
CS	Cover Sheet
D1.1	Demolition Ground Floor Plan
D1.2	Demolition First Floor Plan
A1.1	Ground Floor Plan
A1.2	First Floor Plan
A2.1	Exterior Elevation Plan
A3.1	Reflective Ceiling Ground Floor Plan
A3.2	Reflective Ceiling First Floor Plan

Electrical

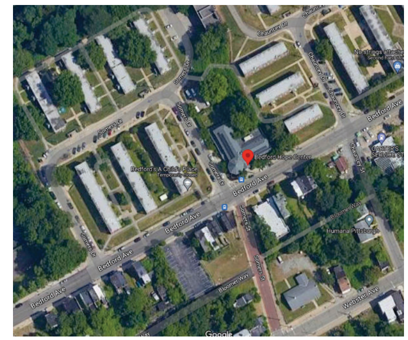
E1.0	Electrical Legend, Schedules, Details and Basement Plan

HVAC

H0.1	HVAC Ledgend & Schedules
H1.1	Ground & Floor Plans
H2.1	Enlarged Boiler Room & Schematic
H3.1	HVAC Details



Location Map
NTS:



Site Map
NTS:

Tusick & Associates Architects, Inc.

STANDARDS AND REGULATIONS:

1. Contractor shall perform all work in conformance with applicable federal, state and local codes, regulations, laws, ordinances, utility provider requirements, and similar standards.
2. Contractor shall obtain all required permits and similar releases required for construction and occupancy. Contractor shall furnish copies of all such items to HACP and Architect within ten days of receipt. If permits are issued subject to certain conditions or revisions in the work, or if permits are delayed for any reason, Contractor shall notify the Architect immediately.
3. Contractor shall obtain all required inspections of the work.
4. Contractor shall regularly update Owner and Architect regarding the status of inspections.
5. Contractor shall coordinate work with the utility providers.
6. Contractor shall be familiar with requirements and construction shall be in compliance with referenced fire-related assembly tests and standards.
7. Contractor shall visit the site prior to submission of bids to review and become familiar with existing conditions.
8. Contractor shall comply with the International Commercial Building Code 2018

ADMINISTRATION OF THE WORK

1. Contractor shall be solely responsible for the means, methods, and sequences of construction.
2. Contractor shall be solely responsible for the safety of all construction personnel and authorized visitors at the site.
3. Contractor shall become fully acquainted with conditions related to the work. Any known discrepancies between the documents and the actual conditions shall be reported to the Architect for resolution prior to proceeding with work related to the discrepancy.
4. Contractor shall take precautions to maintain and protect existing systems and finishes which are to remain. Any damages to such systems and finishes shall be immediately repaired in a manner acceptable to the Architect. If satisfactory repairs can not be made, Contractor shall replace systems and finishes with new construction acceptable to the Architect. All repairs and replacement costs shall be the responsibility of the Contractor.
5. Contractor shall remove and properly dispose of all construction and demolition debris. Contractor shall obtain approval of Owner for details relating to the removal of trash, including such issues as path of travel, use of stairs and elevators, removal of windows, location of chutes and dumpsters, etc, prior to removal of debris. Contractor shall clean and repair any damages to existing items soiled or damaged by the debris removal process. If cleaning and/or repair does not return items to the original condition Contractor shall install new items. All repairs and/or replacement costs shall be the responsibility of the Contractor.
6. Contractor shall become familiar with and comply with Owner's procedures for maintaining a secure site and building.
7. Each installer shall examine all substrate conditions and/or site conditions which affect the quality of each product to be installed. Installation shall not proceed until unsatisfactory conditions are corrected.
8. Contractor shall maintain record drawings on the site at all times.
9. Contractor shall be responsible for ensuring coordination efforts of all subcontractors.
10. Contractor shall lay out all work as soon as possible. Any discrepancies shall be reported to the Architect for resolution prior to proceeding with the work in question.

GENERAL CONSTRUCTION NOTES

1. Contractor shall be responsible for all work, including any subcontractor, building permits and its requirements, insurance, subcontractors, etc. involved in construction and/or demolitions.
2. Contractor shall field verify all conditions and dimensions.
3. Contractor shall not scale drawings. Dimensions on drawing shall be followed.
4. Contractor shall notify the HACP in 72 hrs when the utilities are to be shut off for any period of time. The same notification shall occur for telephone and cable.
5. Contractor shall inform the Architect of any deadlines for materials that affect the completion of the project.
6. Contractor shall keep the work site free of obvious or known hazards such as broken glass, nails and lathing, etc.
7. Contractor shall have the mechanical, electrical. Contractors lay out the mechanical system and electrical.
12. Contractor shall be responsible to secure all building materials from vandalism during non-working hours.
13. All electrical outlets, light fixtures, etc. shall be grounded as per electrical code.
14. All existing floors, walls, ceilings, and doors shall be protected during construction.
15. All work not specifically shown, but necessary to complete the project shall be the responsibility of the General Contractor.
16. During demolition and construction, air borne dust and debris should be kept to a minimum by using equipment that sucks in dust such as when the plaster is being finished.
17. Copies of the building permit, including electrical & plumbing inspections shall be given to the Architect for the records.

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Cover Sheet

Bedford Dwelings EnVision Center
2305 Bedford Ave.
Pittsburgh, PA 15219

SHEET NUMBER:
CS

General Demolition Notes

1. All pink dashed lines indicate areas of demolition unless otherwise noted.
2. Comply with EPA , Title 40, Part 745m Subpart E.
3. Comply with all Local, Commonwealth & Federal regulations, standards & laws.
4. **Contractor shall notify the Architect before demolition begins.**
5. Maintain a safe and clean work environment during construction. Clean up during and after work daily. Protect & cover carpet floor.

General Utilites Notes

6. Electrical: The electricity at the breaker box shall be identified and turned off. Once demolition is finished, all existing electrical lines shall be safely secured and labeled. Refer to Mechanical Plans.
7. Plumbing: All water lines shall be capped, tested and prepped ready for the new construction installation. Refer to Mechanical Plans.
8. H.V.A.C. System: All heating and air conditioning units, lines, and duct work shall remain in place unless noted in Mechanical Demolition Plans.
9. Gas Lines: The main gas line shall be identified and secured.

Specific Demolition Notes:

Corridor - G02

(1) Remove existing access panel and ceiling required to do work. Refer to HVAC drawings and coordinate with HVAC contractor.

Daycare Room - G08

(1) Remove existing access panel and ceiling required to do work. Refer to HVAC drawings and coordinate with HVAC contractor.

Boiler Room-G17

(2) Remove HACP stored items during construction and place items back after construction is compleated.

(3) Floor drain is to be moved as per mechanical drawings.

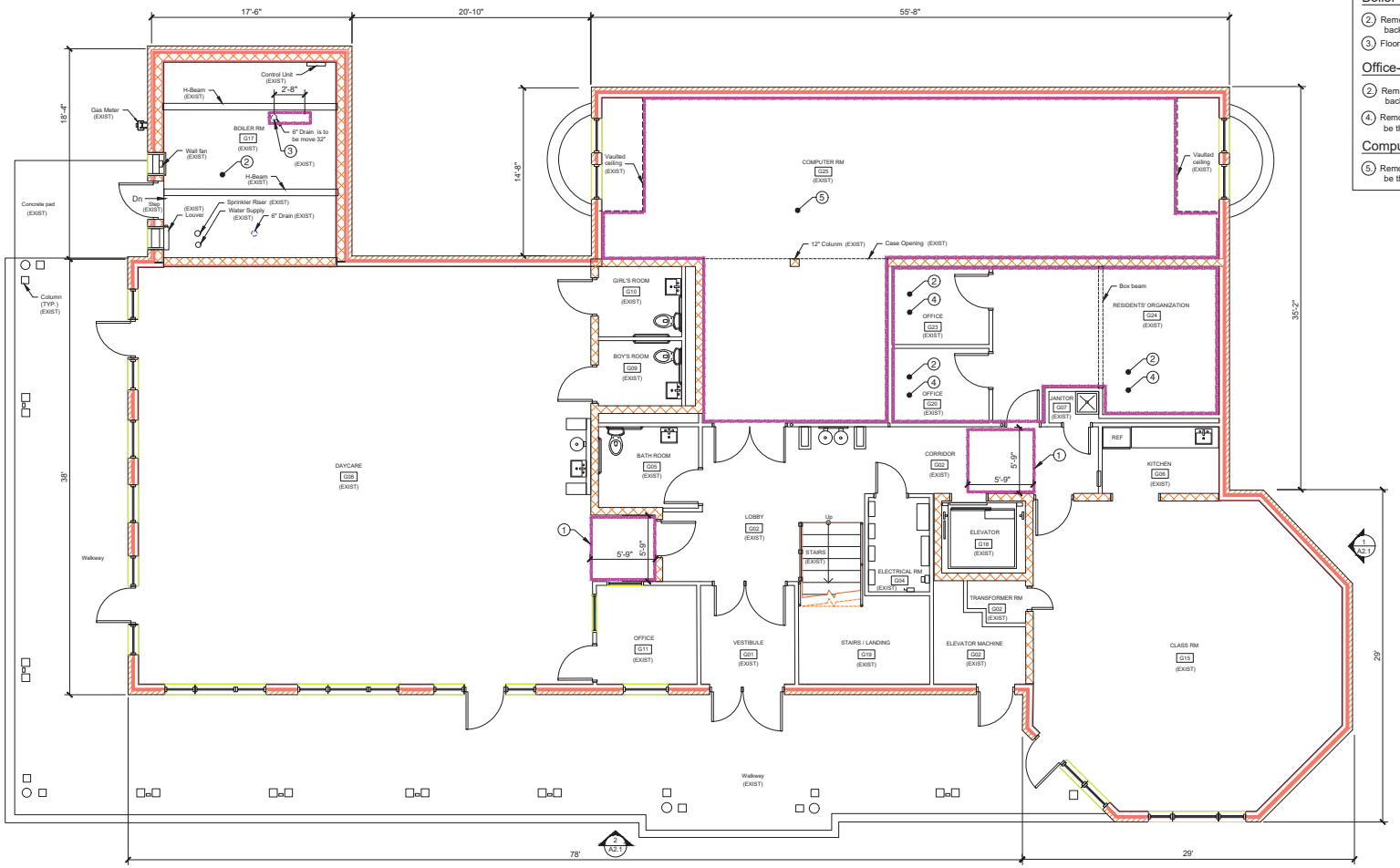
Office-G20, Office-G23 & Residence Organization-G24

(2) Remove HACP stored items during construction and place items back after construction is compleated.

(4) Remove Ceiling track, 2x4 acoustical tile ceiling and light fixtures. They are to be thrown away.

Computer Room-G25

(5) Remove Ceiling track, 2x4 acoustical tile ceiling and light fixtures. They are to be thrown away. Note: Provide HVAC 20 good condition ceiling tiles.



Ground Floor Plan
SCALE: 1/4" = 1'-0"

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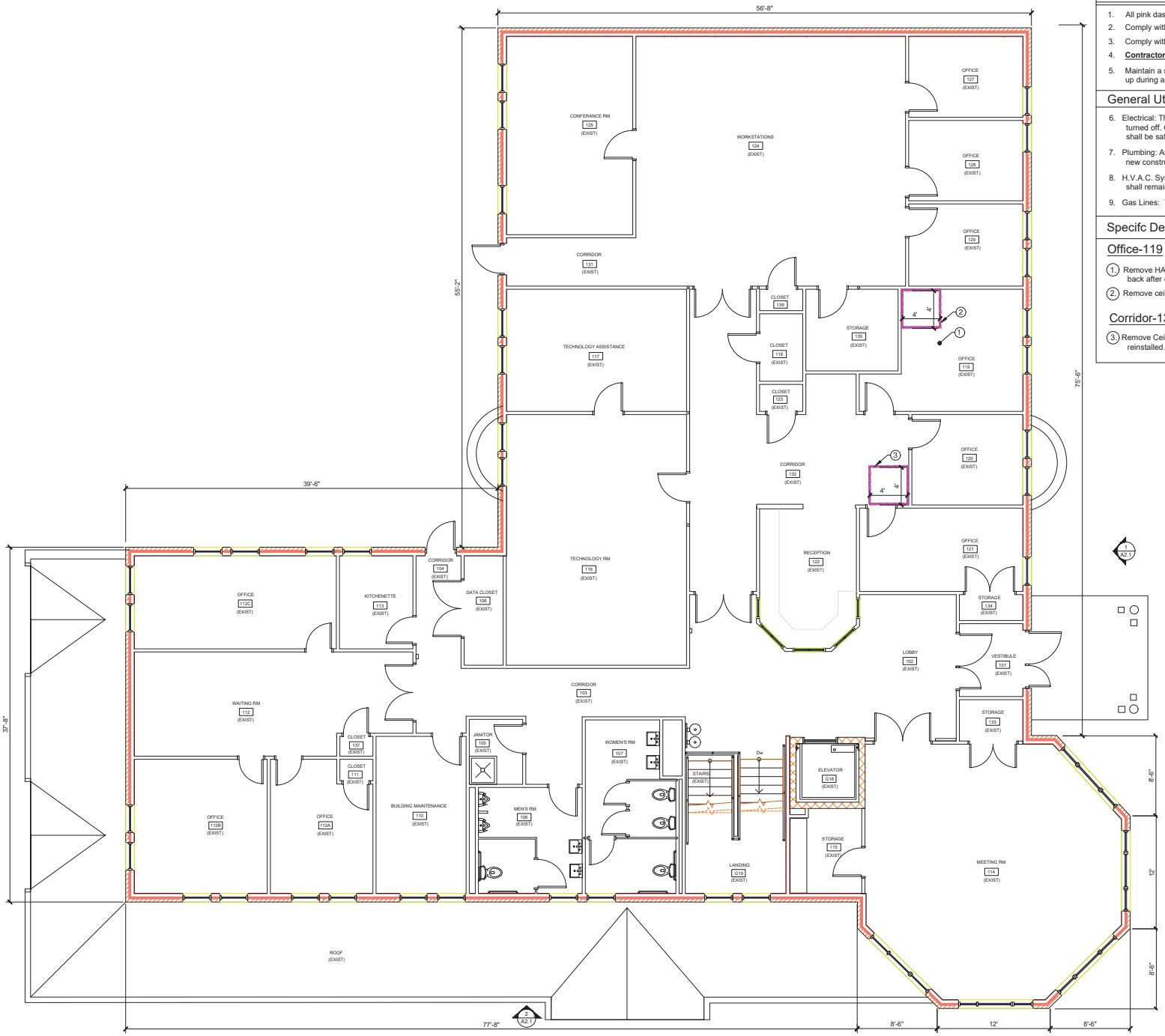
Demolition Ground Floor Plan

Bedford Dwellings EnVision Center
2305 Bedford Ave.
Pittsburgh, PA 15219

SHEET NUMBER:

D1.1



First Floor Plan
SCALE: 1/4" = 1'-0"

General Demolition Notes

1. All pink dashed lines indicate areas of demolition unless otherwise noted.
2. Comply with EPA , Title 40, Part 745m Subpart E.
3. Comply with all Local, Commonwealth & Federal regulations, standards & laws.
4. **Contractor shall notify the Architect before demolition begins.**
5. Maintain a safe and clean work environment during construction. Clean up during and after work daily. Protect & cover carpet floor.

