Marion County Commissioners

222 West Center Street
Marion, Ohio 43302

OWNER'S PROJECT REQUIREMENTS

FOR

EXECUTIVE DRIVE
HEATING PLANT IMPROVEMENTS

March 2, 2026

Prepared By:

Palmer Conservation Consulting, LLC
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614-588-3450

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Legal Notice

Sealed bids will be received by the Board of Marion County Commissioners (the “Owner”), as provided in this notice for the Executive Drive Heating Plant Improvements Project (the “Project”). Contract documents, which include additional details of the Project, are on file and available at www.co.marion.oh.us. Click on “Public Notices”

Bids shall be enclosed in a sealed envelope addressed to Marion County Commissioners, ATTN: Teri Slaughterbeck, Marion County Commissioners Office, 222 West Center Street Marion, Ohio 43302 and plainly marked on the outside "Executive Drive Heating Plant Improvements Project." Bids will be received until 9:30 a.m., local time, April 2, 2026.

A pre-bid meeting will be held Thursday March 5, 2026, at 1:00 p.m. at 100 Executive Drive Marion, Ohio 43302. We will meet in the main lobby.

Questions regarding plans and specifications should be addressed in writing to Palmer Conservation Consulting, Attn: Eric Booher at ebooher@palmerc2.com.

All bids must include a Bid Guaranty, as described in the Instructions to Bidders. No bidder may withdraw its bid within 60 days after the opening; the County reserves the right to waive irregularities, reject any or all bids, and conduct necessary investigations to determine bidder responsibility.

Prevailing wage requirements apply to this project.

BY ORDER OF THE BOARD OF MARION COUNTY COMMISSIONERS

Kevin Davidson
Mark Davis
Andy Appelfeller

PRICE PROPOSAL FORM

1.01 PROPOSAL SUBMITTED BY:

_____

(Contractor)

Date bid submitted: _____

1.02 DELIVER TO:

Marion County Commissioners
ATTN: Teri Slaughterbeck
Marion County Commissioners Office
222 West Center Street Marion, Ohio 43302

1.03 Having carefully reviewed the Drawings, Specifications and other Contract Documents for the Project titled **Executive Drive Heating Plant Improvements** including having also received, read, and taken into account the following Addenda:

Addendum No.	Dated
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

and likewise having inspected the site and the conditions affecting and governing the Project, the undersigned hereby proposes to furnish all materials and to perform all labor, as specified and described in the said Specifications and/or as shown on the said Drawings for all Work necessary to complete the Project on a timely basis and in accordance with the Contract Documents regardless of whether expressly provided for in such Specifications and Drawings.

1.04 The base bid will be used for evaluation and budgetary purposes and should not be construed as a guaranteed cost. **Identify any additional cost in detail**. Marion County will pay only for goods or services provided.

1.05 BASE BID:

Base Scope of Work: Executive Drive Heating Plant Improvement Project. Proposer agrees to furnish equipment, materials & labor for all the services/work necessary, as described in the specifications/drawings. Base Bid shall include the allowance specified.

_____ ($_____)

(*Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.*

Alternate #1 – 5-year Maintenance Agreement: Executive Drive Heating Plant Improvement Project. Proposer agrees to furnish equipment, materials & labor for all the services/work necessary, as described in the specifications/drawings.

_____ ($_____)

(*Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.*

Proposed Date of Substantial completion: _____

The undersigned as Offeror declares that the only parties interested in this proposal as principals are named herein; and that this proposal is made without collusion with any other person, firm or corporation; and that no officer or agent of the owner is directly or indirectly interested in this proposal. Offeror hereby attests that any agreement for services required by the County resulting from this solicitation will be provided at the rate(s) as submitted on the firm's bid form. Any amendment increases or elimination of offerings, subsequent to this agreement must be agreed upon by both the Offeror and the County.

BIDDER IS (check one): __ sole proprietor __ partnership __ corporation
__ other legal entity

NAME & TITLE OF PERSON LEGALLY AUTHORIZED TO BIND BIDDER TO A CONTRACT:

_____

Name Title

SIGNATURE: _____

ADDRESS: _____

TELEPHONE: _____

EMAIL: _____

FEDERAL TAX I.D. # _____

DATE SIGNED: _____

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Executive Drive Heating Plant Improvements

Marion County Commissioners, 222 West Center St., Marion, Ohio 43302

Pre-Proposal Meeting Agenda

NOTE: This document is a part of the OPR proposal request documentation

Agenda:

I. Introductions

a. Owner –
Marion County Commissioners
   i. Kevin Davidson, Commissioner
   ii. Andy Appelfeller, Commissioner
   iii. Mark Davis, Commissioner
   iv. Teri Slaughterbeck, Administrative Clerk

b. Criterion Engineer/Owner's Advocate –
Palmer Conservation Consulting
   i. Eric M. Booher, Mechanical Engineer
   ii. Steve Levering, Project Manager
   iii. Joe Sokol, Regional Director – Professional Services

c. Master Systems Integrator/Commissioning Provider (MSI/Cx) –
Palmer Conservation Consulting
   i. Will Reid, Project Manager
   ii. Cody Circle, Project Engineer

II. Goals of Pre-Proposal Meeting – Prepare Proposers for Delivery of Qualified Proposals

a. General Items:
   i. Bid Info **April 2, 2026 9:30 am**. via process and location indicated
   ii. Prevailing Wages – Must Comply with Davis-Bacon stipulations
   iii. Bid Bond & Bid Form as prescribed
   iv. Contract duration – Marion County will adjust based on approvals and Notice of Intent, but Contractor expected to do pre-contract final design & coordination as soon as notified: TARGET to complete entirety of accepted project prior to heating season beginning October 2026.
   v. Letter of Intent right after Bids, Contract prep & approval phase after

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b. Describe Expected Work - refer to Bid Form and Owner's Program of Requirements (OPR) Docs distributed prior to this meeting and subsequently distributed.
    i. PROJECT SITE: 100 Executive Drive, Marion, Oh 43302
    ii. BASE:
        1. Full replacement of Natural Gas High-Efficiency Boiler Plant Equipment/Systems.
            a. A Complete Test & Balance Report will be provided as specified for the commissioned Hot Water Heating System after Installation, including Main Hot Water Plant and ALL Main AHU Coils & Heating Terminals/branch loops on the Hot Water System as noted.
            b. New Hot Water Boiler System Ventilation, Hydronic Accessories and Balancing provided to complete Installation:
                i. Main Pump Setups – Boiler Loop Primary and Variable Secondary Loop/Controls.
                ii. Condensing Boiler Ventilation System implementation.
            c. Condensate Draining Systems
            d. Design/Update/Heating Loop Chemical Treatment System.
            e. Upgrade/Replacement of existing Hot Water Heating Terminal Systems as designated (Piping & Controls-focused).
            f. Modification of Natural Gas Service to existing Heating Plant, including full coordination with local public utility (Columbia Gas of Ohio).
        2. Applied Upgrades for Controls of existing Heating Systems/Terminals – only as noted.
        3. Addition of Marion County's Standard Building Automation System (BAS) & Network Integration Services as performed by Owner's Master Systems Integrator/Commissioning Provider direct to Owner – Palmer Conservation Consulting, including:
            a. Coordination with Main OPEN Temperature Controls Systems
            b. Carbon Monoxide Monitoring Systems – as noted
        4. Specific Demolition/Modification of existing Ceiling Systems, Electrical Lighting, Fire Alarm & Power Distribution Systems – only as required by new Mechanical Scopes.
            a. Updated Low Voltage Control-System Power for new Control and Monitoring/MSI-Automation scopes.

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b. Updated Fire Alarm/Life Safety Systems as required by targeted HVAC Renovations.

5. **Includes ALLOWANCE by Bid Line Item (to be included w/ Proposals)**
   a. **Base ITEM 1 Executive Drive Heating Plant Improvements: $10,000.00.**

iii. ALTERNATE Scope Items per BASE Scope Line Item:
   1. ALT 1: HVAC Maintenance for Heating Plant Systems – 5-year term, annual renew-approval by Marion County.

c. Describe Delivery of the Work – Design-Build w/ Lump Sum GMP & Technical Proposal.
   i. Contractor to coordinate all design and installation with Materials and Services provided by Palmer Conservation Consulting serving as Owner's Master Systems Integrator/Commissioning Provider.

d. Describe Anticipated Timeframes – monies are encumbered, proceed from proposals to contract negotiations without delay after Marion County approvals, substantial completion by September 30, 2026 and being ready for start of HEAT Season in October 2026, and for full system operation as allowable by Project Schedules/Site Completions agreed-to during final engineering, planning & Construction.

e. Established Pre-Proposal Communication pathways
   i. RFI-style E-mail preferred to:
      1. Eric Booher, ebooher@palmerc2.com
      2. Steve Levering, slevering@palmerc2.com
   ii. Voice allowed: to Palmer only.
   iii. Palmer will publish all pertinent Non-PROPRIETARY info/answers to RFIs.
   iv. Last date for Proposer Questions is March 19, 2026.

III. Scope of Work

a. Project Development/History

b. Current Targets
   i. Complete installation of new Hot Water System/Ventilation Upgrades, Ceiling Systems (as applicable), Lighting Systems (as applicable) and noted HVAC Replacements/Refurbishments for areas designated.
   ii. Update Electrical Power Infrastructure – by Proposer as required for coordinated HVAC Scopes of Work and existing Electrical Service (existing Transformer/Main Distribution Panel to remain in service).

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1. Proposer to provide Power for new & upgraded Lighting/HVAC/Controls Scopes of Work as designed/required.

iii. Update designated Controls & Operational Systems
1. Proposer to coordinate Main Systems Integration, Master Programming and Owner-view Commissioning Services with Owner's Master Systems Integrator (Palmer Conservation Consulting) – provided direct to Owner.
a. Enterprise-level Equipment & Programming Services by PCC serving as Owner's Master Systems Integrator (MSI)/Commissioning Services Provider. (PCC to supply NOTED Equipment components, Integration and Programming Services only – see published Scope of Work, Systems Architecture & Integration Scope Diagrams).
b. Coordinated Installation of Wiring & Hardware by Bidder/Proposer: PCC as MSI to supply NOTED Equipment Components, labeled Controls, Integration and *coordination* of Install for low voltage wiring as designated; Proposer provides **all** mechanical-electrical installation and power – see published Scope of Work, Systems Architecture & Integration Scope Diagrams.

IV. Project Framework and Delivery

a. Single Design-Build Agreement includes Contractor-selected vendor-based Final designs. (This Project is NOT "Plan-&-Spec" construction) and will include:
i. Options for BASE & Value-add Proposals.
ii. Mechanical Prime with appropriate Sub Electrical, Structural, General, Plumbing, Fire Protection & Low Voltage Electrical, subject to Marion County/PCC reviews and subsequent approvals.
iii. Final Planning & Design (this includes scopes related to new Heating Plant/Ventilation Systems, modified Natural Gas Service and applicable plan reviews, permits and approvals & detailed coordination/support from applicable Vendors).
1. Standard Design E & O Insurances are required.
iv. Coordination & Project Management.
v. Complete Turn-Key Installation Services AND provision of specified Documentation.
vi. Funding mechanism may require adherence to Davis/Bacon Wage conditions/processes in the Work/Proposal.
vii. Owner *may* require Contractor to provide Bond for their Work/Proposal.

V. Owner's Project Requirements (OPR)

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a. Project Pre-Planning Documents, as applicable
    i. Overall Narratives, Study documents – as applicable
    ii. Asbestos inspection documents – as available.
b. Front-End Documents – furnished by Owner/Palmer
    i. Instructions & Notices
    ii. Bid/Proposal Forms
    iii. Anticipated Forms of Agreement/Supplemental information
c. Specifications
    i. Overall Criteria, Descriptions and Boundaries
    ii. Specific Sections/information as applicable to Owner's choices & preferences
d. Drawings – Schematic Not-to-Scale (nor 'Dimensioned' set) with Best-Scale 'reference' Plans as available
    i. Schematic and Specific Demolition
    ii. Schematic and Targeted Update Descriptions
e. Reference & Product Data Information, as applicable:
    i. Original Construction Drawings as sent via email.
    ii. Integration System Components – as coordinated by Palmer Conservation Consulting (direct to Owner).

VI. Anticipated Project Schedule items

a. Design-Build Proposals Due to Marion County by <u>April 2, 2026, 9:30 a.m. est.</u>
    i. PROPOSAL/Guaranteed Maximum Price – Lump Sum
        1. Noted Bonding requirements apply
        2. Email preferred with follow up as requested for Hard copies/Electronic.
    ii. Technical Proposal Items – Refer to OVERALL Specification Section
        1. Contractor/Sub-Contractor Declarations.
        2. Project Team & Management.
        3. Main Heating Plant System/Ventilation Renovations Preliminary Design information
    iii. Confirmation of Project Schedule targets

b. Pre-Proposal Walk-Thru
    i. Initial: March 5, 2026 at 1:00 PM.
    ii. Planned Subsequent Times
        1. As Scheduled with Marion County Personnel – minimum 48 hour notice

c. Bidders Scope-Reviews – Targeted <u>April 3-5, 2026.</u>
    i. Selection Criteria: Best Value (Schedule, Scope & Pricing).

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d. Recommendation/Selection of Best VALUE Bid/Proposal- Target: April 9, 2026.

e. Construction Targets:
   i. Begin, Upon Owner Approvals & Valid Notice-to-Proceed – by mid-April 2026
      1. Notice of Intent to award (mid-July) is expected to instigate 'paperwork/submittal' preparations while final Orders are being approved (late July) – to make best/flexible progress for all parties.
   ii. Complete Commissioning of Project by October 25, 2026.

VII. Important Discussion Items:

a. Simultaneous Projects – Owner may have standard projects going on during the Construction period/breaks. Bidders must be prepared to Coordinate Construction efforts/timing.

b. Work Access: buildings areas will be fully occupied during initial and end portions of planned Construction Period. Work during planned Holiday Breaks is expected. Construction activities will need to be worked-around (no "free" access can be planned for, but Owner is committed to coordination to help project).
   i. Overtime/Shutdown/Weekend Efforts may be required to complete Work in time.
      1. Expected End-of-Business Day is 4:30 p.m.
      2. Coordinated Work in Mechanical Rooms during Standard days is allowable.
      3. Coordinated HVAC/Electric Shutdowns Work in Mech Rms is REQUIRED.
   ii. Parking – some is available at jobsite in designated areas.
   iii. Entry/Staging: Coordination with Site Administration/Security Personnel is required.

c. Security: Background checks and Screening/Badging may be required.

d. Salvage Rights – Marion County reserves the right to retain any contractor-removed items. For all items not retained by Marion County, the Contractor is responsible for complete disposal.

e. Specific Construction Items:
   i. Cleanliness – daily requirement for all areas
   ii. As-built Documents – must provide accurate records for HVAC & Electrical Power

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iii. Project Meetings
1. Safety & Normal Progress Meetings arranged by Bidder with Project Team
2. Periodic Meetings with Owner's Key Staff may be required.

VIII. Questions

- All questions to be submitted in writing to Eric Booher & Steve Levering (contact information below)

IX. Subsequent Tour of designated facility areas – after Pre-Proposal Meeting.

This Meeting Agenda and subsequent NOTES are to be considered a part of the OPR Documents being used to prepare the Performance Spec Proposals. Please notify the writer if any items are not clear enough as stated or omitted as understood from the discussions.

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DESIGN-BUILD PROJECT STANDARDS

GENERAL

Purpose

The purpose of this document is to establish Marion County's owner-requested criteria to be used in the design, implementation and commissioning of each facility within the owner's jurisdiction, focused on the Balanced Total Life of the facility (construction/renovation, operation, maintenance).

Approach

Each design professional has the liberty to act with the owner's best interests in mind, based on the individual situations/boundaries presented before design begins and based on qualified professional experience. The criteria set forth is intended to be a guideline to limit the risks of dissatisfaction over the Balanced Total Life of each facility and to make the tasks associated with long-term owning/managing the facilities as effective as it can be, including the limitation of equipment/service providers to those listed.