General Utilites Notes

6. Electrical: The electricity at the breaker box shall be identified and turned off. Once demolition is finished, all existing electrical lines shall be safely secured and labeled. Refer to Mechanical Plans.
7. Plumbing: All water lines shall be capped, tested and prepped ready for the new construction installation. Refer to Mechanical Plans.
8. H.V.A.C. System: All heating and air conditioning units, lines, and duct work shall remain in place unless noted in Mechanical Demolition Plans.
9. Gas Lines: The main gas line shall be identified and secured.

Specifc Demolition Notes:

Office-119

1. Remove HACP Office items during construction and place items back after construction is compleated.
2. Remove ceiling track, 2x4 acoustical tile ceiling. They are to be reinstalled.

Corridor-132

3. Remove Ceiling track, tile ceiling and light fixture. They are to be reinstalled.

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First Floor Plan

Bedford Dwellings EnVision Center
2305 Bedford Ave.
Pittsburgh, PA 15219

SHEET NUMBER:
D1.2

General Construction Notes

1. All pink dashed lines indicate areas of demolition unless otherwise noted.
2. Comply with EPA , Title 40, Part 745m Subpart E.
3. Comply with all Local, Commonwealth & Federal regulations, standards & laws.
4. **Contractor shall notify the Architect before demolition begins.**
5. Maintain a safe and clean work environment during construction. Clean up during and after work daily. Protect & cover carpet floor.

General Utilites Notes

6. Electrical: The electricity at the breaker box shall be identified and turned off. Once demolition is finished, all existing electrical lines shall be safely secured and labeled. Refer to Mechanical Plans.
7. Plumbing: All water lines shall be capped, tested and prepped ready for the new construction installation. Refer to Mechanical Plans.
8. H.V.A.C. System: All heating and air conditioning units, lines, and duct work shall remain in place unless noted in Mechanical Demolition Plans.
9. Gas Lines: The main gas line shall be identified and secured.

Specific Construction Notes:

Corridor - G02

(1.) Install the new 5/8" GWB ceiling with 36" x 36" access panel. Patch & paint ceiling to match existing ceiling.

Daycare Room - G08

(1.) Install the new 5/8" GWB ceiling with 36" x 36" access panel. Patch & paint ceiling to match existing ceiling.

Boiler Room-G17

(2.) Install boiler and boiler system. Refer to Engineers drawings.

(3.) Move floor drain 32" Install new floor drain. Refer to Engineers drawings.

Office-G20, Office-G23 & Residence Organization-G24

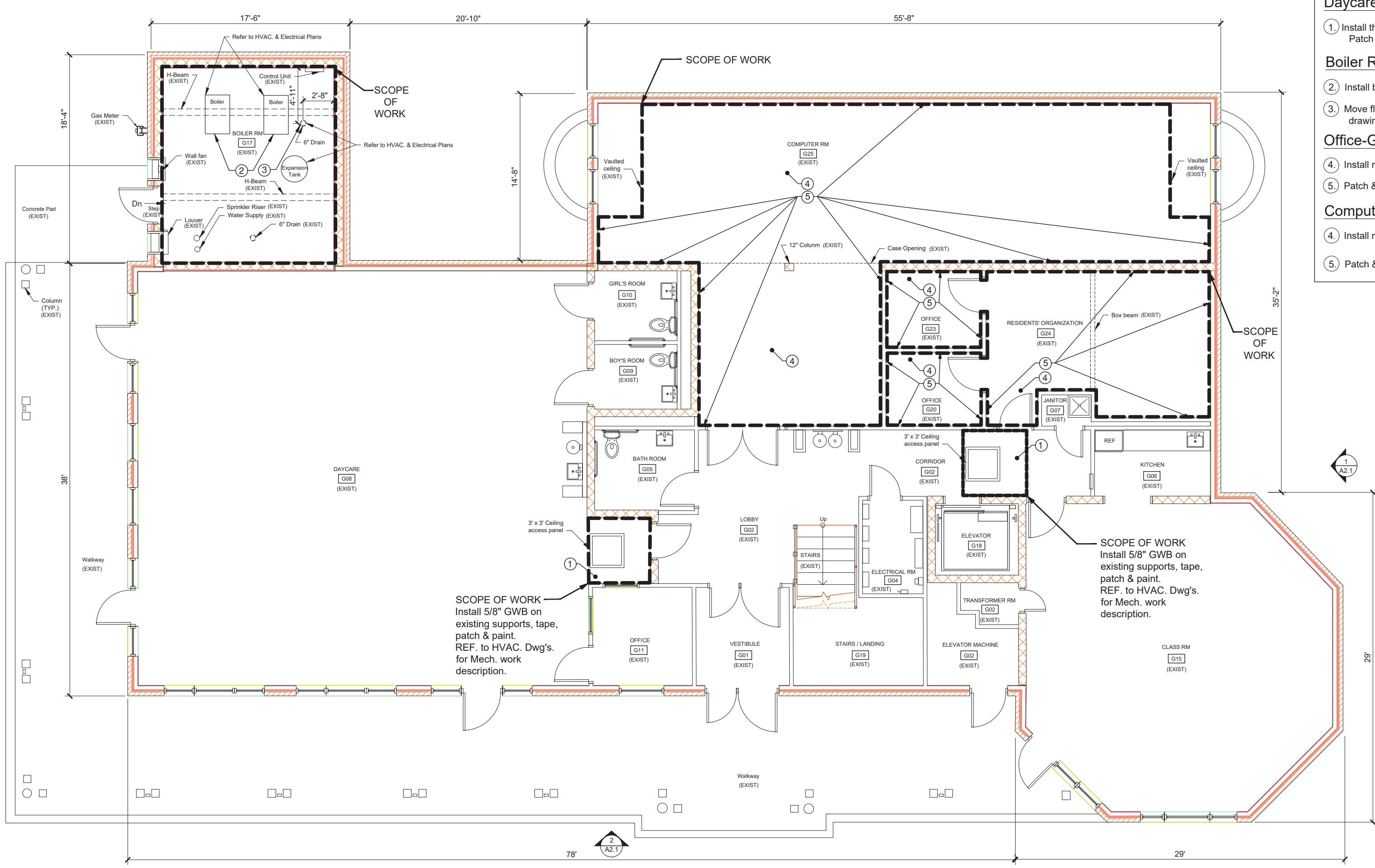
(4.) Install new Ceiling track, 2x4 acoustical tile ceiling and light fixtures.

(5.) Patch & Paint all the walls. Match existing color.

Computer Room-G25

(4.) Install new Ceiling track, 2x4 acoustical tile ceiling and light fixtures.

(5.) Patch & Paint all the walls. Match existing color.



Ground Floor Plan

SCALE: 1/4" = 1'-0"

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Ground Floor Plan

Bedford Dwelings EnVision Center
2305 Bedford Ave.
Pittsburgh, PA 15219

SHEET NUMBER:
A1.1

General Construction Notes

1. All pink dashed lines indicate areas of demolition unless otherwise noted.
2. Comply with EPA , Title 40, Part 745m Subpart E.
3. Comply with all Local, Commonwealth & Federal regulations, standards & laws.
4. **Contractor shall notify the Architect before demolition begins.**
5. Maintain a safe and clean work environment during construction. Clean up during and after work daily. Protect & cover carpet floor.

General Utilites Notes

6. Electrical: The electricity at the breaker box shall be identified and turned off. Once demolition is finished, all existing electrical lines shall be safely secured and labeled. Refer to Mechanical Plans.
7. Plumbing: All water lines shall be capped, tested and prepped ready for the new construction installation. Refer to Mechanical Plans.
8. H.V.A.C. System: All heating and air conditioning units, lines, and duct work shall remain in place unless noted in Mechanical Demolition Plans.
9. Gas Lines: The main gas line shall be identified and secured.

Specific Construction Notes:

Office-119

(1) Move office item back once construction is complete.

(2) Reinstall ceiling track 2x4 acoustical tile ceiling that were removed.

Corridor-132

(3) Reinstall ceiling track 2x4 acoustical tile ceiling and light fixture that were removed.

First Floor Plan
SCALE: 1/4" = 1'-0"

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First Floor Plan

Bedford Dwelings EnVision Center
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Pittsburgh, PA 15219

SHEET NUMBER:
A1.2

1 A2.1 Bedford Avenue Elevation
SCALE: 1/4" = 1'-0"

2 A2.1 Somers Drive Elevation
SCALE: 1/4" = 1'-0"

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Exterior Elevation Plan

Bedford Dwelings EnVision Center
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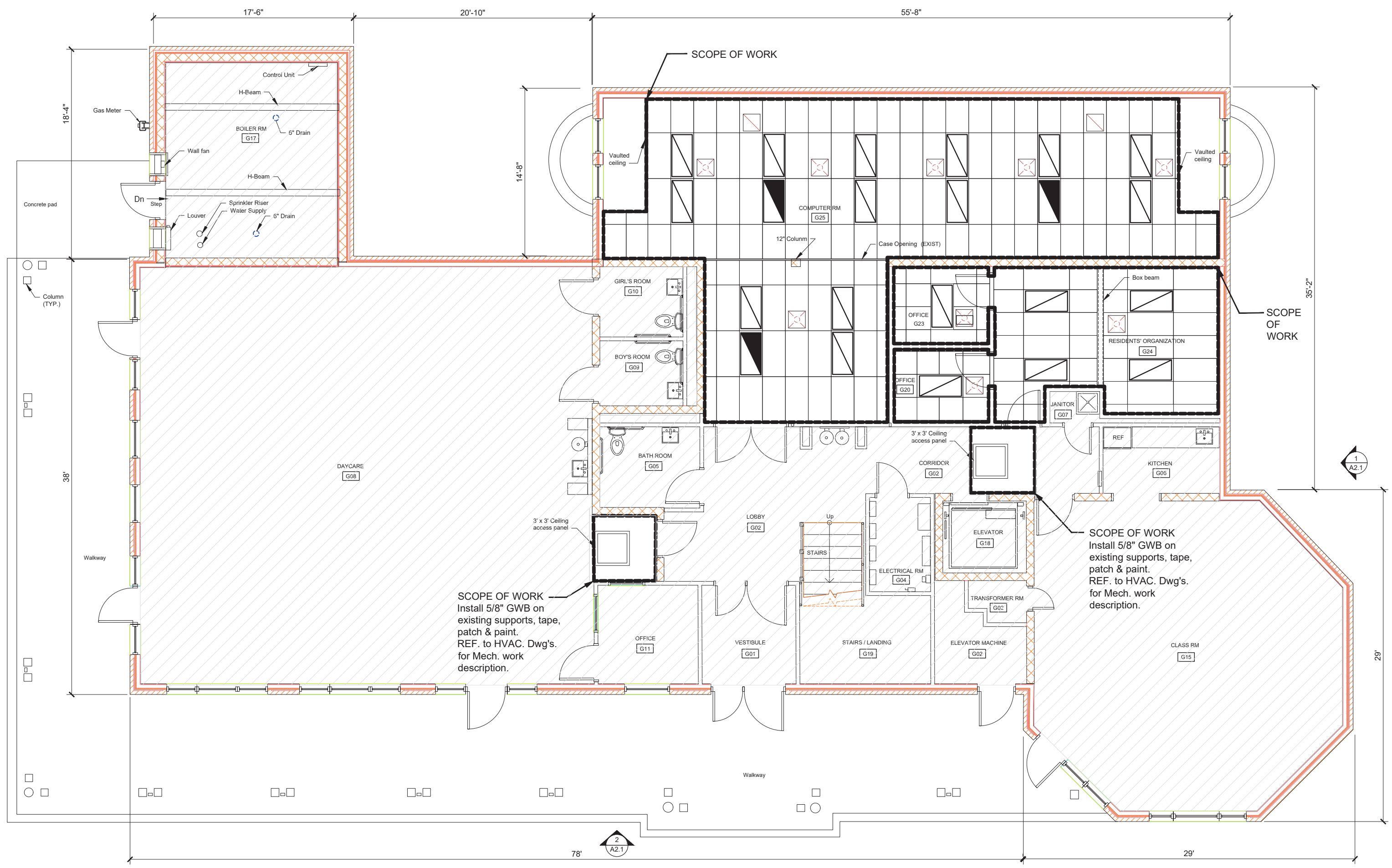
SHEET NUMBER:
A2.1

DUNE™
Second Look® II
15/16"
Angled Tegular
11 2712 24 x 48 x 3/4"
0.50 35
•
N/A Class A
0.81 • • • • Std • •

KEY SELECTION ATTRIBUTES
- Upgrade look at a modest price
- Dune™ Second Look® panels are part of the Sustain® portfolio, and meet the most stringent industry sustainability compliance standards today
- Mold- and mildew-resistant surface
- USDA-Certified Biobased Content – 99%
- Durable – Scratch-resistant
- 30-Year Limited System Warranty against visible sag, mold, and mildew
- 10-Year replacement panel available for item 2711, 2712, 2722

1 Total Acoustics® ceiling panels have an ideal combination of sound absorption and sound blocking in one product.
VISUAL SELECTION PERFORMANCE SELECTION Dots represent high level of performance.
FACE VIEW
Second Look I panel – Scoring creates nominal 12" x 12" squares
Second Look II panel – Scoring creates nominal 24" x 24" squares



Reflective Ceiling Ground Floor Plan
SCALE: 1/4" = 1'-0"

DRAWINGS & ESPECIFICATIONS, AS INSTRUMENTS OF SERVICE, ARE AND SHALL REMAIN THE PROPERTY OF THE ARCHITECT. THEY ARE NOT TO BE USED ON EXTENSIONS OF THE PROJECT, OR OTHER PROJECTS, EXCEPT BY AGREEMENT IN WRITING WITH APPROPRIATE COMPENSATION TO THE ARCHITECT. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING DIMENSIONS AT THE JOB SITE. THE ARCHITECT WILL NOT BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS THECHIQUES, SEQUENCES, OR PROCCEDURES, OR FOR SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTIONS WITH THE PROJECT.

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Reflective Ceiling Ground Floor Plan

Bedford Dwelings EnVision Center
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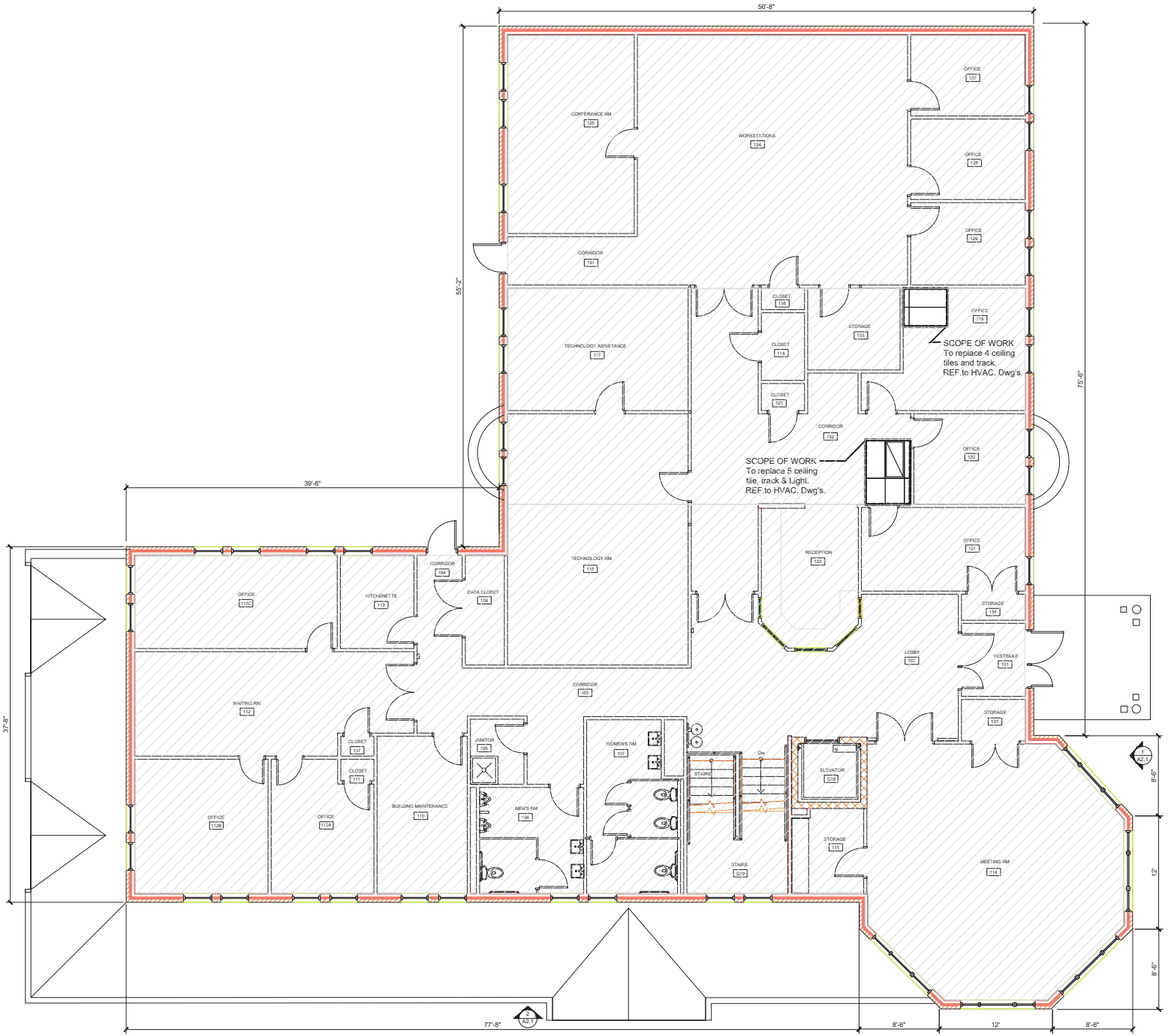
Pittsburgh, PA 15219

SHEET NUMBER:
A3.1



Reflective Ceiling First Floor Plan
SCALE: 1/4" = 1'-0"

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Reflective Ceiling First Floor Plan

Bedford Dwellings EnVision Center
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SHEET NUMBER:
A3.2

GENERAL DRAWING SYMBOLS

DETAIL INDICATOR
'NO' DENOTES SEQUENTIAL ALPHANUMERIC DESIGNATION
'DWG' DENOTES NUMBER WHERE DETAIL IS DRAWN

REVISION INDICATOR
'NO' DENOTES REVISION LEVEL

CODED NOTE
'NO' DENOTES SEQUENTIAL ALPHANUMERIC DESIGNATION

GENERAL NOTES

A. NOTES PERTAINING TO ALL BRANCH CIRCUITING:

1. ALL ELECTRICAL DEVICES HAVE BRANCH CIRCUIT NUMBERS AND PANELS INDICATED ADJACENT TO THE POWER CONNECTION SYMBOL ON THE PLANS. ALTHOUGH THE INTERCONNECTING BRANCH CIRCUITING IS NOT SHOWN, THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR ALL WIRE AND CONDUIT REQUIRED FOR A COMPLETE AND OPERATIONAL POWER DISTRIBUTION SYSTEM.
2. UNLESS NOTED OTHERWISE ON THE DRAWINGS, ALL BRANCH CIRCUITING SHALL BE INSTALLED CONCEALED IN EMT, 3/4" MINIMUM.
3. ALL CONDUIT SHALL BE 3/4" EMT, UNLESS NOTED OTHERWISE ON THE DRAWINGS. THE FOLLOWING EXCEPTIONS ALSO APPLY:
   A. THE CONDUIT FOR ALL HVAC EQUIPMENT SHALL BE AS SCHEDULED UNDER THE 'MECHANICAL EQUIPMENT SCHEDULE'.
   B. THE WIRE FOR ALL HVAC EQUIPMENT SHALL BE AS SCHEDULED UNDER THE 'MECHANICAL EQUIPMENT SCHEDULE'.
   C. THE MAXIMUM NUMBER OF CURRENT CARRYING WIRING (DOES NOT INCLUDE GROUND WIRE) IN ANY ONE CONDUIT SHALL NOT EXCEED SIX (6), UNLESS NOTED OTHERWISE ON THE DRAWINGS.
   D. FOR BRANCH CIRCUIT WIRING TO LED LAMPED LIGHT FIXTURES THAT ARE DIMMED, PROVIDE CIRCUITING (2-#12, 1-#12GRD.) TO ALL LIGHT FIXTURES IN MC CABLE WITH TWO CONDUCTORS FOR 0-10 VOLT CONTROL ORIGINATING AT RELAY PACK, UNO. CIRCUITING SHALL BE AFC CABLE SYSTEMS MC LUMINARY CABLE TYPE MC-PCS (12-2 BLACK, WHITE, GREEN WITH 16-2 PURPLE AND PINK) OR APPROVED EQUIVALENT. WHERE DISTANCE EXCEEDS 100', PROVIDE #10 CONDUCTORS.

B. NOTES PERTAINING TO GROUNDING:

1. PROVIDE A SEPARATE INSULATED GROUND WIRE IN EACH CONDUIT RUN. MINIMUM WIRE SIZE SHALL BE #12AWG. GROUND WIRE IS TYPICALLY NOT SHOWN.

C. NOTES PERTAINING TO CUTTING AND PATCHING:

1. ALL OPENINGS IN EXISTING STRUCTURAL ELEMENTS, REQUIRED FOR COMPLETION OF THE CONTRACT (SUCH AS FLOORS, WALLS, CEILINGS, AND ROOFS), SHALL BE CUT AND/OR PATCHED BY THE ELECTRICAL CONTRACTOR.

D. EXISTING PANELBOARD SCHEDULES:

1. THE ELECTRICAL CONTRACTOR SHALL PROVIDE TYPE-WRITTEN PANELBOARD DIRECTORIES IN ALL EXISTING PANELBOARDS WHERE CIRCUITS HAVE BEEN ADDED OR DELETED. THE INFORMATION FOR EACH CIRCUIT SHALL INCLUDE TYPE OF LOAD AND LOCATION OF CIRCUITING. THE ROOM NUMBERS USED TO CREATE THESE PANELBOARD DIRECTORIES WILL BE BASED ON THE AS-BUILT ROOM NUMBERS, IF DIFFERENT THAN THE ROOM NUMBERS ON DRAWINGS. COORDINATE THE ROOM NUMBERS WITH OWNER AND ARCHITECT PRIOR TO CREATING DIRECTORIES. AFTER ALL DIRECTORIES HAVE BEEN INSTALLED IN PANELBOARDS, THE CONTRACTOR WILL PROVIDE ALL DIRECTORIES ON A USB DRIVE LISTING SOFTWARE USED TO CREATE THE FILES FOR USE BY THE OWNER.

E. EXISTING FIRE ALARM SYSTEM:

1. THE EXISTING FIRE ALARM SYSTEM SHALL REMAIN. (CONTRACTOR SHALL FIELD VERIFY MANUFACTURER). ALL NEW DEVICES SHOWN ON DRAWINGS SHALL BE CONNECTED TO THE EXISTING FIRE ALARM SYSTEM. PROVIDE ALL CONNECTIONS REQUIRED TO INTEGRATE NEW DEVICES TO THE EXISTING SYSTEM. PROVIDE A MINIMUM OF 8 HOURS OF TECHNICIAN LABOR FROM LOCAL MANUFACTURER'S REPRESENTATIVE TO CONNECT DEVICES AND PROGRAM DEVICES INTO SYSTEM.

GENERAL ABBREVIATIONS

A	AMPERE
AWG	AMERICAN WIRE GAUGE
C	CONDUIT
EMT	ELECTRIC METALLIC TUBING
G	GROUND OR GROUNDED
GRD	GROUND OR GROUNDED
MLO	MAIN LUG ONLY
ø	PHASE
V	VOLT
W	WATT

LIGHTING

CEILING MOUNTED | WALL MOUNTED

INDIVIDUAL LIGHTING FIXTURE, WALL MOUNT AT 6'-8" AFF TO BOTTOM OR CEILING MOUNT

LIGHTING FIXTURE WITH EMERGENCY BATTERY BACKUP, CEILING MOUNT

NOMENCLATURE:
- 'G01' DENOTES TYPE (REFER TO LIGHTING FIXTURE SCHEDULE)

NOTES:
1. ADJACENT FIXTURES WITHOUT TAGS TO BE SAME TYPE AS TAGGED FIXTURES
2. REFER TO LIGHTING FIXTURE SCHEDULE FOR LIGHTING FIXTURE DESCRIPTIONS
3. WHERE POSSIBLE, LIGHTING FIXTURES AS SHOWN ACTUAL SIZE AND CONFIGURATION.

WALL SWITCH - MOUNT 48" AFF TO TOP OF BOX, UNO
NOMENCLATURE:
- 'WD' DENOTES DUAL TECHNOLOGY WALL SENSOR DIMMING SWITCH. SENSOR SWITCH WSXD OR APPROVED EQUAL. REFER TO DETAIL 7/E1.0.
- 'LV' DENOTES LOW VOLTAGE. nLIGHT NPODM OR APPROVED EQUAL. REFER TO DETAILS 5/E1.0 AND 6/E1.0.

DRP — LOW VOLTAGE RELAY PACK. nLIGHT nPP16 OR APPROVED EQUAL. REFER TO DETAIL 5/E1.0.

DUAL TECHNOLOGY OCCUPANCY SENSOR (360 DEGREE COVERAGE), CEILING MOUNT. nLIGHT nCM OR APPROVED EQUAL. REFER TO DETAIL 5/E1.0.

POWER

CEILING MTD | FLOOR MTD | WALL MTD

JUNCTION BOX

WALL SWITCH, MOUNT 48" AFF TO TOP OF BOX (UNO)
NOMENCLATURE:
- 'M' DENOTES MANUAL MOTOR STARTER

VFD OR MOTOR STARTER - MOUNT 6'-0" AFF TO TOP OF ENCLOSURE, UNO

100/3/80 NOMENCLATURES:
- '3R' DENOTES NEMA RATING
- DENOTES FUSE SIZE
- DENOTES NUMBER OF POLES
- DENOTES SWITCH RATING

PANELBOARD, MOUNT NEW 6'-0" AFF TO TOP CIRCUIT BREAKER

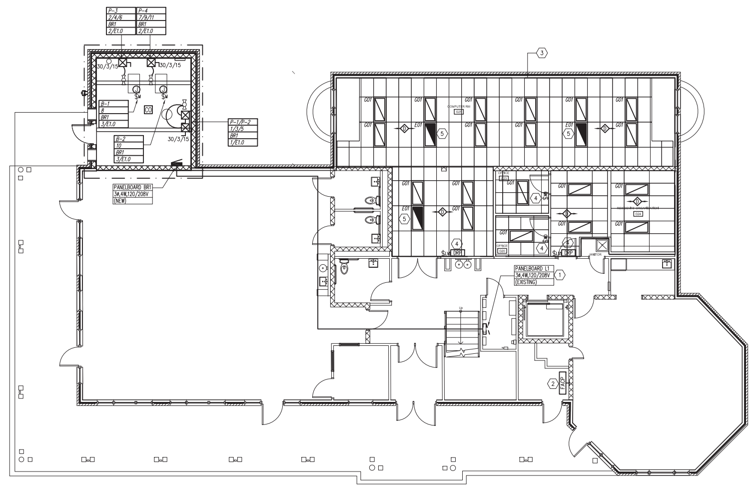
EQUIPMENT REQUIRING ELECTRICAL CONNECTIONS - REFER TO EQUIPMENT SCHEDULE FOR SPECIFICATION
NOMENCLATURES:
- B-1 — DENOTES EQUIPMENT NUMBER (REFER TO SCHEDULE)
- 1 — DENOTES POSITION NUMBER IN PANELBOARD. TWO NUMBERS SEPARATED BY A SLASH (e.g. 31/33) INDICATES A 2-POLE CIRCUIT TO BE CONNECTED TO POSITIONS 31 AND 33 IN THE PANELBOARD. THREE NUMBERS SEPARATED BY A SLASH (e.g. 31/33/35) INDICATES A 3-POLE CIRCUIT IN THE PANELBOARD. NUMBERS SEPARATED BY COMMAS, INDICATES INDIVIDUAL SINGLE-POLE CIRCUITS (e.g. 31,33,35).
- BR1 — DENOTES PANELBOARD EQUIPMENT SHALL BE CONNECTED TO
- 1/E0.0 — DENOTES REFERENCE TO EQUIPMENT CONNECTION DETAIL

FIRE ALARM

CEILING MTD | WALL MTD

CO — CARBON MONOXIDE DETECTOR. VERIFY EXACT LOCATION WITH HVAC CONTRACTOR.