Adherence

All standards are to be strictly adhered to. Deviations for specific cases will be addressed during pre-design/pre-commissioning project functions.

Documentation

The owner will facilitate the storage of all project design/specification documentation and all project-specific management materials for each project. Each design professional will coordinate the provision for the specification/collection of these documented materials as appropriate for the project (with DB/CMR/PM). Necessary documentation includes, but is not limited to:

- Construction Plans and Specifications
- Product Data and Submittals
- LEED Data and Documentation (only as declared Applicable)
- Coordination Drawings (prepared by Mechanical trades in all "congested" areas)
- Operation and Maintenance Manuals, includes Labeling keys (see labeling requirements below)
- System Startup and Commissioning Documents – Contractors to coordinate with Palmer Conservation Consulting functioning as Marion County Systems Integrator & Commissioning Provider.
- Training Schedules and documentation including videotaping – Contractors to coordinate with Palmer Conservation Consulting functioning as Marion County Systems Integrator & Commissioning Provider
- Warranty Designations (see warranty requirements below)
- As-Built Plans (furnished by all trades at job completion)

- Closeout Procedures (Demonstrations/Training Sessions/Recorded Documents)

Design Coordination

The Design Professionals shall attempt to adequately & actively coordinate design elements between construction trades/activities during design, including the evaluation commentary done by the owner's Commissioning Authority (PCC). This shall include, but not be limited to:

- HVAC to General (fire walls, wall openings, equipment weights & servicing)
- HVAC to Electrical (voltages, starters/motor control, disconnects, smoke detectors)
- HVAC to Plumbing (gas piping, drains & vent locations, Water makeup piping)
- Plumbing to General (piping chases & access, equipment weights, servicing)
- Plumbing to Electrical (voltages, starters/motor control, disconnects, smoke detectors)
- Plumbing to HVAC (ventilation requirements, drain & vent locations)

Standards

The owner has set forth noted design elements, product quality, system procedures as follows, in order to establish fair competition at a desired level of results, and to keep the facilities as reasonably managed as possible. Any design elements not specifically addressed in the body of this document are expected to be dealt with using commonly-accepted practices and with the owner's benefit in mind.

PLUMBING

System Descriptions

Best Standard Practice approach to Plumbing Design shall prevail, bound by enforced/in-place Building Codes and Marion County -accepted Design Guidelines. Design Professional shall give adequate and specific consideration to:

- Constructability
- Serviceability
    - Include an alternate for an extended warranty for one additional year after the warranty expires. This warranty shall include parts and labor.
    - Include an alternate for maintenance of all equipment and accessories for a period of one year from receipt of Final Certificate of Occupancy for all work. All parts and labor shall be included in this scope of work. (Contractor to submit for review a detailed schedule of the maintenance activities prior to maintenance commencement)
- Replacement
- Vibration Isolation
- Acoustic Performance
- Domestic Hot Water Balancing – as applicable

- Building Systems Integration (BAS/Open Protocol) – Contractors to coordinate with Palmer Conservation Consulting functioning as MARION COUNTY Systems Integrator & Commissioning Provider.

Fixtures – Commercial quality, designed for use in School atmosphere

- Toilet Room Fixture Vendors: American Standard, Kohler (Water closets to be carrier type)
- Faucet Vendors: Chicago, Peerless, Kohler
- Mixing Valves Vendors: Speakman, Leonard, Zurn
- Drain Components: Smith, Watts, Zurn
- Pump/Specialties Vendors: Aurora, Bell & Gossett, Grundfos, Taco
- Water Heater Vendors: AO Smith, Lochinvar, Bradford-White, PVI

HVAC

System Descriptions

Best Standard Practice approach to HVAC Design shall prevail, bound by enforced/in-place Building Codes, including the current adopted version of ASHRAE STD 90.1& IES (Energy Code) and published Design Guidelines. Design Professional shall give adequate and specific consideration to:

- Constructability
- Performance – Provide SEQUENCES of OPERATION for all building systems (Reference published OPR documents, Coordinate with Control Templates on Drawings and Systems Integration requirements)
    - DESIGN PARAMETERS: Indoor Temperature Set points – Occupied
        - Heating – 72 degrees F
        - Cooling – 74 degrees F
- Serviceability
    - Include provisions for Extended Warranty & Maintenance Services coverage for designated systems
        - Extensions to Product Warranties
            - Compressors
            - Heat Exchangers
        - Extensions to Installation/Performance Guarantees
            - HVAC Packaged Control Systems
                - Functional Performance
                - Training
        - Include an alternate for an extended warranty for one additional year after the warranty expires. This warranty shall include parts and labor.
        - Include an alternate for maintenance of all equipment and accessories for a period of one year from receipt of Final Certificate of Occupancy for all work. All parts and labor shall be included in this scope of work, including

belts and filters. (Contractor to submit for review a detailed schedule of the maintenance activities prior to maintenance commencement)

- Equipment Replacement
- Vibration Isolation
- Acoustic Performance
- Temperature Control Zones – Internal, Perimeter, Heat Recovery Exchange for VRF Systems, etc.)
- Thermal Environmental Quality
    - Temperature
    - Humidity
    - Air Quality/Filtration
- Air, Water & VRF System Balancing
    - Ensure Devices are specified and that Performance Evaluations are performed and Documented
        - Note deficiencies found in evaluations
        - Note recommendations for eliminating and finding deficiencies
        - Prepare report/summary for use by Commissioning Agent
        - Include in the documents that the owner has the right to request up to 25% of all the balanced systems be verified during the warranty period.
- Testing of Critical Systems
    - Ensure Devices are specified and that Performance Evaluations are performed and Documented
        - Generator Tests – Coordinate with Electrical Design & Team Contractors
        - Condensate Drain Alarms
        - Technology Room Temperature Alarms
        - Kitchen Equipment Temperature Alarms
        - Submersible Sump Pumps and Critical Drain Alarms – Coordinate with Plumbing Contractor
        - Fire Alarm Systems Alarms – Coordinate with Electrical Contractor
        - Fire Sprinkler Alarm Systems – Coordinate with Electrical/Fire Suppression Contractors
    - Packaged HVAC Controls/Building Systems Integration (BAS/Open Protocol) – Contractors to coordinate with Palmer Conservation Consulting functioning as MARION COUNTY Systems Integrator & Commissioning Provider.

BASIC MECHANICAL ITEMS

Valves

Usual and customary practices for duty

- Ball valves in HVAC systems – full port, three-piece construction
- Drain valves – with cap/chain and hose end connection

HVAC Drives/Motors

Standard configurations, EPAct minimum efficiencies or premium efficiencies as required by procedures/designs

- Service Factor on belt-driven sets – 1.35 minimum
- Provide multiple V-belts on fan motors > 5 HP
- Vendors – Century, Lincoln, General Electric, Baldor, US Motor

Extra Filter Materials

- One set for construction
- One set for replacement at IAQ Testing
- One set at Project Turnover

Controls Systems Integration Design

- Complete documents showing Integration Coordination on Construction Documents – Use of Control Schematic Templates encouraged
- Include diagnostic points for utility exhaust fan status and control for building pressurization monitoring and sequences.
- Include Sequences of Operation on Construction Documents
- Include Integration into Lighting Design/Control Systems – Coordinate with Electrical Engineering functions.
- Include Integration into Main Power metering and Sub-Metering Systems – Coordinate with Electrical Engineering functions.

Labeling Guidelines

All labels to be ½" x 3" or larger plastic laminate with engraved letters 3/16" high and attached to the ceiling grid. The labels should have the mark number or valve tag number. The MARION COUNTY Standard colors are as follows

• VAVs, VRFs, Heat Pumps, etc.	Black/White letters	(VAV A – 01)
• HVAC Cold Water Valves	Green/White letters	(CWS – 01)
• HVAC Hot Water/Steam Valves	Green/White letters	(HWS – 01)
• Fire/Smoke Dampers	Red/White letters	
• Domestic Cold Water Valves	White/Green letters	(CW – 01)
• Domestic Hot Water Valves	White/Green letters	(HW – 01)
• Gas Valves	Yellow/Black letters	(Gas – 01)
• Compressed Air	Blue/White letters	(Air – 01)
• Fire Suppression Valves	White/Red letters	(Zone – A)

INTEGRATED DESIGN & MAJOR RENOVATION PROJECTS

Integrate Design elements according to established project programs/scopes/budgets at Schematic Phase.

- **PLACE DESIGN EMPHASIS ON**
  - Meters and Monitoring devices
    - Utilities : water, natural gas, electric
    - Ventilation: Outside Air, Exhaust Air
  - Energy Use Optimization
    - Systems Choices by Professional Evaluation and referenced MARION COUNTY Standards
    - Controls & System Design to support
      - Comfort – Thermal, Acoustical, Air Quality, Humidity
      - Efficiency – Combination of Unitary & System
      - Safety
- Place Documentation Emphasis
  - Forms and Templates
  - Energy Modeling and Reporting – as appropriate.
  - HVAC Packaged Unitary Controls/Building Automation Systems diagnostics and reporting – Contractors to coordinate with Palmer Conservation Consulting functioning as MARION COUNTY Systems Integrator & Commissioning Provider.

NEW CONSTRUCTION & MAJOR DESIGN-BUILD RENOVATIONS – AS APPLICABLE TO D-B PROJECT SCOPES

Main Air Handling Systems

Indoor Central Station Air Handling equipment with no specialized Sound-Attenuating equipment or vision windows in access doors

- Variable Air Volume (VAV) with variable speed Enthalpy Energy Recovery Wheel for classroom areas (referenced to current Energy Codes/OSDM requirements)
- Separate Variable Air Volume (VAV) for Administration Area
- Variable Air Volume (VAV) or Cafeteria/Dining/Gymnasium areas
- Constant Volume (CAV) for Laboratory/Shop areas
- Design layouts to allow proper air mixing in AHU's to eliminate nuisance Freeze – Stat problems
  - Extended Mixing Chambers
  - Use of Air Blender Devices
  - Design layouts to allow proper spacing/airflow for Airflow Monitoring/Measuring Stations
  - Construction – Double-wall insulated

- Configuration – Modular for units with system design Total Static Pressures up to 5.9", Custom above 5.9" Total Static Pressure
- Access – Sections for adequate maintenance access
- Bearings – Upgraded quality
- Control Dampers – Extruded aluminum, insulated, Ultra-Low Leakage
- Fan Motor/Wheels – Energy efficient rated "premium", Direct-Drive Plenum (preferred)
- Drain Pans – Stainless Steel
- Filters – MERV 8 Pre-filters, MERV 13 After-filters
- Acoustics – Limit Supply Fan outlet velocities at 2100 feet per minute or less
- Modular AHU Vendors – Carrier, Daikin, Trane, York-JCI
- Custom AHU Vendors – Air Enterprises, Buffalo Air Handling, Environmental Air Systems

<u>Cooling Plant</u>

Water Chillers - Option

- 300 net tons & below – air-cooled, multiple chillers
  - Unit EERs to meet ASHRAE 90.1, Premium Efficiencies
  - Unit Acoustics near 95 dBA, Sound Power
- Serial Interface – ModBus™ or BacNet™ (Preferred),
- Fluid – Pre-mixed Glycol (35% ethylene) with integral inhibitors for piping systems
- Pumps – All pumps to be lead lag in sequence (i.e. Main Secondary Loop Circ Pump, etc.)
- System – Primary (constant flow)/Secondary (variable flow), Chilled water only
- Less than 300 ton Unit Configurations – Utilize multiple smaller Scroll chillers in lieu of single Screw chiller and air – cooled condensing unit for Administrative Area AHU
- Sound – Coordinate design of barriers with architect to diffuse chiller sound
- Chiller Vendors – Carrier, Daikin, Trane, York-JCI.
- Pump/Specialties Vendors – Aurora, Bell & Gossett, Grundfos, Taco

<u>Heating Plant</u>

Natural Gas Hot Water Boilers, multiple units, each sized for 65% net load required, forced-draft burners

- High-efficiency Condensing (smaller systems)
- Flexible Water-Tube (larger systems)
- Fluid – Water with engineered water treatment systems/Pre-mix inhibited Glycol (preferred)
- Pump – All pumps to be lead lag
- System – Primary (constant flow)/Secondary (variable flow), Hot Water only
- Boiler Vendors – Cleaver-Brooks, Patterson-Kelley, Bryan, Hurst, Lochinvar,
- Serial Interface – ModBus™, or BacNet™ (Preferred).

- Pump/Specialties Vendors – Aurora, Bell & Gossett, Grundfos, Taco

Heating Terminals

Selected use of Steam/Hot Water equipment dependent upon layout of Electric Heaters in Decoupled systems (WSHP, VRF)

- Cabinet Heaters – Vestibules/Entryways - fan supported, exposed/recessed
- Unit Heaters - Utility Spaces
- Finned-Tube Radiation – Heavy duty covers (Modine, Sterling, Trane)
- Radiant Panels – Large glass surface exposures (Airtex, Modine, Sterling)
- Vendors – Carrier, Daikin, Sterling, Trane, York-JCI
- Electric Heat Vendors – Brasch MFG, Berko-Markey, Greenheck, Markel, Q-Mark

Technology Support/Computer Server Rooms

Refrigeration (R-410A) Low Ambient Heat Pump Split/Multi-Split -Systems with Variable Speed Compressors

- Mini-Split Vendors – Bryant, Daikin AC, Mitsubishi Electric
- Serial Interface – ModBus™ or BacNet™ (Preferred),
- Option for Ducted/Larger Critical Space HVAC Split-Systems when Mini-Split approach is not adequate for spaces – Vertiv, APC-Stulz, United Coolair

Variable Flow Refrigerant-based Heat Pump Heat Recovery (VRF) Systems

Air cooled (standard outdoor mounted) or Condenser (Fluid cooler/boiler) water-cooled (standard indoor mounted) modular heat pump-condensers, indoor 2-pipe refrigerant-based Fan Coil Terminals (vertical, horizontal, ceiling, wall, floor), as integrated to D-B procedures/designs. Make Provisions that all above-ceiling filter locations are known to MARION COUNTY Maintenance personnel

- Refrigerant – R-410a
- Heat Recovery/Simultaneous Heat-Cool Operation – 2/3-Pipe Central Refrigeration Piping Network
- Zoning – Each classroom and major-use space to be chosen as location for Mode-Control Refrigerant switching terminals
- Instructional spaces – Larger Horizontal/Cassette-style VRF Fan Coil Terminals
- Option for Assembly Space Service – Conventional CV or VAV AHU w/coils served by Air-Cooled or Water-to-Water WSHP (chiller/boiler duty) – Allows economizer sequences
- Dedicated Outdoor Air Systems (DOAS) – Stacked indoor AHU with variable speed Energy Recovery Wheel w/coils served by W-T-W WSHPs in Mechanical Rooms and Condenser Water Reheat in AHU for dehumidification-reheat control.
- Option for Dedicated Outdoor Air System – Stacked/Side-by-Side indoor AHU with variable speed Energy Recovery Wheel w/integral WSHPs in Mechanical Rooms and Condenser Water Reheat/Heat Recovery in AHU for dehumidification-reheat control

- Controls – ModBus™ or BacNet™ (Preferred), Standard Open Protocol Interface
- VRF Vendors (air cooled) – Bryant, Daikin AC, Mitsubishi Electric
- VRF Vendors (water cooled) – Daikin AC, LG, Mitsubishi Electric
- DOAS Vendors (standard RTUs/ERV AHUs) – Carrier, Daikin, Trane, York-JCI, Valent Air.
- Customized Indoor Vendors (dehumidification/reheat) – Air Flow Equipment, Engineered Air, Innovent Air

Ductwork Systems

Insulated Galvanized Sheet Metal, SMACNA gauges

- Dishwasher Hoods/Locker Rooms – Aluminum
- Flexible Ductwork – Limited to 5 feet total length per device
- 0.5 inch liner in main Return Air Ducts
- Perforated Doublewall spiral ductwork for first 20 feet of supply duct from Air Handling Units

VAV Air Distribution Terminals

Series Fan-Powered VAV Terminals with Hot Water Reheat Coils. Single-duct VAV Terminals allowed in Student Dining/Auditorium/Gymnasium areas provided Night Setback heating terminals included. Provide with no specialized Sound-Attenuating equipment. Make provisions that all above-ceiling filter locations are known to MARION COUNTY Maintenance personnel. (See labeling requirements below)

- Vendors: Environmental Technologies, Price, Trane, Tuttle & Bailey

Air Distribution Devices

Aluminum construction, selected for best performance in spaces served.