FACP — EXISTING FIRE ALARM CONTROL PANEL.



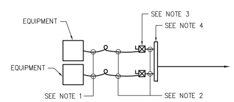
BASEMENT ELECTRICAL PLAN
1/E1.0 SCALE: 1/8" = 1'-0"

GENERAL NOTES: (THIS DRAWING)

A. EXISTING PANELBOARD L1 HAS A 200A/3P MAIN CIRCUIT BREAKER AND EXISTING PEAK DEMAND OF (27.2 KW X 1.25%) 34.0 KW.
PANELBOARD BR1 ADDS NEW ADDITIONAL LOAD OF 7.5 KW. NEW PANELBOARD L1 LOAD BECOMES 41.5 KW AND 115.2 AMPS.

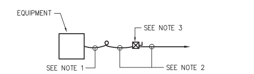
CODED NOTES: (THIS DRAWING)

1. REMOVE (3) 20A/1P SPARES AND PROVIDE 50A/3P CIRCUIT BREAKER FOR NEW PANELBOARD BR1. PROVIDE 4#6 AND 1#10G IN 1"C FROM NEW CIRCUIT BREAKER TO NEW PANELBOARD BR1. CIRCUIT BREAKER SHALL MATCH EXISTING PANELBOARD MANUFACTURER, CUTLER HAMMER POWER LINE C, AND EXISTING AIC RATING.
2. EXISTING FIRE ALARM CONTROL PANEL TO REMAIN.
3. REMOVE EXISTING LIGHT FIXTURES AND SWITCHES IN THIS AREA. BRANCH CIRCUIT WIRING SHALL REMAIN FOR EXTENSION TO NEW LIGHT FIXTURES AND CONTROLS.
4. INTERCEPT EXISTING LIGHTING BRANCH CIRCUIT TO NEW LIGHT FIXTURES THROUGH RELAY PACK OR WALL SENSOR SWITCH.
5. INTERCEPT UNSWITCHED PORTION OF EXISTING LIGHTING BRANCH CIRCUIT TO EMERGENCY BATTERY DRIVER FOR VOLTAGE SENSING. REFER TO DETAIL 4/E1.0.



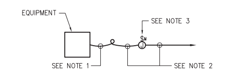
NOTES:
1. PROVIDE FLEXIBLE CONDUIT IN ACCORDANCE WITH THE SPECIFICATION.
2. PROVIDE WIRING IN ACCORDANCE WITH EQUIPMENT SCHEDULE.
3. INSTALL STARTERS, FURNISHED BY OTHERS, IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S RECOMMENDATION. INSTALL ADJACENT TO EQUIPMENT IN ACCORDANCE WITH NEC REQUIREMENTS.
4. PROVIDE ENCLOSED WIREWAY WITH TERMINAL STRIPS IN ACCORDANCE WITH NEC REQUIREMENTS.

1/E1.0 EQUIPMENT CONNECTION DETAIL
NOT TO SCALE



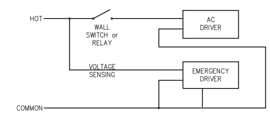
NOTES:
1. PROVIDE FLEXIBLE CONDUIT IN ACCORDANCE WITH THE SPECIFICATION.
2. PROVIDE WIRING IN ACCORDANCE WITH EQUIPMENT SCHEDULE.
3. INSTALL STARTER, FURNISHED BY OTHERS, IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S RECOMMENDATION. INSTALL ADJACENT TO EQUIPMENT IN ACCORDANCE WITH NEC REQUIREMENTS.

2/E1.0 EQUIPMENT CONNECTION DETAIL
NOT TO SCALE



NOTES:
1. PROVIDE FLEXIBLE CONDUIT IN ACCORDANCE WITH THE SPECIFICATION.
2. PROVIDE WIRING IN ACCORDANCE WITH EQUIPMENT SCHEDULE.
3. PROVIDE A JUNCTION BOX AND MANUAL MOTOR STARTER ADJACENT TO EQUIPMENT.

3/E1.0 EQUIPMENT CONNECTION DETAIL
NOT TO SCALE



NOTES:
1. WIRE EMERGENCY BALLAST IN LIGHT FIXTURE AHEAD OF SWITCHED PORTION OF LIGHTING CIRCUIT AS SHOWN IN DIAGRAM.

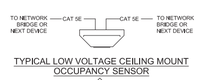
4/E1.0 EMERGENCY BATTERY BACKUP WIRING DIAGRAM
NOT TO SCALE

PANELBOARD SCHEDULE

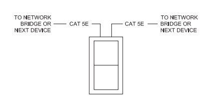
VOLTAGE: 208Y/120V, 3PH, 4W	PANEL TAG: BR1	MIN. AIC: 10K
SIZE/TYPE BUS: 100A COPPER	LOCATION: BOILER ROOM	MOUNTING: SURFACE
SIZE/TYPE MAIN: 100A MAIN LUGS		OPTIONS:

DESCRIPTION	LOCATION	LOAD (WATTS)	C/B SIZE	POS. NO.	Aø	Bø	Cø	POS. NO.	C/B SIZE	LOAD (WATTS)	LOCATION	DESCRIPTION
P-1/P-2		936	15A/3P	1	*			2	15A/3P	576		P-3
MULTI-POLE		936		3		*		4		576		*MULTI-POLE*
MULTI-POLE		936		5			*	6		576		*MULTI-POLE*
P-4		576	15A/3P	7	*			8	20A/1P	600		B-1
MULTI-POLE		576		9		*		10	20A/1P	600		B-2
MULTI-POLE		576		11			*	12	20A/1P			SPARE
SPARE			20A/1P	13	*			14	20A/1P			SPARE
SPARE			20A/1P	15		*		16	20A/1P			SPARE
SPARE			20A/1P	17			*	18	20A/1P			SPARE
SPARE			20A/1P	19	*			20	20A/1P			SPARE
SPARE			20A/1P	21		*		22	20A/1P			SPARE
SPARE			20A/1P	23			*	24	20A/1P			SPARE

CONNECTED LOAD (KW) - Aø	2.69	TOTAL CONNECTED LOAD (KW)	7.46
CONNECTED LOAD (KW) - Bø	2.69		
CONNECTED LOAD (KW) - Cø	2.09	TOTAL CONNECTED LOAD (AMPS)	21

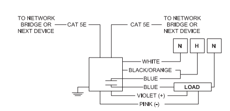


TYPICAL LOW VOLTAGE CEILING MOUNT OCCUPANCY SENSOR



TYPICAL LOW VOLTAGE SWITCH - REFER TO LOW VOLTAGE SWITCH DETAILS

$LV1

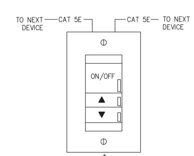


TYPICAL 0-10 VOLT DIMMING RELAY PACK

DRP

LIGHTING CONTROL DETAIL NOTES:
A. ELECTRICAL CONTRACTOR TO PROVIDE & TERMINATE ALL LOW VOLTAGE CAT 5E DATA CABLE.
B. ELECTRICAL CONTRACTOR TO CONNECT ALL DEVICES WITH CAT 5E DATA CABLE IN A DAISY CHAIN, STARTING WITH THE SYSTEM GATEWAY THEN TO NEXT NEAREST SYSTEM BRIDGE AND SO ON.
C. ALL CAT 5 CABLE RUNS NEED TO BE TESTED WITH A CAT 5E METER FOR PROPER TERMINATION OF RJ45 CONNECTORS.
D. WHERE FOUR OR MORE RELAY PACKS ARE GROUPED TOGETHER IN ONE LOCATION, MOUNT RELAYS TO A 6" X 6" X 4" DEEP JUNCTION BOX ABOVE ACCESSIBLE CEILING.
E. LABEL EACH RELAY PACK WITH CONTROL ZONE AS NOTED ON DRAWINGS USING PERMANENT MARKER.
F. REFER TO MANUFACTURER'S RECOMMENDED INSTALLATION INSTRUCTIONS FOR EXACT ROUGH-IN REQUIREMENTS AND CONNECTION REQUIREMENTS.
G. THE SYSTEM MANUFACTURER SHALL VISIT SITE AND COMMISSION EACH DEVICE TO PROVIDE PROPER SET-UP OF SYSTEM. EC SHALL INCLUDE THE MANUFACTURER'S SITE VISIT IN THE BIDDING.
H. OCCUPANCY SENSORS CONNECTED TO SYSTEM SHALL BE SET FOR VACANCY MODE, UNO, EXCEPT ALL SENSORS IN CORRIDORS WILL BE PROGRAMMED FOR INSTANT ON OPERATION.

5/E1.0 LOW VOLTAGE LIGHTING CONTROL DETAILS
NOT TO SCALE



LOW VOLTAGE SWITCH NOTES:
1. 'ON/OFF' SHALL CONTROL ALL RELAYS IN ROOM.
2. 'UP ARROW' AND 'DOWN ARROW' SHALL RAISE/LOWER LIGHTS TURNED ON IN ACTIVE SCENE.

6/E1.0 LOW VOLTAGE SWITCH DETAIL
NOT TO SCALE

MECHANICAL EQUIPMENT SCHEDULE

EQUIPMENT TAG	DESCRIPTION	LOAD	VOLTAGE & PHASE	BRANCH CIRCUIT PROTECTION	SETS	BRANCH CIRCUIT SIZE AND TYPE						
						CONDUIT		CONDUCTORS			GROUND	
				TRIP		SIZE	TYPE	NO.	SIZE	TYPE	SIZE	TYPE
B-1	BOILER	5 AMPS	120V,1ø,2W	20A/1P	1	3/4"	EMT	2	12AWG	CU THWN	12AWG	CU THWN
B-2	BOILER	5 AMPS	120V,1ø,2W	20A/1P	1	3/4"	EMT	2	12AWG	CU THWN	12AWG	CU THWN
P-1	PUMP	2 HP	208V,3ø,3W	15A/3P	1	3/4"	EMT	3	12AWG	CU THWN	12AWG	CU THWN
P-2	PUMP	2 HP	208V,3ø,3W	15A/3P	1	3/4"	EMT	3	12AWG	CU THWN	12AWG	CU THWN
P-3	PUMP	1 HP	208V,3ø,3W	15A/3P	1	3/4"	EMT	3	12AWG	CU THWN	12AWG	CU THWN
P-4	PUMP	1 HP	208V,3ø,3W	15A/3P	1	3/4"	EMT	3	12AWG	CU THWN	12AWG	CU THWN

LIGHTING FIXTURE SCHEDULE

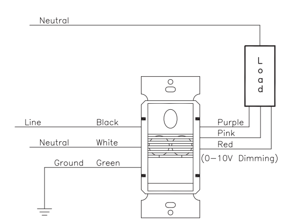
EMERGENCY LIGHTING FIXTURES

TAG	DESCRIPTION	COLOR	MOUNTING	MANUFACTURER	SERIES	LAMPS TYPE	BALLAST TYPE	WATTAGE	VOLTAGE	LOCATION	REMARKS
E01	2'x 4' LED FLAT PANEL PROVIDE WITH EMERGENCY BATTERY BACKUP DRIVER	WHITE	RECESSED	LITHONIA WILLIAMS TRACELITE	EPANL BP LPX	LED (4800 LUMENS)	LED 0-10V	40W	120V	COMPUTER ROOM	

GENERAL LIGHTING FIXTURES

TAG	DESCRIPTION	COLOR	MOUNTING	MANUFACTURER	SERIES	LAMPS	BALLAST	WATTAGE	VOLTAGE	LOCATION	REMARKS
G01	2'x 4' LED FLAT PANEL	WHITE	RECESSED	LITHONIA WILLIAMS TRACELITE	EPANL BP LPX	LED (4800 LUMENS)	LED 0-10V	40W	120V	OFFICES COMPUTER ROOM	

1. WHERE A CONFLICT EXISTS BETWEEN THE DESCRIPTION AND THE CATALOG NUMBER, THE DESCRIPTION SHALL TAKE PRECEDENCE. BID PRICES SHALL BE BASED ON FIXTURES AS DESCRIBED IN THE DESCRIPTION, VOLTAGE, MOUNTING AND FINISH COLUMNS.
2. THE LAMP COLUMN INDICATES THE NORMAL LAMP WATTAGE / SHAPE / COLOR TEMPERATURE / AND/OR DISTRIBUTION. LAMPS SHALL BE PROVIDED AS RECOMMENDED AND TESTED BY THE MANUFACTURER OF THE FIXTURE SPECIFIED. THE FIXTURE MANUFACTURER SHALL BE RESPONSIBLE FOR THE DRIVER COMPATIBILITY.
3. FIXTURES SHALL HAVE A MINIMUM CRI OF 80.
4 ALL INTERIOR LED LAMPS SHALL HAVE A COLOR TEMPERATURE OF 3500K UNLESS NOTED OTHERWISE.



7/E1.0 WALL SWITCH "WD" SENSOR DETAIL
NOT TO SCALE

TOWER ENGINEERING
115 Evergreen Heights Drive, Suite 400, Pittsburgh, Pennsylvania 15229-1346
412.931.8888 • Fax: 412.939.2525 • www.estower.com
Project No: 2023064

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL T STEFFANIE BAKO ENGINEER PE061041
08/04/2023

TAA
Tusick & Associates Architects, Inc.
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REVISIONS

DRAWN BY	CHECKED BY	DATE ISSUED	DATE PRINTED
JVM	TSB	08/04/2023	08/04/2023

Electrical Legend, Schedules, Details and Basement Plan

Bedford Dwelling Envision Center
2305 Bedford Ave.
Pittsburgh, PA 15219

SHEET NUMBER:
E1.0

HVAC SYMBOLS & ABBREVIATIONS

SHEET METAL SYMBOLS

- SUPPLY AIR DUCT TURNED UP
- SUPPLY AIR DUCT TURNED DOWN
- RETURN, EXHAUST OR RELIEF AIR DUCT TURNED UP
- RETURN, EXHAUST OR RELIEF AIR DUCT TURNED DOWN
- RETURN, EXHAUST OR RELIEF AIR DUCT PENETRATION THRU ROOF
- SUPPLY AIR DUCT PENETRATION THRU ROOF
- DIRECTION OF AIR FLOW ARROW
- RECTANGULAR DUCT. DIMENSION IS FREE AREA. REFER TO PROJECT MANUAL FOR DUCT LINER REQUIREMENTS. ADD LINER THICKNESS TO EACH DIMENSION TO GET OUTSIDE DIMENSION OF SHEET METAL. (1ST FIGURE, SIDE SHOWN; 2ND FIGURE, SIDE NOT SHOWN.) DUCT SIZE WITH A 'X' PREFIX (E.G. x24/12) INDICATES EXISTING DUCT SIZE. (24/12)
- RECTANGULAR MAIN DUCT WITH 45° CLINCH COLLAR, AND VOLUME DAMPER IN SUB-DUCT. (PER SMACNA DUCT CONSTRUCTION STANDARDS)
- ROUND DUCT. SINGLE WALL. FOR DOUBLE WALL DUCT REQUIREMENTS, SEE SPECIFICATION AND/OR SEE CODED NOTES ON PLANS. (12"ø)
- ROUND MAIN DUCT WITH 90° TAP OR 90° SADDLE TAP AND VOLUME DAMPER IN SUB-DUCT. (PER SMACNA DUCT CONSTRUCTION STANDARDS)
- TRANSITIONS. GIVE SIZES. NOTE F.O.T. (FLAT ON TOP), OR F.O.B. (FLAT ON BOTTOM) IF APPLICABLE. (16/12, 24/12)
- ACCESS DOOR (AD) OR ACCESS PANEL (AP) AS NOTED.
- INCLINED RISE (UP) OR DROP (DN). ARROW IN DIRECTION OF AIR FLOW. (UP (or DN))
- DUCT MOUNTED SMOKE DETECTOR
- VOLUME DAMPER
- BACKDRAFT DAMPER (BDD) COUNTER BALANCED BACKDRAFT DAMPER (CBBDD)
- AUTOMATIC AIR DAMPER (AAD)
- FIRE DAMPER (FD) FIRE/SMOKE DAMPER (F/SD) SMOKE DAMPER (SD)
- FLEXIBLE DUCT CONNECTION TO FAN (OR EQUIP. WITH FAN)
- FLEXIBLE DUCT
- FLEXIBLE DUCT CONNECTION, WITH EQUIVALENT 90° ELBOW, TO ROUND DIFFUSER.
- FLEXIBLE DUCT OR ROUND HARD METAL DUCT CONNECTION, WITH NO 90° ELBOW, TO ROUND DIFFUSER.
- FLEXIBLE DUCT CONNECTION, WITH ONE EQUIVALENT 90° TURN OR OFFSET, TO SQUARE DIFFUSER.
- FLEXIBLE DUCT OR ROUND HARD METAL DUCT CONNECTION, WITH NO 90° ELBOW, TO SQUARE DIFFUSER.
- DIRECTION DIFFUSER (SLD). DARKENED QUADRANT(S) NO AIR FLOW. 3-WAY BLOW SHOWN.
- ROUND DUCT
- FLAT OVAL DUCT
- DIRECTION OF AIR FLOW IN OR OUT OF EQUIPMENT OR AN AIR TERMINAL DEVICE.

PIPING SYMBOLS

- CHWR — CHILLED WATER RETURN
- CHWS — CHILLED WATER SUPPLY
- CW — COLD (CITY) WATER PIPING
- CD — COIL CONDENSATE DRAIN
- D — DRAIN
- G — NATURAL GAS PIPING
- HPR — HIGH PRESSURE STEAM RETURN
- HPS — HIGH PRESSURE STEAM
- HWR — HOT WATER RETURN
- HWS — HOT WATER SUPPLY
- LPG — LIQUID PROPANE GAS PIPING
- LPR — LOW PRESSURE STEAM RETURN
- LPS — LOW PRESSURE STEAM
- PD — PUMPED DISCHARGE PIPING (FROM CONDENSATE PUMP)
- RG — REFRIGERANT HOT GAS
- RL — REFRIGERANT LIQUID
- RS — REFRIGERANT SUCTION
- PIPING TURNED UP
- PIPING TURNED DOWN
- 90° RISE OR DROP IN PIPE
- 45° RISE OR DROP IN PIPE
- PIPE TAKEOFF FROM TOP OF MAIN
- PIPE TAKEOFF FROM BOTTOM OF MAIN
- PIPE TAKEOFF FROM SIDE OF MAIN
- GATE VALVE (OR)
- BALL VALVE
- GLOBE VALVE
- PLUG VALVE
- BUTTERFLY VALVE
- DRAIN VALVE WITH HOSE CONNECTION (HOSE CONNECTION)
- CHECK VALVE
- FLOW CONTROL VALVE WITH GPM INDICATED WHEN LOCATED IN MAINS OR SERVING MULTIPLE UNITS. WHEN SERVING SINGLE-UNIT, REFER TO EQUIPMENT SCHEDULES.
- PRESSURE RELIEF VALVE
- PRESSURE REDUCING VALVE WITH BUILT-IN CHECK VALVE
- UNION
- TWO-WAY CONTROL VALVE
- THREE-WAY CONTROL VALVE
- AIR VENT. INSTALL AT ALL HIGH POINTS IN SYSTEM. AAV-AUTOMATIC. MAV-MANUAL. EXTEND DRAIN LINE FROM ALL AUTOMATIC AIR VENTS TO NEAREST CONDENSATE DRAIN LINE OR SAFEWASTE.
- PRESSURE GAUGE AND COCK
- THERMOMETER
- WELL IN PIPING
- PRESSURE/TEMPERATURE PORT
- HOSE BIBB
- HOSE BIBB W/CAP
- STRAINER
- STRAINER WITH BLOWDOWN AND HOSE CONNECTION (HOSE BIBB)
- DIRECTION OF PIPE SLOPE (DOWN)
- DIRECTION OF FLOW IN PIPE
- EXPANSION COMPENSATOR AND GUIDES
- PIPE ANCHOR
- FLOW SWITCH
- FLEXIBLE CONNECTION

GENERAL DRAWING SYMBOLS

- POINT OF CONNECTION – NEW TO EXISTING
- DEMOLITION LIMIT
- (NO) CODED NOTE
  'NO' DENOTES SEQUENTIAL ALPHANUMERIC DESIGNATION
- (ID / FL-NO) EQUIPMENT TAG
  (REFER TO APPROPRIATE SCHEDULE)
  'ID' DENOTES EQUIPMENT TYPE (I.E. EF=EXHAUST FAN)
  'FL' DENOTES FLOOR EQUIPMENT IS LOCATED ON
  'NO' DENOTES SEQUENTIAL ALPHANUMERIC DESIGNATION
  NOTE: A TEXT STRING MAY ALSO BE USED TO IDENTIFY SCHEDULED EQUIPMENT. E.G. "ID-NO".
- (ID / SB, OBD, CFM) DIFFUSER, REGISTER, GRILLE TAG
  (REFER TO APPROPRIATE SCHEDULE)
  'ID' DENOTES DIFFUSER, REGISTER, GRILLE TYPE
  (I.E. SCD=SQUARE CONE DIFFUSER)
  'SB' DENOTES NECK SIZE AND BLOW PATTERN
  (I.E. 123=12"ø OR 12"x12" NECK WITH 3-WAY BLOW PATTERN)
  'CFM' INDICATES AIR FLOW RATE IN CFM
  OBD INDICATES THAT AN OPPOSED BLADE DAMPER SHALL BE PROVIDED
  (1.E. WHEN OBD NOT SHOWN, NO OPPOSED BLADE DAMPER SHALL BE PROVIDED.
- (NO / D1 D2) SECTION INDICATOR
  'NO' DENOTES SEQUENTIAL ALPHABETIC DESIGNATION
  'D1' DENOTES DRAWING ON WHICH SECTION CUT
  'D2' DENOTES DRAWING ON WHICH SECTION IS LOCATED
- (NO / DWG) DETAIL INDICATOR
  'NO' DENOTES SEQUENTIAL ALPHANUMERIC DESIGNATION
  'DWG' DENOTES DRAWING ON WHICH DETAIL IS LOCATED
- (NO/DWG) ELEVATION/VIEW INDICATOR
  'NO' DENOTES SEQUENTIAL ALPHANUMERIC DESIGNATION
  'D' DENOTES DRAWING ON WHICH ELEVATION/VIEW IS LOCATED
- (NO) REVISION INDICATOR
  'NO' DENOTES REVISION LEVEL

CONTROL SYMBOLS

- $F — PILOT SWITCH (FAN CONTROL)
- (C) — VARIABLE SPEED CONTROLLER
- P — PUSH BUTTON CONTROLLER WITH PILOT LIGHT
- (H) — HUMIDISTAT OR HUMIDITY SENSOR
- (T) — THERMOSTAT OR TEMPERATURE SENSOR
- (T)N — NIGHT THERMOSTAT
- (TH) — TEMPERATURE/HUMIDITY CONTROL
- (CO_2) — CARBON DIOXIDE SENSOR
- (CO) — CARBON MONOXIDE SENSOR

GENERAL NOTES: (ALL DRAWINGS)

A. UNLESS CONDITIONS DO NOT PERMIT, ALL RADIUSED ELBOWS SHOWN ON THE DRAWINGS SHALL BE PROVIDED. WHERE CONDITIONS DO NOT PERMIT, MITERED RECTANGULAR ELBOWS WITH TURNING VANES MAY BE PROVIDED IN LIEU OF RADIUSED ELBOWS. THE RADIUSED RECTANGULAR ELBOWS SHALL HAVE A RADIUSED HEEL AND A RADIUSED THROAT, AND SHALL HAVE A CENTERLINE RADIUS NOT LESS THAN 1.5 TIMES THE DUCT WIDTH.

B. ALL MITERED RECTANGULAR DUCT ELBOWS HAVING AN ANGLE GREATER THAN 45° SHALL BE PROVIDED WITH TURNING VANES.

C. DUCTWORK SHALL NOT BE INSTALLED ABOVE ELECTRICAL PANELS. COORDINATE DUCTWORK WITH ELECTRICAL CONTRACTOR.

D. FINAL THERMOSTAT, SENSOR, AND EXHAUST FAN SWITCH LOCATIONS MUST BE APPROVED BY THE ARCHITECT AND OWNER PRIOR TO INSTALLATION.

E. DUCT DETECTORS SHALL BE PROVIDED BY THE E.C. AND MOUNTED BY THE H.C. THE E.C. SHALL PROVIDE ALL POWER WIRING AND FIRE ALARM CONTROL WIRING FOR THE DETECTOR. THE H.C. SHALL PROVIDE ALL FAN SHUTDOWN CONTROL WIRING.

F. REFERENCES MADE TO THE CONTRACTOR, THE HEATING CONTRACTOR, THE HVAC CONTRACTOR, AND THE MECHANICAL CONTRACTOR SHALL MEAN ONE AND THE SAME.

G. IN AREA INDICATED THE HC SHALL REMOVE, STORE, PROTECT AND REINSTALL ALL CEILING TILES AND CEILING GRID NECESSARY FOR THE INSTALLATION OF THE HVAC WORK. THE HC SHALL TEMPORARILY SUPPORT AND REINSTALL EXISTING CEILING MOUNTED OR CEILING RECESSED DEVICES SUCH AS GRILLES, DIFFUSERS, LIGHTING, SPEAKERS, FIRE ALARM STROBES, ETC. NECESSARY FOR THE INSTALLATION OF THE HVAC WORK. REPLACE ALL MATERIALS THAT ARE DAMAGED DURING THE COURSE OF THE WORK WITH NEW MATERIAL WHICH MATCH EXISTING.

H. PRIOR TO THE COMMENCEMENT OF WORK, THE CONTRACTOR SHALL MEASURE AIR AND WATER FLOW RATES ON EXISTING AIR AND WATER SYSTEMS AND EQUIPMENT MODIFIED UNDER THIS PROJECT. SUBMIT BALANCE REPORT FOR REVIEW.

NOTE: THE DATA OBTAINED FROM THIS PRE-CONSTRUCTION AIR AND WATER BALANCE SHALL BE USED TO BALANCE THE AIR AND WATER SYSTEMS AT THE CONCLUSION OF EACH PHASE OF CONSTRUCTION WORK.

NOTE: NOT ALL OF THE SYMBOLS/ABBREVIATIONS SHOWN ON THIS DRAWING ARE USED WITHIN THE DRAWING SET.