- Vendors: Price, Titus, Tuttle & Bailey

Exhaust Fans

Selected for lower rpms and style appropriate for location in building

- Vendors: Loren Cook, Greenheck, Penn Ventilator

Variable Frequency Drives

IGBT-based VFDs with integral line reactors, electronic bypass and disconnect switch. Drives for Air Handling Equipment and Hydronic Equipment shall be the same manufacturer on each project.

- Serial Interface – BacNet™,
- Vendors – ABB, Danfoss, Square D

Airflow Measuring Stations

Integrated to building DDC system to achieve Sequences of Operation and help assure energy savings, accurate at very low velocities.

- Configurations: Duct-mounted w/access doors and unit-mounted
- Vendors – Dwyer Instruments, Ebtron, Tek-Air Systems.

Packaged Unitary/Building Temperature/Energy Management Controls

Direct Digital, Standard Open Protocol components, integrated to owner's host system/front-end operational, utility management and maintenance management software.

- Packaged Unitary/Device-Level platform: Niagara™Framework – BacNet™
- Vendors for DDC components: Not Applicable – Packaged Controls via HVAC Equipment Vendors.

RENOVATION PROJECTS – SPECIAL NOTES

Design Professional shall make evaluation with owner's input for best overall solution for each case. In general, the intent of the D-B Standards for new construction applies, but design and equipment modifications may be needed for best results.

Conventional Unit Ventilators

Vertical or Horizontal configuration, 4 – pipe

- Vendors: Carrier, Daikin, Trane, York-JCI

Vertical Unit Ventilators

Vertical Exposed or Concealed configuration, 4 – pipe

- Vendors: ChangeAir, Temspec, United Coolair

Hydronic Fan Coil Units

4 – pipe, non-economizer configurations. Make Provisions that all above-ceiling filter locations are known to MARION COUNTY Maintenance personnel. ((See labeling requirements below)

- Vendors: Environmental Technologies, Carrier, Daikin, Trane, York-JCI

DOAS (Ventilation) Units for VRF/WSHP/FCU Retrofits

Indoor DOAS AHUs with ERWs (chilled water, split DX or WSHP), packaged DOAS Rooftop units with ERWs, or limited-specific use of VRF System Ventilation units.

- AHU Vendors: Carrier, Daikin, Trane, York-JCI
- Condensing Unit (Split DX option) Vendors (Standard-stages Scroll Compressors): Carrier, Daikin, Trane, York-JCI
- Packaged Rooftop Option Vendors: Carrier, Daikin, Trane, York-JCI, Valent Air

Interior Lighting Retrofits

Indoor Upgrades using current technologies for lamps/emitters for applications as required, targeted for LED-based improvements.

- Option: Keep Existing Fixtures – intended for sites with fixtures less than 15 years old.

    - Bulb replacement with Ballast removal – limited to areas where existing fixtures are in acceptable visual/operational condition and where existing lighting performance supports the direct-replacement approach (light levels, colors, control-switching).
    - Retrofit Kit with Ballast removal – recommended for areas where existing fixtures have remaining life/value but performance enhancements are required/desired (light levels, colors, control-switching).
- Option: New Fixtures – required for areas where existing fixtures have no/limited remaining life/value but performance enhancements are required/desired (light levels, colors, control-switching).
- Life Safety/Emergency Lighting Systems: upgrade all areas for current space function/layouts and District/Local code requirements.
- Lighting Control Upgrades – employ current & reasonable techniques and technologies (i.e. dimming, digital relay switching, occupancy, daylight harvesting, etc.) to allow updated lighting systems to be integrated into MARION COUNTY Control Networks - Contractors to coordinate with Palmer Conservation Consulting functioning as MARION COUNTY Systems Integrator & Commissioning Provider.
- Fixture Manufacturers: Cree, Cooper, Lithonia and equivalent per MARION COUNTY approvals.
    - Fixture/Bulb/Driver component Warranties: target greater than 5 years/superior protection.

<u>Exterior Lighting Retrofits</u>

Outdoor Upgrades using current technologies for lamps/emitters for applications as required, targeted for LED-based improvements. Intent of Exterior Upgrades to address “on-building” as well as remote-from-building”

- Option: Keep Existing Poles/Supports – intended for sites with fixture supports less than 15 years old.
    - Fixture replacement with Ballast removal – limited to areas where existing poles/supports are in acceptable visual/operational condition and where existing lighting performance supports the direct-replacement approach (light levels, colors, control-switching). For Building-mounted fixtures being upgraded, care must be taken to account for substrate changes and acceptance of decorative effects.
    - Recommended to prepare photometric study of exterior lamp coverage prior to final design choices.
- Option: New Fixtures with Poles/Supports – required for areas where existing fixtures have no/limited remaining life/value but performance enhancements are required/desired (light levels, colors, control-switching).
- Life Safety/Emergency Lighting Systems: upgrade all areas for current space function/layouts and District/Local code requirements.

- Lighting Control Upgrades – employ current & reasonable techniques and technologies (i.e. dimming, digital relay switching, local/master photocells, etc.) to allow updated lighting systems to be integrated into MARION COUNTY Control Networks - Contractors to coordinate with Palmer Conservation Consulting functioning as MARION COUNTY Systems Integrator & Commissioning Provider.
- Fixture Manufacturers: Cree, Cooper, Lithonia and equivalent per MARION COUNTY approvals.
    - Fixture/Bulb/Driver component Warranties: target greater than 5 years/superior protection.

COMMISSIONING - Contractors to coordinate with Palmer Conservation Consulting/AGM Energy Services functioning as MARION COUNTY Systems Integrator & Commissioning Provider.

- Process
    - Pre-Design Conference
    - Schematic Design Review
    - Design Development Review
    - Construction Document Review
    - Pre-Construction Conference
    - Equipment Submittal Review (Concurrent with D-B A/E Review)
        - Chillers
        - Boilers
        - Heat Pumps
        - Air Handling Equipment
        - Variable Refrigerant Flow Systems
        - Variable Speed Drives
        - Generators
        - Lighting Control Systems
        - Packaged Unitary Controls/Building Automation System Interfaces
        - Kitchen Equipment
    - Start Up Phase
    - Systems Integration Phase
    - Post-Construction Conference

IN-SERVICE/PROJECT TURNOVER

- Process
    - Pre-Commencement Conference – establish overall target dates for project
    - Contractor Checkout and Testing – allow MARION COUNTY Facilities to observe the following
        - Main Hydronic Fill

        - Packaged Unitary Controls and Automation/Integration checkout
    - Start Up Phase – allow MARION COUNTY Facilities to observe
    - Systems Integration Phase
    - Training Sessions & Documentation Turnover
        - Contractor Responsibilities
            - Coordinate functions, schedules & documentation with CMR/OA
            - Conduct In-Service/Turnover Meeting(s)
            - Provide As-Built Drawings
            - Provide Operation & Maintenance Documents
                - 1 Hard Copy (Binder)
                - 3 Electronic Copies
                - Videotaped Training Sessions
                - System Integration Components
            - Provide Specific List of Procedures for project
                - Control Sequences of Operation
                - Maintenance Items and Intervals
                - Filter Matrix
                - Fan Belt Matrix
                - Items for major equipment
                - Critical Alarms
            - Provide Specific Tools and Spare Materials as specified
                - Packaged Controls/BAS Programming Tools
                - Spare Filters and Belts
                - Acoustic Ceiling tiles as applicable
        - Major Vendor Responsibilities: Demonstration for each system
            - Chillers
            - Boilers
            - VRF Systems
            - Packaged DOAS/RTU/H & V Units
            - Fluid Coolers/Condenser Water Towers
            - Emergency Generators
            - Lighting Control Systems
            - Packaged Unitary Controls/Building Controls and Integration
        - Engineer-of-Record/Owner Representative Responsibilities: Overall Description of Design Intent
- Warranty Period and Guarantee Limits
    - Warranty Period Goals (with Qualified Factory-Authorized Start up)
        - Chiller Compressors – Five Years Parts/Two Years Labor
        - Heating Heat Exchangers – Ten years Parts & Labor
        - Water Source Heat Pump Compressors – Five Years Parts/Two Years Labor
        - VRF Heat Pump Compressors – Six Years Parts & Labor

        - VFDs – Two Years Parts & Labor
        - LED Lighting Fixtures/Systems
    - Guarantee Period Goals (Coverage of Costs by Contractor) – Does not include owner responsible maintenance. Refer to project specific documents for Extended term requirements.
        - Basic Functional HVAC System (pipes, ducts, pumps, equipment & operational controls) – One Year Basic
            - Controls/System Walkthru and Issue List examination at Eleven Months post In-Service/Turnover date
- Owner Responsibilities (Maintenance & Documentation)
    - Attend All In-Service/Turnover functions
    - Participate in Procedures established by the OA/Cx/A-E Criteria for reporting & logging post-construction issues
    - Perform and Document (Self or Contracted) all noted & agreed to maintenance functions according to coordinated documents

SECTION 102326 – OVERALL SPECIFICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS & GENERAL SCOPE OF WORK

A. Instructions to Proposers, Overall Scopes of Work descriptions, published Supplemental Drawings/Documents and general provisions of the Performance Specification Contract, including General and Supplementary Conditions and Documents of County Requirements apply to this Section.

1. Refer to Original and subsequent RFQ/RFP Documents issued by County's Professional Services Consultants, that may be referred to as the Owner's Project Requirements (OPR). The OPR Documents in-whole are considered the minimum standard on which the Proposing Design-Build format Contractor bases his offering.
    a. Each Proposing Contractor (and necessary sub-contractors/vendors) will familiarize himself/team with all documents issued as part of the OPR, including Front-End, Exhibits and For-Reference documents in addition to typical drawings & specifications addressing the project Scopes of Work.
    b. Each Proposing Contractor will issue an RFI (Request for Information) for any apparent or possible conflict found in the OPR documents/field verification efforts in a timeframe before Proposals are due such that the County can responsibly offer a clarification on each item in question.
    c. If in the event that any conflict discovered/questioned in the OPR documents (i.e. between Specifications and Drawing references) is not properly/officially addressed prior to Proposals being due, the Proposing Contractor will base his offer on the most conservative/stringent/highest value or quantity of the interpretation of the matter, as determined by the County/Consultant, which will then continue into final design & coordination stages after a successful award of Contract is made.
2. Coordinate all Upgrade Scopes of Work with fire alarm system with County and/or Fire Alarm System Vendor directly as applicable (temporary removals/replacements, painting, service interruptions, etc.).
3. Coordinate all internet technology/public address Upgrade Scopes of Work required with County directly as applicable (new IT layouts & devices being planned, temporary removals/replacements, painting, service interruptions, etc.).
4. **Executive Drive Heating Plant Improvements:** Scope of Work: General – [Base Scope], refer to the OPR documents issued:
    a. Mechanical Upgrades:
        1) Hot Water Heating System Upgrade: Replace existing Natural Gas-fired Hot Water Heating System with new High-Efficiency Hot Water Boiler System; components include, but are not limited to:

a) Final Coordination & Installation of updated sensors & control for complete new system.
b) Installation of all new pumps
c) Only as specifically designated - Staged Refurbishment of Existing ductwork and electrical feeds – coordinate final demolition schedules with County. County retains First Right of Salvage on all removed items.
d) Provision of Carbon Monoxide Sensor System as applicable.

2) Complete Demolition of existing equipment/piping/ductwork/wiring not required to remain in service for complete install of designated Heating Plant Improvements and Refurbished Equipment. County retains First Right of Salvage for all removed items, including all removed sensors/heating equipment.
3) Testing, Adjusting & Balancing: Provide Measuring/Balancing Services for the following:
a) Replaced/Added Boilers and pumps as designated. etc.
b) HVAC Equipment/Systems as designated.
4) Provide multi-year-year Extended Maintenance Agreement [ALT Scope]:
a) Heating Plant Systems: Five Years, Annual Renewal.

b. Electrical Power & Lighting Upgrades:
1) HVAC Power: None beyond that required by noted Mechanical & BAS Upgrade Scopes, including noted ventilation modifications/ requirements/additions.
2) Lighting: Updated only as required by new HVAC Scopes - for general areas meeting design requirements for space(s) served (LED with Control) and current National Electrical Code (NEC) – refer to accompanying layouts.

c. General Trades Upgrades:
1) As-applicable Concrete Demolition/Replacements as they correspond to HVAC Upgrade Scopes; NOTE: Coordinate with all-trades in this Project/Sub-Contractors for Scopes of Work being performed as part of this project.
2) Cutting & Patching as Related to HVAC/Electrical Scopes of Work including, but not limited to:
a) Removal of Existing HVAC Units, Concrete with patching/sealing.
b) Modification of Roof Curbs/Roofs/Ceilings.
3) Preparation for new equipment foundations, Service Areas and Protective Devices (posts, fencing, etc.).

5. ALTERNATE ITEMS: Coordinate Proposals with published OPR Documents – Bid Form and Schematic Drawings:
a. ALT-1: Heating Plant Systems: Five Years, Annual Renewal
6. Targeted Schedule:

a. Proposals due April 2, 2026.
b. Target Selection/Final Notice to Proceed by April 12, 2026.
c. Submittals & Coordination Complete by May 29, 2026.
d. Construction Substantially-complete by October 2, 2026.
e. Final Commissioning (by County's Commissioning Provider) complete by End of October 2026.
f. Obtain any applicable Certificates of Occupancy by October 31, 2026.

1.2 SUMMARY

A. The purpose of this Overall Specification Section is to describe the project's main intent, to establish main boundaries of responsibilities (including the performance of ALL design & construction work in accordance with local/County requirements and Usual & Customary Standards for Public Office Support Facilities), and to reasonably narrow the not-yet-made choices of the proposers according to County-driven Criteria & Project intents:
1. Basic Form of Contract – Performance Specification Design-Build (D-B) Contractor with Guaranteed Maximum Lump-Sum Pricing (refer to supplemental documents for legal and clarifications). Mechanical/Plumbing/Electrical/General is primary under a Performance-Based (D-B) Agreement using County-furnished schematic design/criteria and certain County-evaluated equipment and services as noted.
   a. Bidders must offer their Proposals in a separated setup according to the stipulations in the Proposal Form; it is one project with two funding sources.
2. Schedule: Coordinate Proposed activities to allow project completions to coincide with target completions of this Scope of Work, based upon published schedules in RFQ/RFP documents:
   a. Heating Systems fully operational: October 30, 2026.
3. Demolition: Bidder is responsible for the demolition of materials/equipment affecting the Scopes of Work. The Bidder will assume ALL project-required Asbestos-related abatements will be/have been performed by the County, unless noted otherwise.
   a. Coordinate Salvage Rights of County with County's designated representative prior to removals and disposals. Items not claimed by County through this process shall be completely removed and properly disposed.
      1) Contractor shall provide a complete (by official Transmittal to & Signed-off by County) Inventory of Demolished materials/items designated as "Salvaged-Retained-by-County", including but not limited to: Descriptions, Make/Model Numbers, Serial Numbers, Quantity, etc.
4. General Trades Scope of Work – furnished by Bidder as appropriate for the work. This may include, but is not limited to:

a. Complete Final Design and Supportive Coordination for intended Scopes of Work noted in schematic documents and descriptions, both Base and Alternates.
    1) Both Engineering Design and Means & Methods for all General Trades items required by the new mechanical/electrical systems Scope are a part of the Performance-Based proposal. General Trades Sub-Contractor(s) will use Mechanical/Electrical Contractor's HVAC equipment/systems choices in the proposal and evaluate the building system re-works/new components that are required, coordinated with schematic plans/documents published. Specific items to note include, but are not limited to:
        a) Provision for necessary/beneficial Re-Work of existing Exterior Panels/Wall/Ceiling Systems in affected work areas; Interior/Exteriors Sub-Contractor to assess and evaluate best options for performing the targeted Base Mechanical Scopes with "Final-finished" Siding/Wall/Ceiling Systems in mind. The Wall/Ceiling System "Updates" are to be included in Base Scope Pricing and coordinated with applicable Electrical Trades (Added Power/Lighting Replacement) Scopes of Work.
        b) Provision for necessary/beneficial Re-Work and/or installation of new walls/partitions/floor-patching as required by new Mechanical/Electrical installations, (i.e. Walls, Soffits, Plenums, Panel Supports, Floors, Shafts, enclosures for exposed ductwork/piping/wiring, etc.), completed to match existing décor as reasonable as possible for the application.

b. Existing Interior Partition modifications required by intended Scope of Work (fencing, walls, ceilings, flooring, etc.): No New Work intended beyond that which affects the new mechanical equipment/systems and routing paths - Return to Existing (risk-protected) Conditions unless noted otherwise.

c. Structural Support modifications/additions (miscellaneous concrete pads/foundations and structural steel): modify existing infrastructure and add new support as required to properly install New Mechanical Equipment/Systems.
    1) Both Engineering Design and Means & Methods for all structural items required by the new mechanical systems Scope are a part of the Performance-Based proposals.

d. Site modifications required by intended Scope of Work (roads, lawns, planters, pavement, etc.): No New Work intended beyond Scopes noted, Return to Existing Conditions unless noted otherwise.

e. Existing Roofing/Curbing modifications required by intended Scope of Work (rails, curb/roofing, etc.): No New Work intended beyond that which affects the new mechanical equipment/systems and routing paths

(Ventilation Intakes, etc.) - Return to Existing Conditions unless noted otherwise.

f. Roofing modifications required by intended Scope of Work (flat roofs, sloped roofs, etc.): No New Work intended, beyond that which affects the new mechanical equipment/systems locations, modify existing infrastructure as required to support New Mechanical Equipment and/or piping modifications.
   1) Both Engineering Design and Means & Methods for all Roofing items required by the new mechanical systems Scope are a part of the Performance-Based proposal. Coordinate Roofing resources utilized with known provider/product warranties that may be in-place.

g. Coordination with County/County's Representative teams on Project Schedule and Work Progress Plans (locations, areas, shut-downs, tie-ins, etc.).

5. Plumbing Trades Scope of Work – furnished by Proposer as appropriate for the work. This may include, but is not limited to:
   a. Existing Interior/Exterior piping/fixture modifications required by intended Scope of Work. No New Work intended beyond that which affects the new mechanical equipment/systems and routing paths and Updated BAS Scopes (i.e. new Meters, Water line systems, Floor Drains, etc.) - Return to Existing Conditions unless noted otherwise.
   b. Coordination with County/County's Representative teams on Project Schedule and Work Progress Plans (locations, areas, shut-downs, tie-ins, etc.).
   c. Complete Installation (materials and labor) of both County-preferred Equipment and Systems and Plumbing Sub-Contractor-furnished items.
6. Mechanical Trades Scope of Work – furnished by Bidder as appropriate for the work. This may include, but is not limited to:
   a. Complete Final design and build and Overall Project Coordination for intended Scope of Work noted in published documents and descriptions, including, but not limited to: the preparation/submission of applicable permit/coordination drawings (All-pertinent-trades) for the purpose of obtaining a valid Occupancy condition for the County (design drawings, permit, inspections, approvals, etc.).
      1) Both Engineering Design and Means & Methods for all Mechanical items required by the new mechanical systems Scope are a part of the Performance-Based proposal. Mechanical Contractor's HVAC equipment/BAS/systems choice(s) and County's preferred Equipment in the proposal will be shared & coordinated with each trade both prior to and subsequent to the final (D-B) Proposal, referenced to schematic plans/documents published. Post-Proposal and after award of contract(s), the Proposer shall also share the design choices with the County's Master Systems

Integrator/Commissioning Provider for coordination and planning functions.

2) Piping Exposed-to-Walls or penetrating from walls/ceiling spaces thru occupied floor spaces should be located to minimize interruption to use of prime floor space and finished to protect the new piping and to match the current décor in the spaces/routes chosen for the pathways.

b. Coordination with County/County's Representative teams on Project Schedule and Work Progress Plans (locations, areas, shut-downs, tie-ins, etc.).

c. Complete Installation (materials and labor) of both County-preferred/provided Equipment and Systems and Mechanical Contractor-furnished items.

1) For any County Purchased items, this contractor assumes ALL coordinational requirements for complete design and installation 'as if he placed the order for the items himself'. The County is not prepared to coordinate any logistics on the Contractor's behalf, once the design-build orders are in place.

7. Electrical Trades Scope of Work – furnished/coordinated by Bidder as appropriate for the work. This may include, but is not limited to:

a. Complete Final Design and Overall Coordination for intended Scope of Work noted in schematic documents and descriptions.

1) Both Engineering Design and Means & Methods for all Electrical items required by the added Power/Lighting and new mechanical systems Scopes are a part of the Performance-Based proposal. Electrical Contractor will use County's Pre-Selected/preferred and/or /Mechanical Contractor's HVAC equipment/BAS/systems choices in the proposal and evaluate the electrical power system re-works to existing that are required, and properly coordinate all electrical work needed with schematic/final/permit plans/documents published/submitted.

a) Re-Work of existing Main Power Panels/Feeds to affected/new Lighting systems, Emergency power, Ventilation Fans and Mechanical Equipment. Field-coordinate Electrical power locations and unitary components to allow for proper installations/performance based on wiring distance/routing and locations of required terminations.

b) Include provisions for additional disconnect/safety switches/controls required for BAS/HVAC Units and electrical Accessories provided with Mechanical Equipment, (Operational Controls & Safeties, Metering and Flow Control devices, etc.).

c) Provision for New (Local-to-affected-work-areas) Electrical Power Sub-Panels required to serve added/redistributed lighting/power panel feeds and equipment power loads and

connections (i.e. new HVAC Loads, LED Lighting, Misc. Fans, and Upgraded BAS/Energy-use and/or Flow Metering components.).

d) Provision for both added and necessary/beneficial Re-Work of existing Lighting Systems in affected work areas; Electrical Contractor to assess and evaluate best options for performing the targeted Base Mechanical Scopes with "Updated" Lighting Systems in mind. The Lighting System "Updates" are included in Base Scope Pricing and coordinated with applicable General Trades (Wall/Ceiling repairs-patching) and HVAC (new HVAC/Ventilation Systems) Scopes of Work.

2) Both Engineering Design and Means & Methods for all newly-affected Electrical Low-Voltage Systems including affected Fire Alarm System items required by the new mechanical systems Scope are a part of the Performance-Based proposal. Electrical Sub-Contractor will use County's/Mechanical Sub-Contractor's HVAC equipment/systems choices in the proposal and evaluate the existing system re-works & integrations that are required (with appropriate Vendor(s)), as coordinated with schematic plans/documents published. No New Work intended beyond that which affects the required re-integration of new mechanical equipment/systems and routing paths into the existing FA System or local compliance requirements/updates/methods - Return to Existing/Current-required Conditions unless noted otherwise.

b. Coordination with Project Team on Project Schedule and Work Progress Plans (renovation locations, areas, shut-downs, tie-ins, etc.).

c. Complete Installation (materials and labor) of both County-preferred/provided Equipment and Systems and Mechanical Contractor-furnished items. New Work only as required to update/modify existing electrical power infrastructure to accommodate New Mechanical Renovations and designated upgrades.

1) Conduit/wiring Exposed-to-Walls or penetrating from walls/ceiling spaces thru occupied floor spaces should be located to minimize interruption to use of prime floor space and finished to match the current décor in the spaces/routes chosen for the pathways.

8. Temperature Control Systems – Main system is furnished by Design-Build Contractor using County's Master Systems Integrator for design/coordination and physically installed by the D-B/Proposer, unless specifically noted otherwise on OPR drawings. Items furnished by Bidder's Mechanical Vendor(s) and installed by Bidder's Sub-Contractor(s) to include, but not be limited to:

a. Packaged Unitary Controls (Contractor-Purchased HVAC components and HVAC Systems wiring) as part of a selected Vendor system.

b. Temperature-Pressure Sensors/Relays, control valves and necessary operational components for each Applied/Vendor-driven System in the Scope of Work.

Items furnished by Bidder/Proposer's Electrical Sub-Contractor and installed by Electrical Sub-Contractor (as coordinated with County's Master Systems Integrator) to include, but not be limited to:

9. Fire Alarm Systems – No New Work expected beyond the Contractor's HVAC-focused Scope noted, applicable items furnished and installed by Contractor (alarm devices, VFD/Carbon Monoxide or Smoke Detection devices, controls, etc.), unless noted otherwise or required by local authorities for Systems Upgrades to current installations. - Return to Existing Conditions unless noted otherwise.
10. Sprinkler Systems – Applicable items furnished and installed by Bidder under Base Scopes as required (water sprinklers, piping, controls, etc.). New Work intended includes only that which affects the new mechanical equipment/systems and routing paths – Provide for current Occupancy requirements unless noted otherwise.

1.3 RELATED SPECIFICATION SECTIONS

A. The equipment and systems designated as Contractor-purchased or County- preferred may have specification sections supplemental to this section. The Intent of any supplemental specification sections offered is to enhance the descriptions of these equipment and services items so that each Performance-Based (D-B) Proposer has reasonable information to consider in preparing his Scope/Design/pricing. Actual Completed Designs and Installations proposed are to be fully compliant with applicable customary and County-furnished standards, industry best practices, written installation instructions offered by the manufacturers of the equipment to be installed, and applicable local, state and national code regulations. Related sections include, but are not limited to:

1. HVAC Sequences of Operation.
2. High Efficiency Boilers
3. Pumps

1.4 SUBMITTALS

A. Pre-Award Phase: At time of (D-B) Performance Specification Proposal and in addition to any Proposal/Bid/Clarification Forms required, provide the following documents to aid the evaluation of Proposals meeting the Criteria, as applicable to the Scopes of Work:
1. Schedule of Construction: timeline and expected area sequence of actions – to be continually updated for plans and progress and then shared with Construction Team.

2. Floor Plans for Project Areas.
3. Upgraded Equipment Supports – layouts, materials, support systems.
4. Lighting, Motor Controls, Ventilation Equipment and related items, & other required Preliminary Submittals, as applicable to design.
5. Main Electrical Power System Update w/ planned updates to existing One-Line Diagram and all proposed new Lighting Fixtures and circuiting.
6. Technical Clarification Statements, Options & Conditions.

B. Post-Award/Construction Phase: Prior to/after the completion of the Pre-Construction Meeting, provide the following documents to aid the evaluation of Proposals meeting the Criteria established:
   1. REVISED Schedule of Construction: timeline and expected area sequence of actions – to be continually updated for plans and progress and then shared with Construction Team.
      a. During Construction, approximately by 9/18/26, an updated Left-to-Do Schedule shall be published to County with critical Timeline schedule or all remaining items to complete.
   2. Final Product Data/System Submittals – refer to individual sections for Submittal requirements, but include as a minimum:
      a. Final HVAC Equipment & Accessories:
         1) HVAC Equipment, Ductwork & Piping Systems.
         Ventilation/ Fan Systems – as applicable.
      b. Final Electrical Systems - Equipment & Accessories:
         1) Power Components.
         Low Voltage Systems, including required Fire Alarm System modifications.
      c. Final General Trades Equipment
         1) Structural Supports.
         Final Wall/Roof Modification Design/Layout & Accessories, as coordinated with HVAC Upgrade Scopes.
         Accepted supplemental Scope Product/System Data-information – as applicable.
      d. Coordination Drawings/Plans as noted in HVAC Equipment specification sections.
      e. Final ALT Scopes of Work schedules/components/systems.
   3. HVAC Heating, Cooling & Ventilation Calculations.
   4. Inventory of Salvage-Rights Materials/Items – for County Review.
   5. Schedule of Extra Materials/Attic Stock Items being furnished – for County Review.
   6. Final Plan Approval/Permit and Coordination Drawing documents for applicable Scopes:
      a. Main Mechanical & Electrical Systems.
      b. Detailed Enlarged Mechanical/Electrical Room Plans.
      c. Detailed Mechanical Flow Diagrams/Electrical One-Line Diagrams.
      d. New/Updated Fire Alarm System.

7. Service Ticket/Work Order Reporting Documents: Provide industry-standard forms for each product/system being maintained to include in emergency, operation, and maintenance manuals.
    a. Include a SPECIFIC Summary of completed maintenance items for each unit/system, complete with pertinent part numbers and frequency of actions taken.

C. Product Data: For each product component proposed, including items that may be County-furnished: Include standard documentation for the purposes of County-review and recordkeeping. Included in this group, but not limited to the group, are the following items:

1. Warranty terms and associated project documentation.
2. Maintenance and Operation data, for inclusion in master job O & M manuals.
3. Applicable Vibration and Acoustic Performance project documentation.

D. Operation and Maintenance Data: For each product/system provided to include in emergency, operation, and maintenance manuals.
1. Include a SPECIFIC Summary of required maintenance items for each unit/system, complete with pertinent part numbers and frequency of actions recommended.

E. Closeout Documentation & Materials: Provide complete documents as required by the Scope of Work, transmitted to the County's Consultants as requested, including, but not limited to:
1. As-Built versions of all Drawings covering the Scope of Work, in hard red-line, pdf and CAD formats.
    a. Install Laminated legible Control As-Built Drawings in each applied Field Panel/Enclosure, ensuring the documents match the required field-labeling of each component utilized in that panel/portion of the Control System.
    b. Final Heating Plant System Piping and Wiring Systems.
    c. Fire Alarm Systems as updated.
2. Complete Startup Documentation for each System affected Equipment in Scope of Work, including coordination of any County purchased items.
3. Testing, Adjusting & Balancing Reports.
4. Final Pay Applications and Waivers.
5. Clarification that Punch Lists and Issues Logs are fully completed.
6. Three (3) sets of any specialized tools the installed Systems/Equipment manufacturers require/recommend for Installation, Maintenance and/or Calibration of any portion of the provided Equipment/Systems.
7. Operations & Maintenance Manuals/Data as specified.
8. Training Documents.
9. Warranty Documents.
10. Systems Manuals.

11. Extra Material/Attic Stock: Signed Receipt for delivery of all materials required.
12. Extended Maintenance Documents – as applicable.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain only first-quality components.

B. 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.

C. NFPA Compliance: Select and furnish components of installation meeting applicable sections of the current NFPA regulations.

D. Product Rating Certifications: Select and furnish components of installation meeting applicable sections of the current industry standard rating/listing/labeling regulations.

1.6 COORDINATION

A. Coordinate with all trades the placement, support and utility requirements for each major equipment item. This includes, but is not limited to:
   1. Substrate elements – Asphalt surfaces, Concrete Pads, structural steel, louver locations/lintel sizes, wall sleeves, mechanical/electrical room/closet structures.
   2. Existing Floors/Walls/Ceilings/Partitions – coordinate with County/County's Representative team any proposed disturbances of existing substrates and/or those containing hazardous materials.
   3. Wall/Ceiling/Roofing modifications – Contractor to fully-coordinate with each trade involved in the renovation construction (HVAC, Electrical power/lighting, etc.) and also with the County for existing-to-remain & modified low voltage systems (audio/visual, fire alarm, security, clocks, public address, etc.) affecting existing partitions.
   4. Piping – mechanical/fire protection/plumbing service and drain piping - coordinate with County/County's Representative team any proposed disturbances of existing partitions/accessways.
   5. Flues/Ductwork/Engineered Ventilation Systems – planned routing from unit connections; coordinated with designated equipment/layouts.
   6. Electrical – power wiring, including means of disconnect and planned location/sources of power for replaced/downsized/added mechanical equipment.
      a. Provide complete installation with NEC/Local Authority panel Clearances as required.
   7. Electrical – Updated power/control wiring, including means of disconnect and planned location/sources of power for replaced/added Lighting Fixtures and equipment.