ABBREVIATIONS

AAD AUTOMATIC AIR DAMPER
AAV AUTOMATIC AIR VENT
ABV ABOVE
ACU AIR CONDITIONING UNIT
AD ACCESS DOOR
ADC AIR DIFFUSION COUNCIL
AFF ABOVE FINISHED FLOOR
AGA AMERICAN GAS ASSOCIATION
AHU AIR HANDLING UNIT
ALT ALTERNATE
AMCA AIR MOVEMENT AND CONTROL ASSOCIATION
AP ACCESS PANEL
APD AIR PRESSURE DROP
ARI AIR-CONDITIONING AND REFRIGERATION INSTITUTE
AS AIR SEPARATOR
ASHRAE AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS
ASME AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM AMERICAN SOCIETY FOR TESTING AND MATERIALS
ATC AUTOMATIC TEMPERATURE CONTROL
B BOILER
BAS BUILDING AUTOMATION SYSTEM
BCU BLOWER COIL UNIT
BDD BACK-DRAFT DAMPER
BFP BACK-FLOW PREVENTER
BFV BUTTERFLY VALVE
BHP BREAK HORSE POWER
BJ BETWEEN JOISTS
BL STL BLACK STEEL
BLDG BUILDING
BTUH BRITISH THERMAL UNITS/HOUR
BV BALL VALVE
C CHILLER
CAU COMBUSTION AIR UNIT
CBBDD COUNTER BALANCED BACKDRAFT DAMPER
CC COOLING COIL
CD COIL CONDENSATE DRAIN OR CEILING DIFFUSER
CFM CUBIC FEET PER MINUTE
CHWR CHILLED WATER RETURN
CHWS CHILLED WATER SUPPLY
CLG CEILING
CO CLEAN OUT
CONN CONNECTION
CP CONTROL PANEL
CRAC COMPUTER ROOM AIR CONDITIONING UNIT
CS CIRCUIT SETTER
CU CONDENSING UNIT
CUH CABINET UNIT HEATER
CV HOT WATER CONVECTOR
CW COLD WATER OR CITY WATER DB DRY BULB
DCW DOMESTIC COLD WATER
°F DEGREE FAHRENHEIT
DD DUCT MOUNTED SMOKE DETECTOR
DDG DOUBLE DEFLECTION GRILLE
DEMO DEMOLITION
DL DRUM LOUVER
DX DIRECT EXPANSION
EAT ENTERING AIR TEMPERATURE (°F)
EC ELECTRICAL CONTRACTOR
ECG EGG CRATE GRILLE
ECH ELECTRIC CEILING HEATER
ECP ELECTRIC RADIANT CEILING PANEL
ECUH ELECTRIC CABINET UNIT HEATER
EDC ELECTRIC DUCT COIL
EER ENERGY EFFICIENCY RATIO
EF EXHAUST FAN
EG EXHAUST GRILLE
EJ EXPANSION JOINT
ER EXHAUST REGISTER
ERCP ELECTRIC RADIANT CEILING PANEL
ESP EXTERNAL STATIC PRESSURE
ET EXPANSION TANK ELECTRIC
EUH UNIT HEATER
EWH ELECTRIC WALL HEATER
EWT ENTERING WATER TEMPERATURE
EXP EXPANSION
FD FIRE DAMPER
F/S D FIRE AND SMOKE DAMPER
FCU FAN COIL UNIT
FLA FULL LOAD AMPS
FLEX FLEXIBLE
FO FLAT OVAL DUCTWORK
FOB FLAT ON BOTTOM
FOT FLAT ON TOP
FPB FAN POWERED BOX
FT FEET
FTR FINNED TUBE RADIATION
FURN FURNISH
G GAS (NATURAL OR REFRIGERANT)
GA GAUGE
GC GENERAL CONTRACTOR
GFU GLYCOL FEED UNIT
GMRU GROUND MOUNTED ROOFTOP UNIT
GPM GALLONS PER MINUTE
GUH GAS FIRED UNIT HEATER
GV GATE VALVE
H HUMIDISTAT
HB DRAIN VALVE WITH HOSE CONNECTION (HOSE BIBB)
HC HVAC CONTRACTOR
HD KITCHEN/LAB HOOD
HDGG HEAVY DUTY GYM GRILLE
HI HYDRONICS INSTITUTE
HP HORSEPOWER OR HEAT PUMP
HR HOUR
HRU HEAT RECOVERY UNIT
HU HUMIDIFIER
HVAC HEATING, VENTILATING & AIR CONDITIONING
HVU HEATING AND VENTILATING UNIT
HWC HOT WATER COIL
HWR HOT WATER RETURN
HWS HOT WATER SUPPLY
IDF INDUCED DRAFT FAN
IMC INTERNATIONAL MECHANICAL CODE
IN INCH
IWG INCHES WATER GAUGE
KH KITCHEN HOOD
KSU KITCHEN SUPPLY UNIT
KW KILOWATT
L LOUVER OR LIQUID (REFRIGERANT)
LAT LEAVING AIR TEMPERATURE (°F)
LBG LINEAR BAR GRILLE
LBS POUNDS
LH LAB HOOD
LRG LINEAR RETURN GRILLE
LSD LINEAR SLOT DIFFUSER
LSR LINEAR SLOT RETURN
LWT LEAVING WATER TEMPERATURE
MANUF MANUFACTURER
MAU MAKE-UP AIR UNIT
MAV MANUAL AIR VENT
MAX MAXIMUM
MBH 1000 BTUH
MCA MINIMUM CIRCUIT AMPS
MIN MINIMUM
MOCP MAXIMUM OVER CURRENT PROTECTION
MTD MOUNTED
N.C. NORMALLY CLOSED
NFPA NATIONAL FIRE PROTECTION ASSOCIATION
N.O. NORMALLY OPEN
NO. NUMBER
NPW NON POTABLE WATER
OA OUTSIDE AIR
OAI OUTSIDE AIR INTAKE
OBD OPPOSED BLADE DAMPER
OCC OCCUPANCY
OS&Y OUTSIDE STEM AND YOKE GATE VALVE
P PUMP
PC PLUMBING CONTRACTOR
PD PRESSURE DROP OR PUMPED DISCHARGE
PG PRESSURE GAUGE
PRV PRESSURE RELIEF VALVE
PRS PRESSURE REDUCING STATION
PSI POUNDS PER SQUARE INCH
P/T PRESSURE/TEMPERATURE PORT
PV PLUG VALVE
RA RETURN AIR
RCD ROUND CONE DIFFUSER
RCP RADIANT CEILING PANEL (HOT WATER)
RG RETURN GRILLE
RL REFRIGERANT LIQUID
R/L A RELIEF AIR
RPM REVOLUTIONS PER MINUTE
RR RETURN REGISTER
RS REFRIGERANT SUCTION
RTU ROOFTOP UNIT
RV ROOF VENTILATOR
S SUCTION (REFRIGERANT)
SA SUPPLY AIR OR SOUND ATTENUATOR
SAN SANITARY
SCD SQUARE CONE DIFFUSER (4-WAY BLOW PATTERN)
SD SMOKE DAMPER
SDG SPIRAL DUCT GRILLE
SENS SENSIBLE
SF SUPPLY FAN
SFC SPLIT FAN COIL UNIT
SG SUPPLY GRILLE
SLD SQUARE DIRECTIONAL DIFFUSER
SMACNA SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
SPD SQUARE PLAQUE DIFFUSER
SR SUPPLY REGISTER
ST STL (SS) STAINLESS STEEL
T THERMOSTAT OR THERMOMETER
TB TERMINAL BOX
TDV TRIPLE DUTY VALVE
TJ THREAD JOISTS
TPD THERMALLY POWERED DIFFUSER
TSP TOTAL STATIC PRESSURE
T STAT THERMOSTAT
TYP TYPICAL
UH UNIT HEATER
UV UNIT VENTILATOR
V/PH VOLT / PHASE
VAV VARIABLE AIR VOLUME
VAVD VARIABLE AIR VOLUME DIFFUSER
VEL VELOCITY
VFD VARIABLE FREQUENCY DRIVE
VOL D (VD) VOLUME DAMPER
WB WET BULB
WG WATER GAUGE
WPD WATER PRESSURE DROP
WSHP WATER SOURCE HEAT PUMP
xCD EXISTING CONDENSATE DRAIN
xCHWR EXISTING CHILLED WATER RETURN
xCHWS EXISTING CHILLED WATER SUPPLY
xHWR EXISTING HOT WATER RETURN
xHWS EXISTING HOT WATER SUPPLY

HOT WATER BOILER SCHEDULE

UNIT NO.	FUEL	MAX INPUT (MBH)	MAX OUTPUT (MBH)	NATURAL GAS PRESSURE MIN (IN WG)	NATURAL GAS PRESSURE MAX (IN WG)	EWT (°F)	LWT (°F)	WATER FLOW (GPM)	W.P.D. (FT HD)	MIN VOLUME (GAL)	RELIEF VALVE PSI	BOILER ELECTRICAL FLA	BOILER ELECTRICAL VOLTS	BOILER ELECTRICAL PHASE	BASED ON MANUF.	BASED ON MODEL	REMARKS
B-1	NATURAL GAS	399	359	2	14	160	180	36	2	6		5	120	1	ATH	KN-4	
B-2	NATURAL GAS	399	359	2	14	160	180	36	2	6		5	120	1	ATH	KN-4	

REMARKS:

PUMP SCHEDULE

UNIT NO.	SERVES	TYPE	GPM	TOTAL HEAD (FT)	MAX POWER (BHP)	PUMP EFFICIENCY (%)	IMPELLER SIZE (IN)	MOTOR DATA HP	RPM	FLA	V/ph	BASED ON MANUF.	PUMP SERIES	PUMP MODEL	REMARKS
P-1	BUILDING LOOP	INLINE	40	55		47	7.75	2	1800		208 / 3	B&G	E-80	1.5x1.5x9.5B	1,2
P-2	BUILDING LOOP	INLINE	40	55		47	7.75	2	1800		208 / 3	B&G	E-80	1.5x1.5x9.5B	1,2
P-3	BOILER LOOP	INLINE	36	30		55	6.125	1	1800		208 / 3	B&G	E-80	1.5x1.5x7C	1
P-4	BOILER LOOP	INLINE	36	30		55	6.125	1	1800		208 / 3	B&G	E-80	1.5x1.5x7C	1

REMARKS:
1. PROVIDE COMBINATION STARTER/DISCONNECT
2. LEAD LAG SERVICE

TERMINAL BOX SCHEDULE

UNIT NO.	SPACE/ZONE SERVED	PRIMARY AIR FLOW MIN	PRIMARY AIR FLOW MAX	INLET SIZE (in)	HOT WATER COIL CFM HTG	EAT (°F)	LAT (°F)	MBH	GPM	# ROWS	FPI	APD (in WG)	WPD (ft)	BASED ON MANUF.	BASED ON MODEL	REMARKS
VAV-3	Office	100	250	6	250	55	95	10.9	1	2	10	0.1	0.1	TITUS	DESV	
VAV-4	Meeting Room	400	1000	10	1000	55	95	43.4	3	2	12	0.4	0.6	TITUS	DESV	
VAV-5	Corridor	80	200	6	200	55	95	9.5	1	2	10	0.1	0.1	TITUS	DESV	

REMARKS:
1. MAX DISCHARGE NC = 25
2. MAX RAD NC = 25

EXISTING HOT WATER EQUIPMENT SCHEDULE

UNIT NO.	SPACE/ZONE SERVED	WATER FLOW (GPM)	REMARKS
xVAV-1	GROUND FLOOR	3	
xVAV-2	GROUND FLOOR	5.7	
xVAV-6	FIRST FLOOR	0.6	
xVAV-7	FIRST FLOOR	–	
xVAV-8	FIRST FLOOR	3.8	
xVAV-9	FIRST FLOOR	0.8	
xVAV-10	FIRST FLOOR	1.7	
xVAV-11	FIRST FLOOR	1.7	
xVAV-12	FIRST FLOOR	1	
xVAV-13	FIRST FLOOR	2.5	
xVAV-14	FIRST FLOOR	3.7	
xVAV-15	FIRST FLOOR	2	
xVAV-16	FIRST FLOOR	0.5	
xVAV-17	FIRST FLOOR	2	
xVAV-18	FIRST FLOOR	0.5	
xVAV-19	FIRST FLOOR	2	
xUH-1	BOILER ROOM	1	
xCUH-1	VESTIBULE	1	
xCUH-2	STAIRS	1	
xCUH-3	VESTIBULE	1	
x Radiant Floor	GROUND FLOOR DAYCARE	2	
new VAV-3	GROUND FLOOR	1	
new VAV-4	GROUND FLOOR	3	
new VAV-5	GROUND FLOOR	1	

REMARKS:

TOWER ENGINEERING
115 Evergreen Heights Drive, Suite 400, Pittsburgh, Pennsylvania 15229-1346
412.931.8888 • Fax: 412.939.2525 • www.estower.com
Project No: 2023064

COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL ENGINEER
08/04/2023

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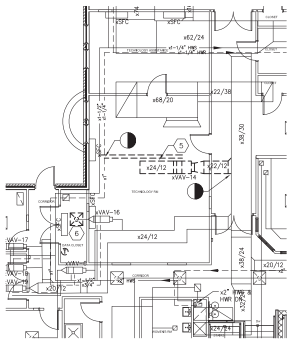
REVISIONS

DRAWN BY JRP
CHECKED BY MAC
DATE ISSUED 08/04/2023
DATE PRINTED 08/04/2023

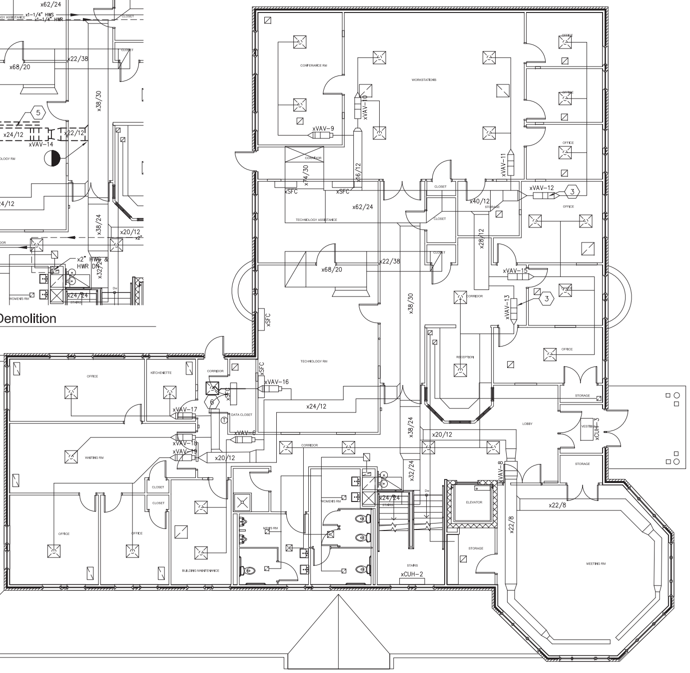
HVAC LEGEND & SCHEDULES
Bedford Dwelling Envision Center
2305 Bedford Ave.
Pittsburgh, PA 15219

SHEET NUMBER:
H0.1



First Floor Plan - Demolition

SCALE: 1/8" = 1'-0"



First Floor New Work Plan - Ductwork

SCALE: 1/8" = 1'-0"

GENERAL NOTES: (THIS DRAWING)

A. UNLESS OTHERWISE NOTED EXISTING SUPPLY, RETURN AND EXHAUST SYSTEMS THRU OUT THE ENTIRE BUILDING TO REMAIN AND BE REUSED.