8. Vendor-based Controls – location of components/accessories not factory-mounted or County-provided.

B. Provide Coordination and cooperation services to County's Consulting team for purposes of filing for public utility and/or tax credit incentives. Palmer Conservation Consulting has created pre-approval files for the project, according to the requirements published by the "programs". The Contractor's team shall provide timely responses and paperwork required to fully execute these functions.

1.7 PRE-COMMISSIONING CRITERIA

A. Coordinate access/layout and installation of each System component and suspension system with other construction elements that are set near existing walls, on roofs or penetrate walls/ceilings/floors or is supported by them, including light fixtures, HVAC equipment, fire-suppression systems, and partition assemblies.

B. Note operating condition of all existing systems prior to replacements & coordinate with County, including describing any known deficiencies in existing performance and making provisions for temporary services including, but not limited to Temporary Heating/Cooling for periods between scheduled demolitions and energizing of the new HVAC/Power Systems.

1.8 WARRANTY PROVISIONS

A. Basic Installation warranty: Provide Bidder/Manufacturer's standard forms in which Bidder/manufacturer agrees to repair or replace components of furnished equipment that fails in materials or workmanship. Submit a written warranty signed by Bidder & furnished equipment manufacturer(s) and installer(s) agreeing to furnish labor and parts for failures within a warranty period of Twelve (12) Months from the date of substantial completion/documented Start-up.

B. Extended Unit/Equipment/Installed Systems warranty: Provide Bidder/Manufacturer's standard forms in which Bidder/manufacturer agrees to repair or replace components of furnished equipment that fails in materials or workmanship. Submit a written warranty signed by Bidder & furnished equipment manufacturer(s) and installer(s) agreeing to furnish labor and parts for failures within a warranty period as described within the equipment sections from the date of substantial completion/documented Start-up.
   1. Descriptions of Systems/Component Extended Warranties required can be found in the specific equipment/systems specification sections.
   2. Coordinate terms of Extended Warranties that are part of any County-furnished items.

1.9 EXTRA MATERIALS/ATTIC STOCK

A. Furnish total sets of materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. General: Two Sets (2) of each manufacturer-recommended Standard SPARE SERVICE PARTS for each unit furnished in project, properly transmitted and labeled.

2. Furnish two of each of the following for each type of unit installed:
   a. Flame sensors
   b. Ignition control
   c. Ignitors
   d. Space temperature & pressure sensors.

3. Touch-up Paint: Quantity of complete containers to be used by County to maintain corrodible surfaces after construction is completed.
   a. Paint containers: One (1) for each system/equipment employed.

1.10 PREVENTATIVE MAINTENANCE SERVICES

A. Purpose of this section is to allow the Contractor/ Proposers an opportunity to offer the County a flexible option(s) for annual contracting of manufacturer/System-based full-coverage Maintenance Services for the installed and operating **HVAC Equipment & Systems** affected in this project:
   1. Each Boiler/pump and each specifically-designated, including Electrical Controls/Burners/Fans/Motors.

B. The County reserves the right to accept, reject or modify-and-accept the conditions returned in this Manufacturer-based Maintenance Services proposal.

C. Interviews and/or Scope of Services reviews may be subsequently held to clarify inclusions, exclusions and creative options prior to making any formal decisions on agreements.

D. Basic Terms & Conditions for Preventative Maintenance Services Scopes of Work:
   1. Commencement and Duration of Maintenance Agreement:
      a. Start – begins at dates stated/agreed-to by Marion County and consultant (Palmer Conservation Consulting).
      b. Documents: Scheduled activity Reporting & Project Completion Sign-Off Forms, including applicable WARRANTY documents, dates and Terms & Conditions.

c. Duration of Manufacturer's Recommended Service Maintenance Agreement: **Overall FIVE Years with One-Year Annual Term Agreement updates**

2. Sign-in & Access:
   a. Contractor will sign in at the beginning of each day.
3. Work Order/Tickets:
   a. Start & end labor times for each day/project are to be reported for each workorder.
4. Notifications:
   a. Maintenance Services Contractor will notify Marion County Superintendent monthly to review service over previous month and discuss the following month's planned maintenance.
   b. Maintenance Services Contractor will also notify Marion County consultant **(Palmer Conservation Consulting)** at same time to review equipment/maintenance services performed over previous month and discuss the following month's planned maintenance & potential Integration impacts to overall operations of the systems.
   c. A phone number must be provided for 24/7 service and the employ of same maintenance technicians is preferred on all PM services calls to the designated site(s), both regular maintenance and any applicable emergency services agreed-to.
5. Billing Procedures:
   a. After Services are Rendered Complete per schedules, Contractor will bill quarterly the agreed upon contracted sums.
   b. Any Approved Work completed beyond the contract is to be billed following the completion of the project.
   c. All repairs (including both labor & materials) that are not covered in this contract will be approved prior to commencement.
6. Service Personnel:
   a. Contractor will perform all work in a timely and workmanlike manner, using only qualified maintenance technicians with a minimum of 5 years of experience with equipment types in contract, and will adhere to all code standards:
      1) Journeyman-level training on all functions, less filter media changing.
      2) Local organization and/or manufacture-recommended certifications for refrigeration-based PM Services.
      3) Similar/same personnel shall be used per site/equipment to build reliability of the PM services & operations.
7. Preventative Maintenance Services Warranty:
   a. All work performed under this contract will carry a minimum thirty-day warranty on labor and the manufacturer's customary warranty on any materials.

E. Basic Specifications for administration of Preventative Maintenance Services:

1. All customary Preventative Maintenance work/repairs during normal working hours are included at no additional cost.
2. All customary Preventative Maintenance work/repairs outside normal working hours are included at no additional cost.
3. Any additional cost to perform Preventative Maintenance work or repairs by other companies (subs) is included within this proposal.
4. All Preventative Maintenance required repair parts, including valve actuator motors & heating/cooling valves, are to be addressed under the base PM Services.
5. All HVAC equipment affected, including Heating Plant Systems and Refurbished Heating Terminal Systems and VFD services to be proposed per manufacturer's recommendations, similar to those noted as guidelines herein.
6. One inspection per season of each system, or packaged unit listed (some units may run 24/7). Contractor to follow quarterly scope of services as detailed in subsequent sections.
7. Heating HVAC Units/VFD Packaged Control systems Preventative Maintenance to be performed on a quarterly basis.
8. All units listed with this service plan will have service within four hours of trouble call instigated by Marion County. Service provider to stock adequate parts to ensure seamless operation.
9. All fan belts and drive belts on all listed equipment will be replaced a minimum of once per year.
10. Change or wash air/Water screens/filters as recommended.
11. Provide electronic annual report of all Preventative Maintenance per unit/system.
12. It is the sole responsibility of the service provider to maintain the unit/s at their highest efficiency at all times.

F. The goal of this program is to eliminate HVAC mechanical equipment breakdowns and repairs before they occur through proper and manufacturer recommended preventative maintenance measures. However, if repairs on equipment become necessary, it will be expected that the service (parts and labor) be accomplished at no additional cost to the County. Repairs due to events outside of the contractor's control will be reviewed individually by Marion County as required for compensation beyond the scope of this project. Examples of events outside the contractor's control include natural weather phenomena, vandalism, power surges, etc. that cause damage to systems under this program. No such claims are expected.

1.11 ALLOWANCES

A. Proposers are to include an Allowance amount of $10,000.00, for use in addressing unforeseen conditions/repair-level work discovered during project execution. The County, via Palmer Conservation Consulting, has the sole direction that these funds may be used for the project, including justification documentation as required. The Allowances for each bid Item are therefore:
   1. BASE ITEM 1: Executive Drive Heating Plant Improvements = $10,000.00.

PART 2 - PRODUCTS & SCOPE CRITERIA

2.1 DESIGN CRITERIA

A. Provide Complete Final Design for noted project Scope of Work utilizing schematic-phase documentation included from County via the OPR Documents published.

1. Building Code: Current version adopted in the State of Ohio.
2. Energy Code: Current version of IECC and ASHRAE 90.1 as adopted/enforced.
3. Environmental (space/zone) conditions: Layouts/sizing based on current version of applicable ASHRAE/IEEE standards.
4. Marion County Project Standards: reference OPR Documents and apply as applicable to intent of Scope of Work.
    a. BASE: Heating Plant Upgrades using OPR and County's preferred/purchased equipment; Final Designs by Contractor.
    b. BASE: Replace/Update existing boilers and heat exchangers. Replacement intent: Contractor's proposal shall include assessment (as required for function) of each existing boiler/pumps such that all areas of the tunnels are properly pressurized and heated. Options include, but are not limited to:
        1) Fully Demolish as determined by Contractor's Final Design to be replaced.
    c. EQUIPMENT-based on Design Criteria: Refer to specific sections for design criteria including but not limited to:
        1) Boilers
        2) Pumpts
5. Intent: Each design professional utilized in Bidder's proposal has the liberty to act with the County's best interests in mind, based on the individual situations/boundaries presented before design begins and based on qualified professional experience. The criteria set forth in this specification is intended to be a guideline to limit the risks of dissatisfaction over the Balanced Total Life of this facility/project and to make the tasks associated with long-term owning/managing the facilities as effective as it can be, including the limitation of equipment/service providers to those noted as being County-preferred and/or listed within these specifications.
    a. The merits of this Proposal are not dependent on specific savings in operating energy.
    b. The merits/VALUE of this proposal with reference to matching of intended Scopes, Construction Schedules anticipated, energy savings and/or operational improvements are key factors in selection/consideration.

2.2 BASIC DESIGN AND INSTALLATION REQUIREMENTS

A. Provide required actions, documents and fees for applicable plan creation and approvals, and all subsequent construction-phase inspections (rough-in, finals, etc.). Coordinate requirements with all members of County/Bidder teams & County's representatives.

2.3 SITE WORK & OUTDOOR FENCING

A. Return any disturbed grounds areas (lawns, pavement, sidewalks, etc.) to pre-construction conditions.

2.4 STRUCTURAL STEEL CONCRETE AND METAL FABRICATIONS

A. Provide materials for equipment support according to applications required using industry standard means-and-methods and common best practices. This includes, but is not limited to:
   1. Pre-bid investigation of existing equipment, wiring/piping Support & Rigging Access.
   2. Professional evaluation of support/installation modifications required for new equipment chosen/selected for the replacements and related security/access structures or partitions.
   3. All proper Final Design & submittal Documentation required by the Scope of Work for a Complete, serviceable and safe installation.

2.5 INTERIOR FINISHES

A. Provide materials for returning interior surfaces to existing conditions according to applications required using industry standard means-and-methods and common best practices.

2.6 BASIC MATERIALS AND METHODS

A. General: Provide materials for completing general, mechanical and electrical installations according to applications required (including mechanical/electrical modification-driven architectural/general trades finishes) using industry standard means-and-methods and common best practices. This provision applies to, but is not limited to:

   1. Worker and Occupant Safety Signage.
   2. Hangers and Supports.
   3. Sealing at penetrations in partitions – appropriate for application.
      a. Fire Walls: per in-effect codes/requirements.
      b. Exterior: watertight, vermin-proof.
      c. Aesthetic: to match finishes affected.

4. Vibration Controls for moving equipment/Pipe Expansion
5. Equipment/Piping Tagging and Identifying – Black Stencil Markings.
6. Valves – for duty of system served.
7. Meters and Gauges.
    a. Provide Pressure Gauges with minimum 4” Diameter, suitable for remote viewing.
8. Worker Safety & Safety Signage (Construction phase).

2.7 DUCTWORK SYSTEMS

A. General: Provide materials for completing mechanical installations according to applications required (including applicable material choices and finishes) using industry standard means-and-methods and common best practices. This provision applies to, but is not limited to:
    1. Ductwork for Ventilation, Supply and Return Air Systems - SMACNA Gauge and Sealing by duty.
    2. Accessories for complete systems (Fire Walls/sealing, escutcheons, Balancing, Labeling, etc.).

2.8 PIPING

A. General: Provide materials for completing mechanical installations according to applications required using industry standard means-and-methods and common best practices. This provision applies to, but is not limited to:

    1. Gas Piping: Sch. 40 Black Steel or Copper for complete installations.
    2. Fittings shall be flanged, welded or pro-press style
    3. Condensate Drain Piping: Copper, PVC/CPVC for application, with Return Air plenum considerations.

2.9 MECHANICAL EQUIPMENT

A. Contractor and County-Evaluated/preferred-purchased Equipment and Systems include:

    1. Boilers.
        a. Includes Unitary/Applied Controls required for full working System.

B. Ancillary Equipment coordinated with Targeted Scopes of Work, chosen for duty intended/submitted for review and coordination:
    1. Controls Components – Provide all items required for operation of Contractor-designed/provided Systems, Unitary System Controls and Natural Gas Piping Systems (Temperature/Pressure Sensors, Sensor Wells, Relays, Hoses/Valves,

Regulators, etc.). Coordinate component selections and exact locations with Equipment Vendors during submittal phase.

a. Gas Pressure regulators:
    1) Flanged or threaded equal to Sensus 143 or 243.

2.10 ELECTRICAL

A. General: Provide materials for completing electrical installations according to applications required using industry standard means-and-methods and common best practices, assuring that each device placement is completely and safely accessible for future maintenance. This provision applies to, but is not limited to:

1. Panelboards.
2. Disconnect Switches.
3. Transformers.
4. Raceways.
5. Load Centers.
6. Conductors.
7. Grounding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Arrange installations to provide access space around equipment for service, protection and maintenance. Install so that all access doors/panels are fully operable.
    1. Make provisions to properly remove the existing HVAC units required, Cabinetry/piping and Electrical Power and make safe for installation/set of the new equipment. Determine exact locations for intakes/ductwork/flues, piping and electrical connections before demolition scope. This includes any hazardous material removals/fluid pump downs required for properly removing the existing boilers, pumps, piping and heat exchangers.

B. Arrange installations to provide access space around equipment for service, protection and maintenance. Install so that all access doors/panels are fully operable.

C. Controls: Refer to accompanying diagrams and specifications for Contractor's field installation of required Equipment, including temperature & operational controls/meters items. Coordinate locations & installation requirements with planned equipment/systems layouts with Marion County Superintendent prior to final installations. This scope of work includes, but is not limited to:
    1. Boilers.
    2. Pumps.
    3. Gas pressure regulators.

4. Temperature sensors & control panels.
5. Space differential pressure sensors.
6. Updated Motor Controls/VFDs.
7. Safeties, Alarms & Operational Interlocks.

3.2 CONNECTIONS

A. Gas connections are per the Schematic Drawings/submittals which indicate general arrangement of piping, fittings, and specialties, based upon manufacturer-approved methods.
   1. Provide valves and unions or flanged connections – per manufacturer's recommendations & engineering.
   2. Install Temperature/Pressure sensing devices in within spaces served to provide noted level of temperature control / space pressurization.
   3. Provide & Install system-appropriate safety relief valves and piping per customary/code standards and manufacturer's recommendations.

B. Schematic Drawings indicate intents of general arrangement of applicable Ventilation Systems/ducts and duct/flue accessories. Make final duct connections with flexible connections and/or manufactured fittings as applicable.

C. Electrical: Comply with applicable requirements of local codes and best practices.
   1. Properly 'label' each new/existing raceway Junction Box for source (panel) and service.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Coordinate/Engage factory-authorized service representative (including County's Purchase Vendors as applicable) to inspect field-assembled components and equipment installation, including Ventilation materials, piping, control and electrical connections.

   1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 STARTUP SERVICE

A. Coordinate/Engage a factory-authorized service representative (including County's Preferred or Direct-Purchase Vendors as applicable) to perform startup service per manufacturer's instructions and recommendations. Provide applicable Documentation to County.

3.5 FINAL COMMISSIONING

A. After completion of installations, fully Test, Adjust, and Balance each designated system to ensure proper design and operation, coordinating efforts with HVAC Vendor-Unitary Equipment Vendor and. Document results.
   1. The Intent for this function is to assure County that the new heating plant is capable of delivering the expected temperature / pressure to the building. It is intended to Test, Adjust & Balance the overall new heating plant system components for flow performance.

3.6 CLEANING AND SETTING

A. Clean equipment internally and externally, on completion of installation, according to manufacturer's written instructions and usual & customary practices. Clean equipment interiors to remove foreign material and construction dirt and dust.

3.7 DEMONSTRATION

A. Coordinate/Engage a factory-authorized service representative (including County's Preferred or Direct-Purchase Vendors as applicable) to demonstrate/train County's maintenance personnel to adjust, operate, and maintain EACH main equipment item & systems installed, including an agreed-to procedure for post-construction service during the Warranty period.

3.8 PREVENTATIVE MAINTENANCE IMPLEMENTATION GUIDELINES

A. General: the following paragraphs are intended as Service Guidelines that should be understood and applied to EACH HVAC Equipment/System item in the Scope of Work in order to quantify/qualify the nature of Manufacturer-based care for the subject equipment. Service Providers are responsible to review what is actually recommended/published for each item furnished & covered in the Preventative Maintenance Scope of Work.

B. Comprehensive Quarterly Maintenance Guidelines for HVAC Equipment:
   1. General Instructions – in conjunction with Manufacturer's PUBLISHED Recommendations:
      a) Inspect for visual leaks and report leak check results.
      b) Repair minor leaks as required (e.g. valve packings, flare nuts & pipe joints).
      c) Calculate fluid loss rate(s) and report to the customer, as applicable.
      d) Verify electric motor starter(s) and auxiliary electric control device(s) operation.
      e) Check refrigerant charge - not applicable.
      f) Verify smooth operation of burners and fans.
      g) Change Filter media as applicable.
      h) Review operating procedures with operating personnel.

i) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

2. Controls and Safeties
   a) Test the operation of any Unitary Controls & Safety devices, including installed loose accessories and components (space & system temperature/pressure devices, damper/valve controls, unit-provided interfaces to Fire Alarm systems, etc). Calibrate, if applicable, and record setting.
3. Lubrication
   a) Lubricate motor bearings, if applicable.
4. Electric Components, Motors and Starters
   a) Clean the starter and cabinet.
   b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
   c) Check the contactors for free and smooth operation.
   d) “Meg” any major-service motor(s) and record readings.
   e) Verify the tightness of the major motor terminal connections.

END OF SECTION 10 23 26

SECTION 23 07 00 - HVAC INSULATION

PART 1 GENERAL

1.01 REFERENCE

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Divisions 01 Specifications Sections, apply to this Section.

B. Section 23 01 00 - Paragraph 1.05 OHIO ENERGY CODE.

1.02 SCOPE

A. Extent of Work - Insulate pipes, ductwork and other surfaces as follows:

Hot Water Heating Piping
Make-up Water Piping
Air separators

PART 2 PRODUCTS

2.01 All insulating materials, including jackets, cements, adhesives, vapor barriers, etc., shall be U.L. listed with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50.

2.02 Molded plastic fitting covers shall be U.L. approved with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50.

2.03 Pipe insulation shall be Johns Manville "Micro-Lok" glass fiber insulation rated for 850°F. with factory applied AP-1 all purpose, self-sealing vapor barrier jacket. Butt strips shall be minimum 3" wide of same material as jacket.

A. Fiberglass pipe insulation shall be factory molded tubular type with “all service” jacket having an integral vapor barrier. Longitudinal joints of the jacket shall be over-lapping with factory applied adhesive. Butt joints shall be sealed with 3 in. wide ASJ pressure sensitive tape. Insulation shall be GreenGuard Certified for low formaldehyde and VOC emissions.

2.04 Insulation for chilled water pump casings shall be 25/50 rated flexible closed cell, elastomeric Armstrong Armaflex II sheet and roll insulation, rated for -40°F to 220°F.

2.05 All fiberglass cover above shall be by Johns Manville. Equivalent type thickness and conductivity insulation by Owens Corning, Knauf, or CertainTeed meeting all requirements may be furnished at the Contractor's option.

2.06 All elastomeric cover above shall be by Armstrong. Equivalent type thickness and conductivity insulation by Aerotube, Halstead, Imcoa or Rubitex meeting all requirements may be furnished at the Contractor's option.

2.07 Insulation thicknesses are based on insulation having thermal resistance in the range of 4.0 Hr F ft.^{2} /BTU to 4.6 Hr F ft^2/BTU per inch of thickness on a flat surface at a mean temperature of 75°F. Minimum insulation thickness shall be increased for materials having R values less than 4.0 or may be reduced for materials having R values greater than 4.6 to give equivalent "R" values. HVAC piping shall be covered with insulation of thickness listed, to meet or exceed ASHRAE 90.1, latest publication (adopted by the Ohio Building Code).

2.08 All mastics, adhesives, sealers etc, shall have low VOC emittance as required by LEED recommendations.

PART 3 EXECUTION

3.01 Insulation Thickness Table

A. In the absence of a specified insulation thickness, the following table shall apply:

MINIMUM PIPE INSULATION
INSULATION THICKNESS IN INCHES
FOR PIPE SIZES

Piping System Types	Fluid Temperature	Runouts up to 2"*	1" and less	1-1/4 to 2"	2-1/2" to 4"	5" to 6"	8" and larger
HEATING SYSTEMS Steam & Hot water							
Low Temperature	120-200	1	1	1	1	1	1-1/2

*Runouts not exceeding 12 ft. in length to Individual Terminal Units.

3.02 Cover hot water heating piping as follows:

A. Cover all piping with glass fiber pipe insulation. Minimum insulation thickness to be as shown in the Table (3.01).

B. Fittings shall be wrapped with compressed fiberglass to same thickness and density as adjacent pipe insulation and covered with a molded plastic fitting.

C. All mechanical couplings shall be wrapped with compressed fiberglass to the same thickness as adjacent pipe insulation and covered with a molded plastic fitting.

D. No covering required on supply and return lines inside heating units cabinets.

E. Valves, flanges and unions shall not be covered. Insulation shall be stopped square with valves, etc., and ends sealed with Benjamin Foster "Tight Fit" coating.

F. Hot water piping connecting to duct coils and air terminal unit coils shall be insulated up to the coil shut-off valves, and insulated with vapor barrier maintained from the coil to a point 6 in. from the coil. The piping and accessories between these points shall remain uninsulated for ease of access

3.03 Cover cold water make-up and condensation drain piping as follows:

A. Cover all piping with 1/2" thickness glass fiber pipe insulation.

B. Seal all laps and butt strips with white vapor barrier cement or factory self-sealing laps.

C. Fittings shall be wrapped with compressed fiberglass to same thickness and density as adjacent pipe insulation and covered with a molded plastic fitting.

D. All valves (including bonnets), flanges, unions, etc. shall be covered with full thickness insulation and jacket.

E. Finish insulation on all piping in mechanical rooms, storage rooms and in exposed locations with glass cloth (minimum 6 x 6 weave/inch, 4.3 ounces per square yard) vapor barrier jacket applied with Foster No. 30-36 and two coats No. 30-42 over glass cloth.

1). Knauf pipe insulation with an ASJ + jacket or equal as approved in advance may be used in place of the above specified glass cloth.

3.05 Cover all pump casings, air/dirt separators and pot feeder/filters as follows:

A. Insulate with 1” thick elastomeric sheet insulation.

B. Do not cover permanent labels or nameplates.

3.06 Application shall be made on clean, dry surfaces with all joints butted firmly together.

3.07 Insulation shall not be applied until the general construction has progressed sufficiently to insure against physical or moisture damage to the insulation. All damaged insulation shall be replaced at this Contractor's expense.

3.08 Install 20 gauge galvanized steel insulation protectors on all insulated exposed pipes passing through floor. Sleeves to be 12" above the floor.

3.09 Hanger rods must be perpendicular before insulation is installed.

3.10 Longitudinal lap joints and butt strips for glass fiber pipe insulation shall be secured with staples or three (3") inch centers and sealed with an approved vapor barrier adhesive where applicable. Staples are not required when insulation utilizes a "double" adhesive self-sealing system.

3.11 Provide removable insulation sections to cover parts of equipment which must be opened periodically or maintenance.

3.12 Where insulation is terminated, insulation shall be beveled at 45 degrees and the beveled surface sealed with vapor barrier mastic. PVC caps over straight cut ends which have been vapor sealed shall be used in lieu of beveling.

3.13 Items such as manholes, handholds, clean cuts, ASTM stamp, and manufacturer’s nameplates, shall be left uninsulated unless omitting insulation would cause a condensation problem. When such is the base, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.

END OF SECTION 23 07 00

SECTION 230916 - VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes matched replacement motors and variable frequency drives (VFD) with open standard protocol capabilities for HVAC systems and components.

B. Related Sections include the following:

1. Division 10 Section 102326 “Overall Specifications” for applications concerning Exhaust Ventilation and/or Hydronic Heating Systems.
2. Division 23 Section 230900 "OPEN Temperature Control Systems" contains requirements that relate to this Section

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Product Data for each type of product specified. Include manufacturer's technical Product Data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, installation instructions, and startup instructions.

C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

D. Shop Drawings containing the following information for each control system:

1. Diagrams for all required electrical wiring (matched motor & VFD Starter). Clearly differentiate between factory-installed and field-installed wiring.
2. Details of control panel faces, including controls, instruments, and labeling.
3. System graphics.
4. System configuration.
5. Software description and sequence of operation.

E. Wiring diagrams detailing wiring for power, signal, and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.

F. Maintenance data for motors/variable frequency drives to include in the operation and maintenance manuals specified. Include the following:

1. Maintenance instructions and applicable spare parts lists.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

G. Field Test Reports: Procedure and certification of variable frequency drive system.

H. Harmonic Testing: Compliance to IEEE 519 - harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion.

1. The VFD manufacturer shall provide calculations, specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519 (latest version), guide for Harmonic Control and Reactive Compensation for Static Power Converters. The acceptance for this calculation must be completed prior to VFD installation.
2. Prior to installation, the VFD manufacturer shall provide the estimated total harmonic distortion (THD) caused by the VFDs. The results shall be based on a computer aided circuit simulation of the total actual system, with information obtained from the power provider and the user.
3. If the voltage THD exceeds 5%, the VFD manufacturer is to recommend the additional equipment required to reduce the voltage THD to an acceptable level.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Wiring installation shall be accomplished by a licensed electrician.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing variable frequency drive & matched motor replacement systems similar to those indicated for this Project and that have a record of successful in-service performance. It is required that the drive manufacturer have an existing sales representative exclusively for HVAC products, with expertise in HVAC systems and controls and must have an independent service organization within a 50 mile radius of the project site. The drive and all necessary controls, as herein specified, shall be supplied by the drive manufacturer.

The manufacturer shall have been engaged in the production of VFDs for a minimum of ten (10) years.

C. Startup Personnel Qualifications: Engage specially trained personnel in direct employ of local representative of variable frequency drives.

D. Comply with NFPA 90A.

E. Comply with NFPA 70.

F. Comply with UL 508C, including all Bypass and accessory components.

G. Comply with IEEE Standard 519-1992, Guide for Harmonic Content and Control.

H. Comply with NEMA ICS 7.0 AC Adjustable Speed Drives.

I. Comply with IEC 16800 Parts 1 and 2.

J. Testing:
1. All printed circuit boards shall be completely tested and burned-in before being assembled into the completed VFD. The VFD shall then be subjected to a computerized systems test (cold), burn-in, and computerized system test (hot). The burn-in shall be at 104 deg. F. (40 deg. C), at full rated load.
2. All testing and manufacturing procedures shall be ISO 9001 certified.

K. Failure Analysis:

1. VFD manufacturer shall have an analysis laboratory to evaluate the failure to any component. The failure analysis lab shall allow the manufacturer to perform complete electrical testing, x-ray of components, and decap or delaminate of components and analyze failures within the component.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store equipment and materials inside and protected from weather.

B. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.

1.6 WARRANTY

A. **Warranty shall be 24 months from the date of certified start-up.** The warranty shall include all parts, labor, travel time and expenses.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide original manufactured/non-branded products by one of the following:

1. Yaskawa HVAC model series HV-600.
2. Owner approved equivalent by ABB – base models and engineered branded.
3. Owner approved equivalent by Danfoss – base models and engineered/branded.

2.2 VARIABLE FREQUENCY DRIVES (VFDs)

A. The Variable Frequency Drives (VFDs) shall be solid state, with a Pulse Width Modulated (PWM) output waveform utilizing insulated gate bipolar transistors (IGBT's). The VFD package specified herein shall be completely assembled in a NEMA 1 enclosure and tested by the manufacturer. The drive efficiency shall be 97% or better at full speed and full load and the fundamental power factor shall be 0.98 at all speeds and loads.

B. General Requirements: VFDs and options shall be UL Listed as a complete assembly. All items in this specification must be adhered to strictly. Any deviations must be submitted and approved in writing ten working days prior to the bid date.

C. All VFDs shall have the following standard features:

1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be used for local control, for setting all parameters and for stepping through the displays and menus. The keypad shall be removable, capable of remote mounting, and shall have its own non-volatile memory. The keypad shall allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs. Provide integral time clock with 10-year backup battery and four (4) separate & independent settable timer functions, for both weekday and weekend time periods.
2. The VFDs shall utilize plain English digital display (code numbers and letters are not acceptable). All set-up parameters, indications, faults, warnings and other information must be displayed in words to allow the user to understand what is being displayed without the use of an installation manual or cross-reference table. VFDs utilizing codes are not acceptable.
3. The keypad shall include Hand-Off-Auto membrane selections. When in the "Hand" position, the VFD will be started and the speed will be controlled from the up/down arrows. When in the "Off" position, the VFD shall be stopped.

When in the "Auto" position, the VFD shall start via an external contact closure and the VFD speed will be controlled via an external speed reference. The drive shall incorporate “bumpless transfer” of speed reference when switching between “Auto” and “Hand” modes and vice-versa.

4. The VFDs shall have impedance line reactors to meet IEEE Standard 519 at no greater than 5% total harmonic voltage distortion.
5. The VFDs shall utilize pre-programmed application macro's specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time.
6. The VFD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
7. The VFD shall be capable of stating into a rotating load (forward or reverse) and accelerate or decelerate to setpoint without safety tripping or component damage (flying start). The VFD shall also be capable of DC injection braking at start to stop a reverse spinning motor prior to ramp.
8. The VFD shall be equipped with an automatic extended control power ride-through circuit, which will utilize the inertia of the load to keep the drive powered. Typical control power ride-through for a fan load shall be 2 second minimum.
9. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.
10. The customer terminal strip shall be isolated from the line and ground.
11. The drive shall employ current limit circuits to provide trip free operation:
    a. The Slow Current Regulation limit circuit shall be adjustable to 150% (minimum) of the VFD's normal duty current rating. This adjustment shall be made via the keypad, and shall be displayed in actual amps, and not as percent of full load.
    b. The Current Switch-off limit shall be fixed at 350% (minimum, instantaneous) of the VFD's normal duty current rating.
12. The overload rating of the drive shall be 110% of its normal duty current rating for one minute in every ten minutes.
13. The VFD shall have integral Input Reactor(s) with a minimum of 3% impedance in the form of AC or DC reactors. DC reactors shall be located on both the positive and negative bus rails to reduce the harmonics to the power line and to increase the fundamental power factor.
14. The VFD shall be capable of sensing a loss of load (broken belt/no water in the pump) and signal the loss of load condition. The drive shall be programmable to

signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

15. The VFD shall allow feedback to BAS over serial communication bus when “loss-of-load” signal is received and provide for programmable actions:
    a. stop-and-display fault.
    b. Run at pre-programmed speed.
    c. Hold last speed.
    d. Issue Warning.
16. The VFD shall have programmable "Sleep" and "Wake-up" functions to allow the drive to be started and stopped from the level of a process feedback or follower signal.
17. VFD heat sinks shall be cooled by an integral cooling fan sized for the application of VFD. Locate cooling fan at exterior of unit to allow service maintenance to be performed without an internal teardown of the VFD.