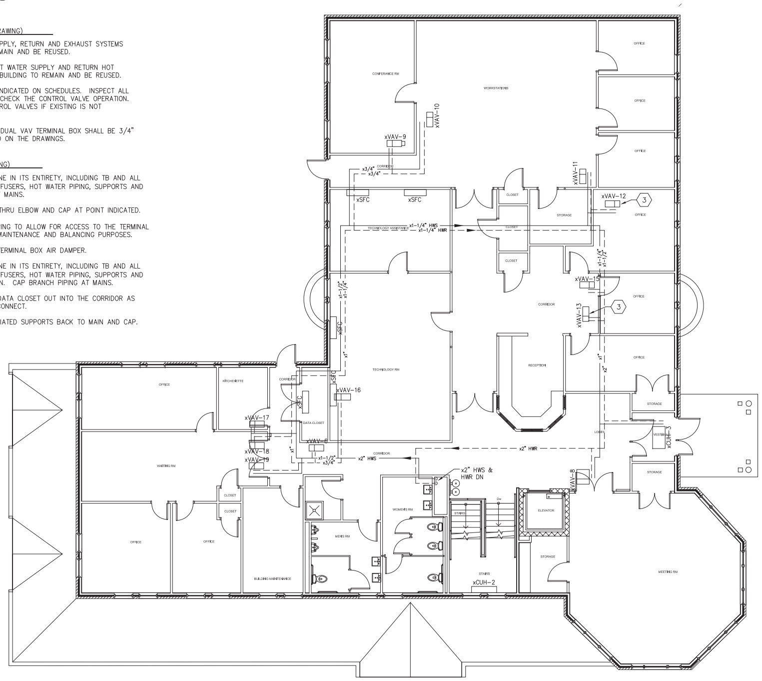
B. UNLESS OTHERWISE NOTED EXISTING HOT WATER SUPPLY AND RETURN HOT WATER SYSTEM THRU OUT THE ENTIRE BUILDING TO REMAIN AND BE REUSED.

C. REBALANCE ALL FLOW RATES TO GPM INDICATED ON SCHEDULES. INSPECT ALL EXISTING COILS FOR CLEANLINESS AND CHECK THE CONTROL VALVE OPERATION. CLEAN ALL COILS. PROVIDE NEW CONTROL VALVES IF EXISTING IS NOT OPERATING PROPERLY.

D. BRANCH PIPING THAT SERVES AN INDIVIDUAL VAV TERMINAL BOX SHALL BE 3/4" HWS & HWR, UNLESS OTHERWISE NOTED ON THE DRAWINGS.

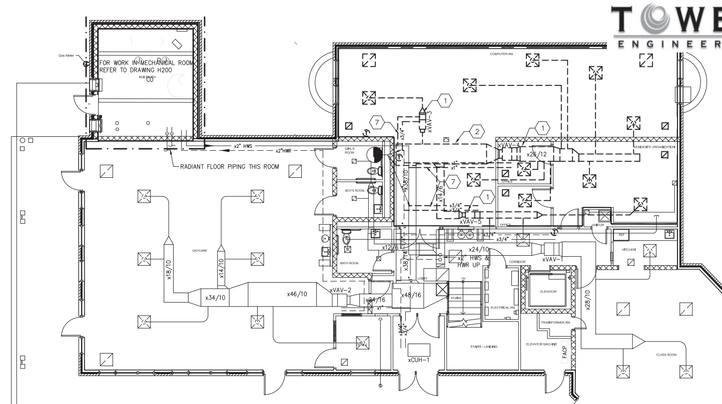
CODED NOTES: (THIS DRAWING)

1. REMOVE EXISTING TERMINAL BOX ZONE IN ITS ENTIRETY, INCLUDING TB AND ALL ASSOCIATED DUCTWORK, GRILLES/DIFFUSERS, HOT WATER PIPING, SUPPORTS AND CONTROLS. CAP BRANCH PIPING AT MAINS.
2. REMOVE EXISTING DUCTWORK BACK THRU ELBOW AND CAP AT POINT INDICATED.
3. MODIFY / RECONFIGURE BRANCH PIPING TO ALLOW FOR ACCESS TO THE TERMINAL BOX AND HOT WATER VALVES FOR MAINTENANCE AND BALANCING PURPOSES.
4. FIX POSITION SENSOR ON EXISTING TERMINAL BOX AIR DAMPER.
5. REMOVE EXISTING TERMINAL BOX ZONE IN ITS ENTIRETY, INCLUDING TB AND ALL ASSOCIATED DUCTWORK, GRILLES/DIFFUSERS, HOT WATER PIPING, SUPPORTS AND CONTROLS. CAP DUCTWORK AT MAIN. CAP BRANCH PIPING AT MAINS.
6. RELOCATE SUPPLY DIFFUSER FROM DATA CLOSET OUT INTO THE CORRIDOR AS SHOWN. EXTEND DUCTWORK TO RECONNECT.
7. REMOVE BRANCH PIPING AND ASSOCIATED SUPPORTS BACK TO MAIN AND CAP.



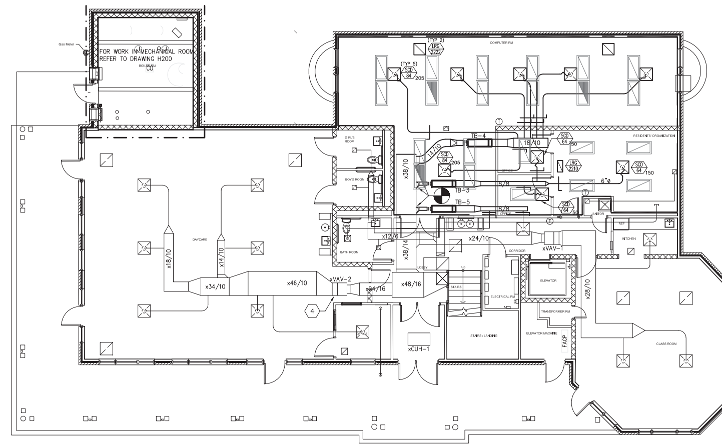
First Floor New Work Plan - Piping

SCALE: 1/8" = 1'-0"



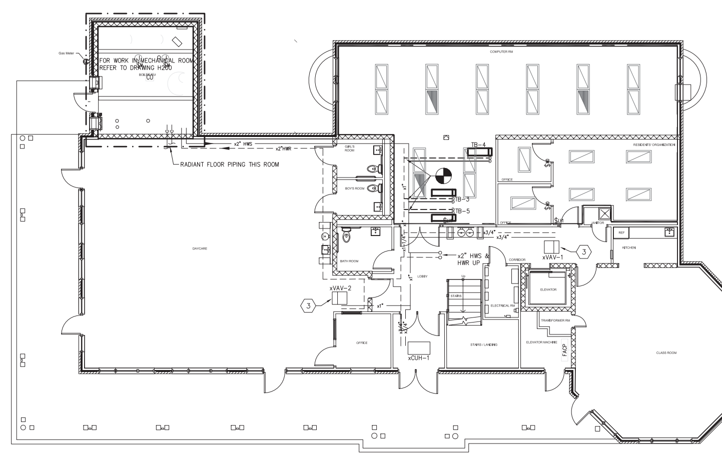
Ground Floor Plan - Demolition

SCALE: 1/8" = 1'-0"



Ground Floor New Work Plan - Ductwork

SCALE: 1/8" = 1'-0"



Ground Floor New Work Plan - Piping

SCALE: 1/8" = 1'-0"

TOWER ENGINEERING

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER JAMES N. KOSINSKI

08/04/2023

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DATE ISSUED	08/04/2023
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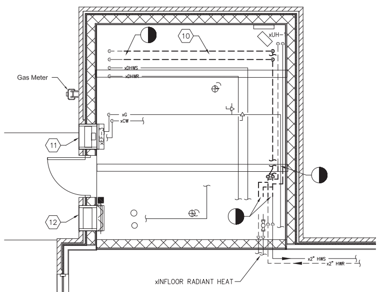
Ground & First Floor Plans

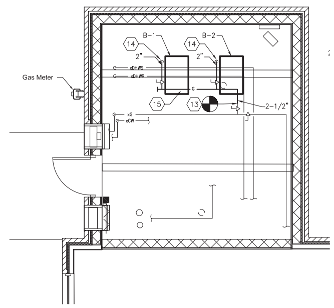
Bedford Dwelling Envision Center
2305 Bedford Ave.
Pittsburgh, PA 15219

SHEET NUMBER:

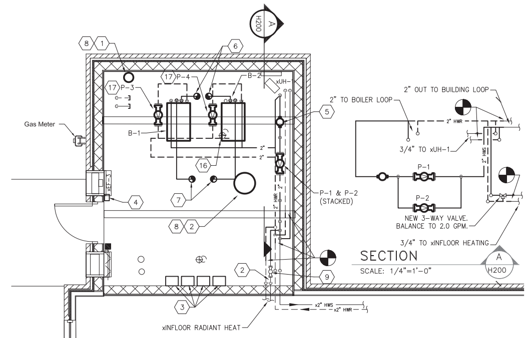
H1.1



Boiler Room Plan - Demolition
SCALE: 1/4" = 1'-0"



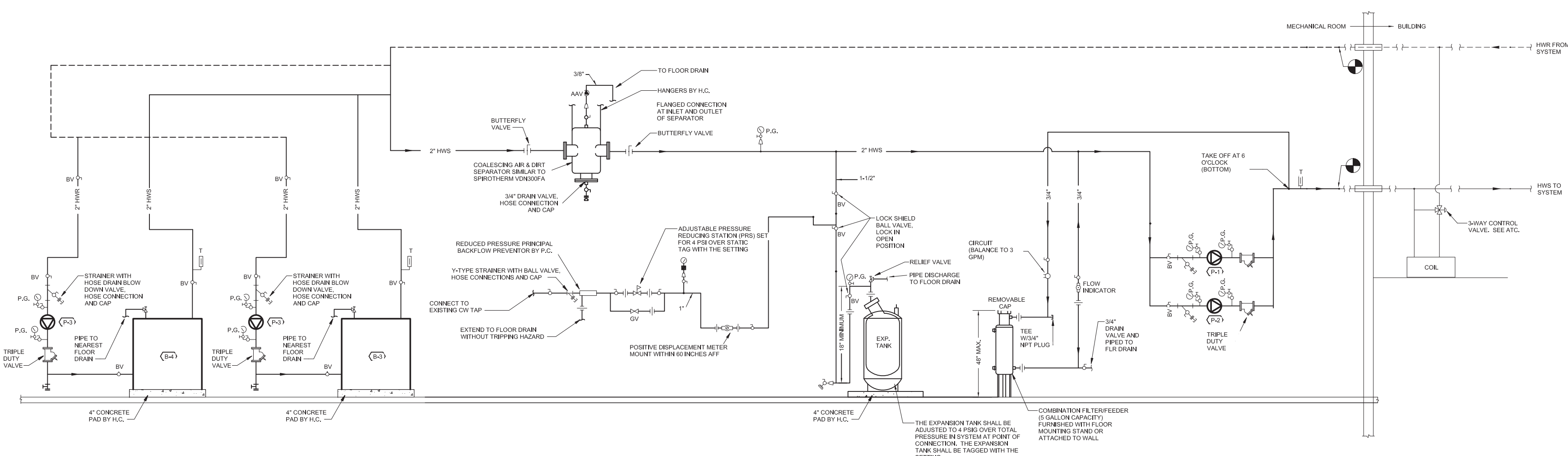
Boiler Room Plan
SCALE: 1/4" = 1'-0"



Boiler Room Plan
SCALE: 1/4" = 1'-0"

CODED NOTES: (THIS DRAWING)

1. COMBINATION FILTER / CHEMICAL FEEDER.
2. VERTICAL FLOOR MOUNT EXPANSION TANK. SIMILAR TO BELL & GOSSETT MODEL B-130.
3. PUMP MOTOR STARTER.
4. EMERGENCY BOILER BREAK GLASS STATION.
5. 2" AIR AND DIRT SEPARATOR. SIMILAR TO BELL & GOSSETT MODEL CRS-2.
6. 4"ø VENT UP THRU ROOF. TERMINATE WITH MANUFACTURERS APPROVED NON-RESTRICTIVE CAP.
7. 4"ø COMBUSTION AIR INLET UP THRU ROOF. TERMINATE WITH MANUFACTURERS APPROVED NON-RESTRICTIVE CAP.
8. 4" THICK CONCRETE HOUSEKEEPING PAD. PAD SHALL EXTEND BEYOND FOOTPRINT OF EQUIPMENT A MINIMUM OF 3" ON ALL SIDES.
9. EXISTING INFLOOR RADIANT HEATING PUMP TO REMAIN AND BE REUSED.
10. REMOVE EXISTING HOT WATER SUPPLY AND HOT WATER RETURN PIPING BETWEEN POINTS INDICATED. CAP PIPING WHERE IT ENTERS THE BOILER ROOM FROM THE OTHER BUILDING. RECONNECT AND REUSE PIPING THAT SERVES THIS BUILDING.
11. EXISTING EXHAUST FAN SYSTEM TO REMAIN AND BE REUSED.
12. EXISTING LOUVER AND DAMPER TO REMAIN AND BE REUSED.
13. CONNECT 2-1/2" GAS TO EXISTING GAS BRANCH CONNECTION. FIELD VERIFY EXACT LOCATION.
14. 2" GAS DOWN TO SERVE BOILER. REFER TO DETAIL FOR FINAL CONNECTION.
15. PROVIDE 2-1/2" GAS HEADER.
16. RELOCATE EXISTING FLOOR DRAIN AS REQUIRED TO ACCOMMODATE NEW BOILERS.
17. INSTALL NEW BOILER PUMPS ABOVE THE TOP OF THE BOILERS AS NECESSARY IN ORDER TO PROVIDE THE REQUIRED BOILER CLEARANCES.