D. All VFDs shall have the following adjustment capabilities:

1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
2. Two (2) PID Setpoint controllers shall be standard in the drive, allowing a pressure or flow signal to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The auxiliary power supply shall have overload and over current protection. the PID setpoint shall be adjustable from the VFD keypad, analog inputs, or over the communications bus.
3. Two (2) programmable analog inputs shall accept a current or voltage signal for speed reference, or for reference and actual (feedback) signals for PID controller. Analog inputs shall include a filter; programmable from 0.01 to 10 second to remove an oscillation in the input signal. The minimum and maximum values (gain and offset) shall be adjustable within the range of 0-20 ma and 0-10 Volts. Additionally, the reference must be able to be scaled so that maximum reference can represent a frequency less than 60Hz, without lowering the drive maximum frequency below 60Hz. Process variables shall be modifiable by math functions such as multiplication and division between the two signals (fan tracking), high/low select, as well as inverted follower.
4. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. One digital input is to be utilized as a customer safety connection point for fire, freeze, and smoke alarm interlocks (Enable). Upon customer reset (reclosure of interlock) drive is to resume normal operation.

5. Two (2) programmable analog outputs proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
6. Three (3) programmable digital relay outputs. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC: Continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable. Relays shall be capable of programmable on and off delay times.
7. Seven (7) programmable preset speeds.
8. Two independently adjustable accel and decel ramps. These ramp times shall be adjustable from 1 to 1800 seconds.
9. The VFD shall Ramp or Coast to a stop, as selected by the user.
10. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on the actual VFD temperature that allows the highest carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.
11. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise.
12. The VFD shall include routines for password protection against unauthorized parameter changes.

E. The following operating information displays shall be standard VFD digital display. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of two operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words:

Output Frequency
Motor Speed (RPM, % or Engineering units)
Motor Current
Calculated Motor Torque
Calculated Motor Power (kW)
DC Bus Voltage
Output Voltage
Heatsink Temperature (F)
Analog Input Values
Analog Output Value
Keypad Reference Values
Elapsed Time Meter (resettable)
kWh meter (resettable)
mWh meter
Digital input status
Digital output status

F. The VFD shall have the following protection circuits. In the case of a protective trip, the drive shall stop, and announce the fault condition in complete words (alphanumeric codes are not acceptable).

Overcurrent trip 350% instantaneous (170% RMs) of the VFD's variable torque current rating
Overvoltage trip 130% of the VFD's rated voltage
Undervoltage trip 65% of the VFD's rated voltage
Overtemperature +90 deg. C, Heatsink Temperature
Ground Fault either running or at start
Adaptable Electronic Motor Overload (I2T). The Electronic Motor Overload protection shall protect the motor based on speed, load curve, and external fan parameter. Circuits, which are not speed dependent, are unacceptable. The electronic motor overload protection shall be UL Listed for this function.

G. Speed Command Input shall be via:

1. Keypad.
2. Two Analog inputs, each capable of accepting a 0-20mA, 4-20mA, 0-10V, 2-10V signal.
3. Floating point input shall accept a three-wire input from a Dwyer Photohelic (or equivalent type) instrument.
4. Serial Communications – coordinate with Siemens/Owner’s Temperature Control System provider.

H. Serial Communications

1. The VFD shall have a BacNET™ certified bus Serial Interface connection, or BacNET™ IP connection for capability with supporting an HVAC industry accepted open standard protocol for communications.
2. The VFD shall be able to communicate with PLC's, DCS's and DDC's.
3. Serial communication capability shall include, but not be limited to, Power consumed, run-stop control; speed set adjustment, proportional/integral/derivative PID control (Set Point) adjustments, current limit, and accel/decel time adjustments. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, digital inputs and diagnostic warning and fault information. Additionally, remote (LAN) VFD fault reset shall be possible. A minimum of 15 field parameters shall be capable of being monitored.
4. The VFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. The serial communications interface shall allow for DO (relay) control and AO (analog) control without being tied to a VFD function. In addition, all

drive digital and analog inputs shall be capable of being monitored by the DDC system.

5. The VFD shall have the capability of accepting fiber optic cables for connection to standard fieldbus adapter. Communications between the drive and fieldbus adapters shall be a 1 Mega Baud.
6. The VFD HMI shall be capable of operating, programming, monitoring the drive as well as diagnosing faults.

2.3 VFD CONFIGURATION FEATURES & ACCESSORIES

A. General: Features shall be furnished and mounted by the drive manufacturer. All features shall be ETL/UL Listed by the drive manufacturer as a complete assembly. In addition to disconnect feature, provide VFDs with the following:

1. Customer Interlock Terminal Strip - provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, Drive or Bypass modes.
2. Fast acting semi-conductor fuses exclusive to the VFD - fast acting semi-conductor fuses allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability.

B. Provide VFDs with NEMA 12/3X/4X Enclosures in applications where the installed environment is subject to excessive conditions and/or as noted on the plans.

C. Provide VFDs with Panel-accessible Disconnect Switch, padlockable in the "Off" position.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to units. Verify that wiring is adequately provided before proceeding with installation.
B. Field Verify conditions for installation of both Replacement Motors and matched VFD Motor Starters.

3.2 INSTALLATION

A. Install equipment as indicated to comply with manufacturer's written instructions and proper reconnection to each existing parameter (Fan shafts, Fire Alarm interface, etc.).

B. Connect and configure equipment to achieve the sequence of operation specified.

3.3 ELECTRICAL WIRING AND CONNECTIONS

A. Install raceways, boxes, and cabinets according to NEC and electrical specifications.

B. Install line voltage wire and cable according to NEC and electrical specifications. Install control signal (low voltage) and communication (BacNET) cable according to NEC and electrical specifications.

1. Conceal cable routings to protect wiring.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where a number of cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, neatly along hinge side; protect against abrasion. Tie and support conductors neatly.
6. Number-code or color-code conductors, except local individual room controls, for future identification and servicing of control system.

C. Connect electrical components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

3.4 COMMISSIONING

A. Manufacturer's Field Services: In conjunction/coordaintion with the Owner’s Master Systems Integrator and Commissioning Services provider, provide & schedule the services of a factory-authorized service representative to start each VFD used on the project.

B. Test and adjust controls and safeties.

C. Replace damaged or malfunctioning controls and equipment.

D. Start, test, and adjust systems.

E. Demonstrate compliance with requirements.

F. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.5 DEMONSTRATION

A. Manufacturer's Field Services: Provide the services of a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
2. Schedule training with Owner with at least 7 days' notice.
3. Provide operator training on data display, alarm and status descriptors, requesting data, execution of commands, and request of logs. Include a minimum of four (4) hours dedicated instructor time on-site.

END OF SECTION 230916

SECTION 23 21 13.23 - HOT WATER HEATING PIPING SYSTEM

PART 1 GENERAL

1.01 REFERENCE

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Divisions 01 Specifications Sections, apply to this Section.

B. Section 23 05 30 - INSTALLATION OF PIPING.

C. Section 23 07 00 - HVAC INSULATION.

1.02 SCOPE

A. From the existing heating water mains provide a complete system of hot water heating piping to VAV box coil connections.

B. Reconnect existing hot water heating piping in mechanical room to new boilers and new base mounted end suction pumps with all piping accessories.

C. Cap existing unit ventilator piping in cabinets and reconnect to mains as required to feed new VAV box coils.

PART 2 PRODUCTS

2.01 Pipe - Schedule 40 black seamless or electric welded ASTM A-53, Grade A with Schedule 40, 150 lb. swp steel welding fitting, except 2" and smaller pipe option 125 lb. cast iron screwed fitting. Elbows shall be long radius type.

2.02 Fittings for piping 2-1/2" and smaller - 125 lb. black cast iron except the Contractor may, at his option, use weld joints in piping 1-1/2" and larger. Use standard weight welding fittings.

2.03 Fittings for piping 3" and larger - standard weight welding fittings.

2.04 At the Contractor's option, weldolets, butt or threaded type, may be used for branch connections that are less than 2/3 main size. Use welded or screwed fittings for branch connections 2/3 main size or larger. Shaped nipples are not acceptable.

2.05 The Contractor, at his option, may use copper pipe and fittings for all pipe less than 4". Pipe shall be Type L hard drawn copper tubing with wrought copper solder type fittings. All joints shall be made with a 6 percent silver alloy with a 1000°F solidus minimum.

2.06 Fittings for piping 4" and smaller - Viega ProPress or EQUAL manufacturers, type fittings rated for a maximum operating pressure of 200 PSIG and UPC/IPC listed may be used at the Contractor's option. Installation of all such fittings to be per manufacturer's recommendations utilizing Viega or EQUAL approved RIGID pressing tools.

PART 3 EXECUTION

3.01 Install water mains without pitch. Use eccentric reducing couplings at changes in size, with top of pipes at same elevation. Use concentric reducers in vertical mains.

3.02 Branches to units below mains to be taken from bottom of mains at a 45 degree angle, pitch downward toward units. Branches to units above mains to be taken from top of mains at a 45 degree angle, pitched upward toward units. Pitch not less than 1" in 10'.

3.03 Install manual air vents at high points of the system, as shown on the Drawings and as required for proper air venting of system. Automatic air vents shall be provided in the supply and return piping to air handling unit heating coils.

END OF SECTION 23 21 13.23

SECTION 23 21 23.16 - END SUCTION PUMPS

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 01 05, Paragraph 1.05 - OHIO ENERGY CODE

B. Section 23 05 13 - ELECTRICAL WORK

1.02 SCOPE

A. Provide end suction, flexible coupled pumps as shown on the Drawings.

B. Provide piping to the pumps to provide a complete and operational system.

1.03 SUBMITTALS

A. Provide dimensional drawings and product data on each pump.

B. Provide pump curves for each pump at the specified operation point, with the flow, pressure and horse power clearly plotted.

C. Installation, Operation, and Maintenance Manual (IOM): Provide manufacturer's installation, operations, and maintenance manual, including instructions on installation, operations, maintenance, alignment, receiving, handling, storage, safety information and cleaning. Provide a troubleshooting guide, parts list, warranty and electrical wiring diagrams.

1.04 QUALITY ASSURANCE

A. Each pump shall be given a vibration and pump alignment analysis by the manufacturer's representative.

B. Comply with the National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.

B. Storage: Store materials in a dry area indoor, protected from damage, and in accordance with manufacturer's instructions. For long term storage follow manufacturer's Installation, Operations, and Maintenance Manual.

C. Handling: Handle and lift pumps in accordance with the manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer.

1.06 WARRANTY

A. Manufacturer's Warranty: Submit, for the Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owners may have under Contract Documents.

1. The warranty of this equipment is to be free from defects in material and workmanship for a period of one year from the date of occupancy.
2. Motor Warranty is warranted by the motor manufacturer for a period of one year from the date of occupancy.

PART 2 PRODUCTS

2.01 End suction, flexible coupled pumps shall be base-mounted, single stage, end suction design, bronze fitted centrifugal type with type 416 stainless steel shaft, bronze case wearing rings, maintenance free ball bearings, motors, flexible couplings, coupling guards, galvanized drip pan and heavy-duty channel steel bases unless otherwise noted. Pumps shall be serviceable without the need to disconnect suction and discharge piping from the pump casing.

A. Manufacturer – Bell & Gossett Series 1510

B. Pump volute shall be made of ductile iron with integrally cast pedestal support. The impeller shall be cast bronze, enclosed type, statically and hydraulically balanced. Impeller shall be keyed to the shaft and secured by a hex head impeller nut and washer.

C. Pumps shall be provided with a single EPR/carbon/silicon carbide mechanical shaft seal for leakless operation. A suitable arrangement shall be provided to furnish a portion of the pumped liquid to lubricate and cool the seal faces. Seals shall be flushed and provided a solids separator and seal flushing piping shipped loose for field installation.

D. Pump shall be rated for a minimum of 175 psi working pressure. Casings shall be provided with tapped and plugged holes for priming, vent, and drain.

E. Pump bearing housing shall have heavy duty re-greaseable ball bearings.

F. Base plate shall be channel steel, sufficiently rigid to support the pump and driving motor. A flexible-type coupler, capable of absorbing torsional vibration, shall be employed between the pump and motor, and it shall be equipped with a suitable coupling guard as required. Contractor to level and grout each unit according to manufacturer's instructions.

G. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

H. Each pump shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for owner's reference.

I. All pumps shall be furnished with bronze shaft sleeves and mechanical shaft seals. Seals shall be rated for 250°F. water temperature.

J. Furnish a spare pump seal for each type and size of pump.

2.02 Pump capacities shall be as shown on the Drawings at total head noted. The operating point of each pump at the conditions shown shall be within five (5) percentage points of the maximum efficiency on its impeller curve. The impeller furnished shall not exceed 90 percent of the maximum diameter catalogued impeller available for the pump casing furnished. To assure stable pump operation, the impeller curve shall be continuously rising throughout the range contained within its efficiency curves. The peak of the impeller curve at maximum total head shall be a minimum of 10 percent above the total head shown on the Drawings. The pump shall not overload the motor at any point on the impeller curve.

2.03 Motors shall be 1750 RPM, 60 Hertz, three phase, maximum 40°C ambient, open drip-proof with grease packed bearings and grease seals and fittings. Voltage as scheduled on the Drawings. Size of motor as indicated on the Drawings. Motor shall be equal to Baldor Premium efficiency type and shall meet Ohio Energy Code and have 1.15 service factor. Efficiency at 1/4, 1/2, 3/4 or full load shall not be less than 91%. Motor for the secondary chilled water pumps shall be high efficiency type for use with variable frequency inverter.

A. Pump and motor shall be factory aligned, and shall be realigned by contractor after installation.

B. Motors shall be “Inverter Ready” per NEMA Std. MG1 part 31.4.4.2 and labeled as such.

C. Provide two-year parts only warranty for the motor.

D. Motors shall be furnished with AEGIS SGR shaft grounding ring kit, installed by the equipment manufacturer.

D. Refer to section 23 05 13 for additional motor requirements.

2.04 Motor horsepower shall not be smaller than that scheduled. Pump furnished must operate within 5% of efficiency noted on Drawings and meet all other requirements specified.

2.05 Pumps by Aurora, Peerless or Armstrong of the same type, size, and capacity and meeting all specification requirements may be furnished at the Contractor’s option. Pumps furnished must operate within 5% of efficiency noted on drawings and meet all other requirements specified.

PART 3 EXECUTION

3.01 Install suction diffusers with integral strainer screens at suction of pumps.

3.02 Pump Alignment - The Contractor, before starting any pumping unit with pump and driver mounted on a common base plate with a flexible coupling, shall check the following points:

A. Make sure base plate is level in both directions.

B. Make sure pump shaft and driver shaft are parallel in both horizontal and vertical planes.

C. Make sure shafts are concentric.

D. Align coupling flanges for concentricity to assure that the face and curved edges are concentric within the manufacturer’s recommendations.

E. Align coupling for angular alignment to tolerances recommended by the manufacturer.

F. Align coupling for parallel alignment.

G. The final coupling alignment shall be documented and the results furnished in writing to the Engineer. Field check all alignments and report the maximum angular and eccentric misalignments to the nearest 0.001 inch.

3.03 Starters, disconnects and wiring by Electrical Contractor.

3.04 Install pumps on existing concrete pads.

3.05 Install flexible connectors on suction and discharge sides of pumps.

3.06 Install a vent cock on the volute casing.

3.07 Mount pumps as shown on the drawings.

3.08 Support vertical piping drops from floor or isolation base (when furnished) to avoid stress on pump connections.

3.09 Install seal flushing separation and piping on pumps.

3.10 Extend drain line from pump basin drain pan.

END OF SECTION 23 21 23.16

SECTION 232123.18 – WET ROTOR CIRCULATOR PUMPS

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Contractor shall furnish and install wet rotor in–line circulator pumps with permanent magnet, asynchronous motors as manufactured by Grundfos in accordance with manufacturer's recommendations and plans. Equal wet rotor pumps by Armstrong Fluid Technologes, or Bell & Gosset maybe provided at the contractor's option.