HOT WATER SYSTEM PIPING SCHEMATIC (MECHANICAL ROOM)

NO SCALE

TOWER ENGINEERING

08/04/2023

DRAWINGS & SPECIFICATIONS, AS INSTRUMENTS OF SERVICE, ARE AND SHALL REMAIN THE PROPERTY OF THE ARCHITECT. THEY ARE NOT TO BE USED ON EXTENSIONS OF THE PROJECT, OR OTHER PROJECTS, EXCEPT BY AGREEMENT IN WRITING WITH APPROPRIATE COMPENSATION TO THE ARCHITECT. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING DIMENSIONS AT THE JOB SITE. THE ARCHITECT WILL NOT BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, OR PROCEDURES, OR FOR SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTIONS WITH THE PROJECT.

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DATE ISSUED	08/04/2023
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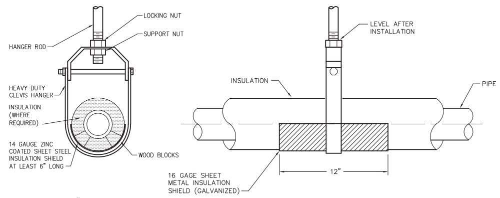
Enlarged Boiler Room & Schematic

Bedford Dwelling Envision Center
2305 Bedford Ave.
Pittsburgh, PA 15219

SHEET NUMBER:

H2.1

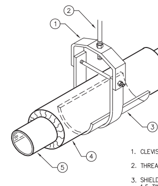


PIPE 8" AND SMALLER

HANGER ROD SCHEDULE			
PIPE SIZE	ROD SIZE	PIPE SIZE	ROD SIZE
UP TO 2"	3/8" DIA.	4" THRU 5"	5/8" DIA.
2 1/2" THRU 3"	1/2" DIA.	6" THRU 12"	7/8" DIA.

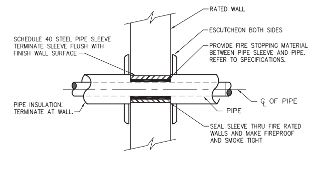
HANGER ROD SPACING												
PIPE SIZE	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"
MAX. ALLOWABLE SPACING	7 FT.	8 FT.	9 FT.	10 FT.	11 FT.	12 FT.	14 FT.	16 FT.	17 FT.	19 FT.	22 FT.	23 FT.
NOTE: FOR TRAPEZE HANGER, TAKE SPACING OF SMALLEST PIPE ON TRAPEZE												

TYPICAL PIPE HANGER DETAIL
NO SCALE

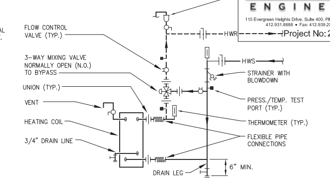


1. CLEVIS TYPE PIPE HANGER.
2. THREADED ROD CUT TO LENGTH.
3. SHIELD FOR INSULATION – LENGTH 1.5 TIMES INSULATION DIAMETER.
4. INSULATION.
5. CARRIER PIPE.

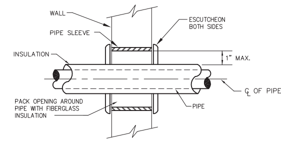
CLEVIS HANGER DETAIL
NO SCALE



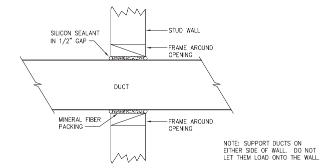
PIPE SLEEVE THRU RATED WALL DETAIL (FOR INSULATED PIPE)
NO SCALE



HOT WATER HEATING COIL DETAIL
NO SCALE

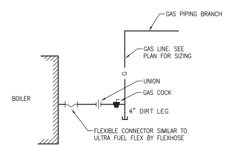


PIPE SLEEVE THRU WALL DETAIL (FOR INSULATED PIPE)
NO SCALE

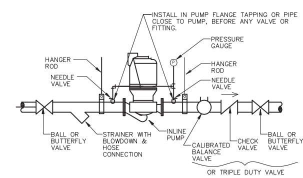


NOTE: SUPPORT DUCTS ON EITHER SIDE OF WALL. DO NOT LET THEM LOAD ONTO THE WALL.

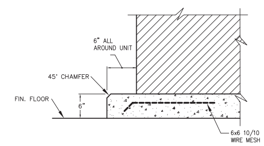
DUCT PENETRATION THROUGH NON-FIRE RATED STUD WALL DETAIL
NO SCALE



INTERIOR HVAC UNIT GAS CONNECTION DETAIL
NO SCALE



IN-LINE PUMP DETAIL
NO SCALE



CONCRETE PAD DETAIL
NO SCALE

LARGEST DIMENSION GOVERNS CONSTRUCTION

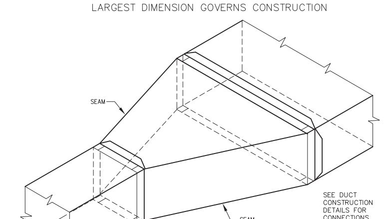


FIG. "A"
TAPER

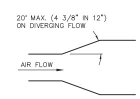


FIG. "B"

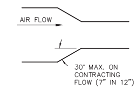


FIG. "C"

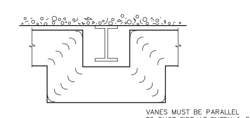


FIG. "D"

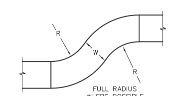
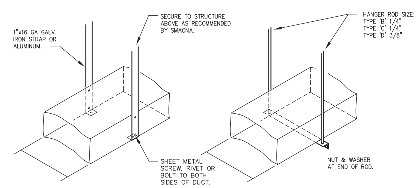


FIG. "E"

DUCTWORK CONSTRUCTION DETAILS
NO SCALE



FOR BRACING ANGLES–SEE NOTES.

TYPE 'A'
8 FT. MAX. HANGER SPACING ALSO PROVIDE 3 HANGERS AT EACH TAKEOFF OR BRANCH.

TYPE 'B', 'C' & 'D'
8 FT. MAX. HANGER SPACING

DUCT SCHEDULE		
DUCT DIMENSIONS INCHES		TYPE HANGER
UP THRU 12		A
13	18	A
19	30	A/B
31	42	B
43	54	B
55	60	B
61	84	C
85	96	C
OVER	96	D

NOTES:

1. FOR SEVERAL DUCTS ON ONE HANGER TYPE 'B'–'C' OR 'D' MAY BE USED. SIZE OF HANGER WILL BE SELECTED ON THE SUM OF DUCT WIDTHS EQUAL TO MAX. WIDTH OF DUCT SCHEDULES.
2. SCHEDULES FOR ANGLES FOR BRACING: TYPE 'B' 1 1/2" x1 1/2"x1/8" ANGLE, MAX. SPACING 8'–0" CENTERS; TYPE 'C' 1 1/2"x1 1/2"x3/16" ANGLE MAX. SPACING 8'–0" CENTERS; TYPE 'D' 2"x2"x1/4" MAX. SPACING 4'–0" CENTERS.

DUCT HANGER DETAIL
NO SCALE

TOWER ENGINEERING
115 Evergreen Heights Drive, Suite 400, Pittsburgh, Pennsylvania 15229-1346
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Project No: 2023064

08/04/2023

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HVAC DETAILS

Bedford Dwelling Envision Center
2305 Bedford Ave.
Pittsburgh, PA 15219

SHEET NUMBER:
H3.1

WATER FLOW TEST SUMMARY SHEET

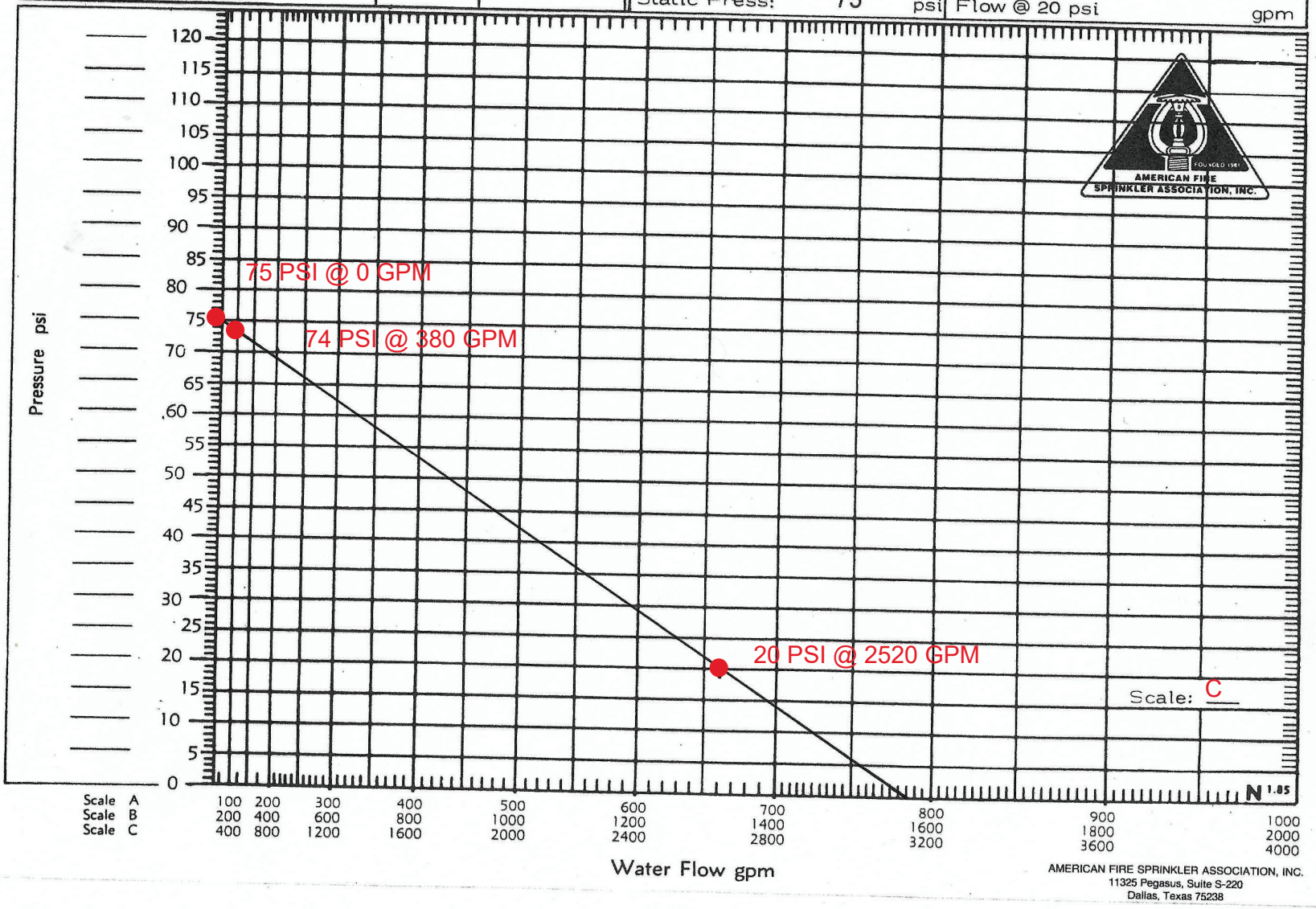
Hydrant No.	Outlet I.D. inches	Pitot Press. psi	Flow gpm	Residual psi
1	2-1/2		380	74
2				
3				
Total Flow				

Date: 8.9.23 Time: 10:00 AM Cont. No.

Cont. Name: Splash Park

Address: 1425 Chicago Street Pittsburgh, PA 15214

Static Press: 75 psi Flow @ 20 psi gpm



AMERICAN FIRE SPRINKLER ASSOCIATION, INC.
11325 Pegasus, Suite S-220
Dallas, Texas 75238

FLOW TEST INFORMATION SHEET

AMERICAN FIRE SPRINKLER ASSOCIATION, INC.

1. Reason for Test: Bid Information ☐ Design Base ☒
   Other _____
2. Location of Property 1425 Chicago Street Pittsburgh, PA 15214
   (Address) (City) (State) (County)
3. Date & Time of Test: Date: 8.9.23 Time: 10:00 AM (am) (pm)
4. Test Conducted by: Jim Blake (Name) Manager (Title) CertaSite (Affiliation)
5. Test Witnessed by: Erich Schulze (Name) Sales Engineer (Title) CertaSite (Affiliation)
6. Source of Water Supply: Gravity ☐ Pump ☐ Other: _____
7. Name of Water District PWSA Fire District City of Pittsburgh
8. Is water supply provided with PRV STA's Yes ☐ No ☒
   (If so what is PRV outlet setting? _____PSIG
9. **Area Map:** (Draw Sketch showing property location; bounding streets and names, north arrow, hydrant locations and identification numbers, distances from hydrants to property elevations of hydrants and property floors or grade, all water mains and sizes and interconnection valves, etc.)

10. Flow Test Data

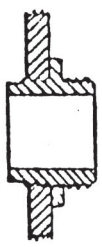
FLOW AT HYDR. NO.	STATIC AT HYDR NO.	STATIC PSIG	RESIDUAL PSIG	FLOW GPM	OUTLET COEFFICIENT	ADJUSTED GPM
Chicago St	Police Sta	75	74	380	2-1/2	

11. See reverse side for graph

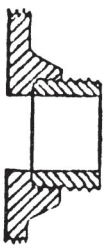
12. Signed Jim Blake

Witness Erich Schulze

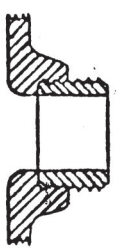
Form No. 102
American Fire Sprinkler Association, Inc.
11325 Pegasus, Suite S-220
Dallas, Texas 75238
(214) 349-5965



Outlet Square and projecting into Barrel Coef. 0.70



Outlet Square and Sharp Coef. 0.80



Outlet Smooth and Rounded Coef. 0.90


DAIKIN