1.2 REFERENCE STANDARDS

The work in this section is subject to the requirements of applicable portions of the following standards:

A. Hydraulic Institute
B. ANSI – American National Standards Institute
C. ASTM – American Society for Testing and Materials
D. IEEE – Institute of Electrical and Electronics Engineers
E. NEMA – National Electrical Manufacturers Association
F. NEC – National Electrical Code
G. ISO – International Standards Organization
H. UL – Underwriters Laboratories, Inc.
I. CSA –Canadian Standards Association

1.3 INSTALLATION REFERENCES

The wet runner pump manufacturer shall have a minimum of 10 years of experience in the country of the installation. The contractor shall provide a minimum of 5 installation references of similar size in the state/province pump is going to be installed.

PART 2 – PRODUCTS

2.1 WET ROTOR CIRCULATOR PUMPS

A. Furnish and install boiler circulators of a wet-rotor design, with 4 pole, permanent magnet motors controlled by an integrated frequency converter..
B. The pump shall be a standard product of a single pump manufacturer. The pump and motor shall be designed and built by the same manufacturer.
C. The wet rotor circulator pump shall be certified and listed by UL (1Z28 Water circulating pump) and/or CSA (Water Circulating Pump) for conformance to U.S. and Canadian Standards to operate at maximum 248□F and minimum 14□F water.
D. Maximum noise level of the pump and motor shall be 41dB(A)
E. The pumps shall be capable of operating continuously at 248 F.
F. For open loop applications maximum water temperature shall be limited to 140 F, water hardness shall not exceed 17 grains per gallon (14 dH).

2.1.1 PUMPS

A. The pumps shall be of the quiet wet rotor in-line design.
B. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region.
C. The pumps shall have the following features:
   1. The pump housing shall have a stainless steel neck ring to minimize recirculation

and increase pump efficiency.

2. The impellers shall be laser welded stainless to obtain maximum efficiency. Composite material shall not be acceptable. The impellers shall be secured to the shaft with a neck ring and a nut.
3. The suction and discharge flanges shall be tapped and drilled to allow gauge installation on the pump.
4. The pumps shall have tungsten carbide sleeve bearings for extended life. Metal impregnated carbons bearings shall not be acceptable.
5. Pump Construction.

a.	Pump housing:	Cast iron EN-JL-1040 (A 48 Cl 40B)
b.	Impellers, rotor can, rotor cladding:	304 Stainless Steel
c.	Shaft	303 Stainless Steel
d.	Bearings:	Tungsten Carbide
e.	Shaft journals/ inner bearings:	Silicon Carbide
f.	O-rings:	EPDM
g.	Bearing plate:	304 Stainless Steel

2.1.2 INTEGRATED MOTORS

A. Each motor shall be of the asynchronous squirrel cage design and tested with the pump as one unit by the same manufacturer.
B. The stator housing shall be made of pressure die cast aluminum. The stator housing shall have 8 drain holes to enable condensed water to escape.
C. The motor shall be cooled by the pumped fluid.
D. Motor shall be self ventilating. The stator housing shall have nickel plated brass inspection screw.
E. Minimum insulation class for the motors shall be Class F.

2.1.3 TERMINAL BOX

A. The terminal box shall be made of black composite material. Enclosure class shall be IP44. Aluminum terminal boxes shall not be acceptable.
B. Each pump shall be supplied with relay module to provide an external fault signal. Relay module shall provide protection against overheating at all speed. Relay module shall supply alarm via Building Automation System. Proposer / Contractor shall coordinate this function with Proposer / Contractor's Temperature Control Subcontractor.

2.2 INSTALLATION

A. The pump shaft shall be installed horizontally per manufacturer's recommendations. The terminal box shall be located as per manufacturer's recommendations. The system shall be vented out from a higher location form the pump. The required inlet pressure by the pump shall be available at the pump inlet.
B. Provide with lug pattern butterfly (2-1/2" pipe size or greater) or threaded, ball type isolation valves (2" pipe size or smaller).
C. Provide with silent type check valve.
D. Provide with flow measurement venturi.

2.3 TESTING

A. The pumps shall be factory performance and hydrostatic tested as a complete unit prior to shipment. The testing shall be done in accordance with ISO 9906 Annex A. No test certificate is required.

2.4 WARRANTY

A. The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture. The warranty shall cover pump, motor and add-on modules as complete unit.

END OF SECTION 232123.18

SECTION 235233 – HIGH-EFFICIENCY BOILER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. It is the Intent of this Project to completely final design/install/coordinate the designated Owner qualified Equipment/Systems & coordinate the applicable manufacturer-based Support Services required (equipment & services delivery, lead times/field-coordinate options, confirm technical performance, confirm physical information and fully integrate pertinent accessories/Options) from the successful Contractor-chosen Vendor with the ultimate responsibilities of performing the final pre-order coordination/recommended solutions being accepted with the Vendor by this Contractor. The Contractor-chosen Vendor/manufacturer of the High-Efficiency Boiler Systems Equipment/Services will accept and will properly execute all reasonable and required equipment furnishing & support services to this Contractor, for a complete and coordinated installation. The expected Contractor-provided Support Services required to be coordinated in this solicitation includes, but is not limited to:
   1. Detailed & complete Final/As-ordered Submittal preparation:
      a. For use in installation coordination.
      b. For use in coordination with Owner's Master Systems Integrator (MSI) and connection to exiting OPEN Building Automation System (BAS) Networks.
      c. Updated for Accurate As-Built documentation.
   2. Final/specific Engineering/Coordination for Hydronic Piping/Wiring components, routing & sizing for the solution proposed/accepted.
   3. Final/specific Engineering/Coordination for Factory-recommended Sequences of Operation and Controls Interlocks coordination as applies to identified Project Scopes of Work, including updating Ventilation Controls/Staging for Combustion Air.
   4. Site-specific field-coordination for Factory-authorized/recommended installation.
   5. Coordination of Factory-authorized Equipment/Systems Start-up.
   6. Coordination of Factory-sponsored Maintenance Services, as applicable.
   7. Coordination of Factory-authorized Warranty support.

C. The Contractor-chosen Vendor of the selected Equipment/System is responsible to provide the following:
   1. Detailed & complete pre-order Submittal preparation.
      a. For use in installation coordination, including product-related data/information published in the Contractor bid packages.
      b. For use in coordination with Owner's Master Systems Integrator (MSI) and connection to existing OPEN Building Automation System (BAS) Networks.

c. Updated for Accurate As-Built documentation.

2. Engineering/Coordination assistance for Hydronic Piping/Wiring components, routing & sizing for the solution accepted.
3. Engineering/Coordination assistance for Flue, Combustion Air Piping, Piping, and Wiring components, routing & sizing for the solution accepted.
4. Engineering for Factory-recommended Sequences of Operation and Controls Interlocks coordination.
   a. Basic Sequence: interlock & operate the Boilers in the heating plant such that after all safety control circuits are satisfied, the SYSTEM operates Stand-Alone to provide heating water supply to the facility.
   b. Ventilation Controls: combustion air to be piped directly to each individual boiler in a "sealed combustion" configuration.
   c. Unitary/Vendor Controls include full design & field implementation between the Boilers to establish "packaged Boiler Heating Plant System Operation", including individual flue and combustion air piping.
   d. Coordination directly with Owner's Master System Integrator (MSI) to address basic Integration (Point/Data transfers, Status, Alarms, etc.) and Operational Integrations for the upgraded Boiler Plant (Pump interlocks, special timing/reset sequences, scheduling, temperature setpoints, etc.).
5. Site-specific field-coordination for Factory-authorized/recommended installations.
6. Factory-authorized Equipment/Systems Start-up.
7. Factory-sponsored Preventative Maintenance Services information, as applicable.
8. Factory-authorized Warranty support.

D. Field-INSTALLATION (Applicable Demolition, Assembly, Mounting, Ducting, Piping, Wiring, Remote Controls, furnished Accessories) of the designated Boiler Systems/Equipment IS intended for this specification, including physical/programming modifications required to any existing-to-remain Combustion Air Ventilation Setups/Sequences to best serve the replaced Equipment.

E. Hot Water Plant Design Criteria: The new Hot Water Heating Plant (multiple boiler primary-secondary piping setup – final unit choice by Contractor/Boiler Vendor) intended to be added to the facility should provide a base heating capacity to cover both the existing heating loads. The installed Plant should include by-unit excess capacity of 67% of total load each if two boilers used and N+1 if three or more boilers for layout are chosen.
   1. Refer to Criteria Flow Diagrams and Floor Plan Layouts for additional information.
   2. Refer to Overall Specification Section for other elements/piping of the Hot Water Heating Plant.

1.2 SUMMARY

A. This Section includes packaged, factory-fabricated & assembled, forced-draft gas-fired, condensing high-efficiency water boilers, trim, and required accessories for safe and reliable generation of heating hot water.

B. This Section includes Packaged High-Efficiency Boiler Systems, designed for indoor use as shown on layout drawings/specified information. High-Efficiency Boiler Systems manufacturer is responsible for the general design & unit construction with provision for the specified/required Mechanical/Electrical equipment/accessories as shown/intended. Items pertaining to the Packaged High-Efficiency Boiler Systems that are NOT both furnished and installed by the Packaged High-Efficiency Boiler Systems manufacturer include:

1. Support curb/Pad supports – furnished and installed/re-worked by Mechanical contractor; the selected Vendor will coordinate any/all mating surfaces with proposed equipment/systems and existing pads/supports prior to final ordering of equipment.
2. Boiler Flue Exhaust & Ventilation Systems – furnished by the Vendor/manufacturer as Specifically Designated and installed/re-worked/final field-coordinated by Mechanical contractor; the selected Vendor will coordinate any/all mating surfaces with proposed equipment/systems and existing substrate/supports prior to final ordering of equipment.
3. Condensate Drain Systems – The required Neutralization equipment is furnished by the Vendor/manufacturer as Specifically Designated and installed/re-worked/final field-coordinated by Mechanical contractor; the selected Vendor will coordinate any/all mating surfaces with proposed equipment/systems and existing substrate/supports prior to final ordering of equipment.
4. Electrical Power – Packaged High-Efficiency Boiler Systems manufacturer provides raceways and conductors for noted line voltage connections shown & as appropriate, set to receive incoming power. Electrical Sub-Contractor field-provides all final electrical connections/disconnect switches (miscellaneous field-installed only), external power wiring, raceways, labeling, etc.
5. Temperature Control Systems (non-Unitary) – designed/furnished/reviewed by Mechanical Contractor, unless specifically noted otherwise on layout drawings (Temperature Sensors, Safety Sensors, Flow Control Monitor devices, etc.).
6. Closed-Loop Flow Control Systems (non-Unitary) – designed/furnished/reviewed by Mechanical Contractor, unless specifically noted otherwise on layout drawings (Flow Sensors, Safety Sensors, Flow Balancing devices, Isolation Valves, etc.)

1.3 SUBMITTALS

A. Product Data: Include rated capacities, min/max flow & operating characteristics, furnished specialties, and required/specified accessories for designer's final review & Installer's final coordination.

B. Shop Drawings: For boilers, boiler trim, accessories, matched/applied Venting design, materials and accessories.
   1. Include plans, elevations, sections, details, piping, accessories and attachments to other Work.
   2. Assembled unit dimensions.
   3. Weight and load distribution.
   4. Required clearances for maintenance and operation.
   5. Size and location of piping and wiring connections.
   6. Heating Plant Integrated/Staged Sequences of Operations.
   7. Applicable External-to-Unit Piping components and external piping arrangements – valves, flow sensing/regulating devices, etc.
   8. Wiring Diagrams: Detailed Power, signal, and control wiring.
   9. Equipment Coordination Drawings: provide reference plans for Boiler unit placement in Mechanical Room using the above information, including applicable support elements.
   10. Installation Coordination Drawings: provide reference plans for Boiler unit placement in Mechanical Room and proposed routing of required Systems Piping, Ductwork & Accessories, including applicable support elements and references to existing conditions.

C. Control System (BAS) Interface Data: Provide complete Serial Communication Point List information for chosen control integration interface (BACNet™) This includes, but is not limited to, PICS statements and Open Standard Protocol PROFILE information.

D. Source quality-control and inspection test reports.

E. Certificate of completed owner training, including the roster of trainees, dates of training, and receipt of delivered materials.

F. Startup service reports.

G. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

H. Receipt for Spare Parts furnished as part of this specification.

I. Warranties: Warranties as specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of boilers and are based on the specific system indicated in design documents.

B. 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.

C. ASME Compliance: Fabricate and label boilers to comply with applicable ASME Boiler and Pressure Vessel Codes.

D. BTS2000 and ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency ratings according to latest applicable versions. Thermal Efficiencies published shall be verified by third-party procedures under AHRI, Hydronics Institute Division.

E. Industry Compliance: Test boilers to comply with ANSI Z21.13 and assure listing/certification by C.S.A. International's latest published standards addressing "Commercial-Industrial Gas Heating Equipment."

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Attach unit into concrete bases per manufacturer's recommendations. Concrete, reinforcement, and formwork requirements shall be provided according to local standards and/or usual and customary best practices.

B. Coordinate size and location/routing of matching Ventilation Systems. Hanging and supporting requirements for installed Ventilation Systems shall be provided according to manufacturer's instructions, to local standards and/or usual and customary best practices.

C. Coordinate size and location/routing of matching Condensate Draining Systems. Routing/sloping and supporting requirements for installed Draining Systems shall be provided according to manufacturer's instructions, to local standards and/or usual and customary best practices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive Packaged High-Efficiency Boiler Systems from the factory fully ready for Coordinated Systems Installation. Provide protective coverings to electronic components and open piping connections.

B. Handle and store Packaged High-Efficiency Boiler Systems per manufacturer's published recommendations, including, but not limited to protection from weather and unclean jobsite conditions.

1.7 WARRANTY

A. Warranty: Lifetime, shockproof warranty on seal of tube to header. Covers leaks in pressure vessel attributed to unequal expansion.

B. 2. All stainless steel heat exchanger shall carry a 10-year limited warranty.

C. Warranty Period for tubes: Tubes shall carry a five (5) year manufacturer's warranty.

D. Pressure vessel and flue collector shall be covered against failure due to fireside flue gas corrosion. Upper & lower pressure vessel headers shall carry a 10-year limited warranty.

E. Burner shall be warranted for 1 year.

F. All other parts shall be warranted for 1 year from date of start-up or 18 months from date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide high-efficiency condensing boiler products/systems by one of the following:

1. Thermal Solutions Condensing boiler.
2. Cleaver-Brooks
3. Lochinvar

2.2 PACKAGED BOILERS

A. Description: Factory-fabricated, -assembled, and -tested water heating boiler with heat exchanger sealed pressure-tight, built on a steel base; including outer jacket, sealed insulated inner combustion chamber, flue-gas vent, combustion-air intake connections, water supply, return and condensate drain connections and controls. The boiler shall be a high-efficiency design with integral boiler circulating pump, integral modulating burner and multipass heat exchangers on a heavy steel frame.
1. Fuel: Natural Gas, standard pressures.

2.3 PACKAGED BOILER COMPONENTS

A. Main Boiler Section:

1. The boiler vessel must be constructed in accordance with ASME Boiler Code and must receive authorized boiler inspection prior to shipment. A copy of the inspection report shall be furnished to the purchaser.
   a. Working Pressure: 160 psig at 210 degrees Fahrenheit.
   b. Safety Relief Valve: Set for 50 psig.
   c. The boiler shall be complete with a 16 gauge metal jacket, steel casing, finished with a suitable heat resisting powdered coated finish. It shall be constructed on a structural steel frame and properly insulated with 1 inch thick insulation. The complete jacket shall be easily removable and reinstalled. The boiler shall incorporate individually removable jacket doors, with handles providing easy access to combustion chamber access panels. The entire tube area shall be easily accessible for fireside cleaning from both sides.

2. Connections:
   a. Main Flue - collar
   b. Combustion Air Inlet - collar
   c. Water Supply and Return
   d. Natural Gas Fuel
   e. Main Electric and Controls – single point power connection
   f. Condensate Drain
3. Insulation: Min. 1 inch thick, mineral fiber insulation surrounding heat exchanger.
4. Condensate Collection Basin: Fully welded 316L stainless steel and shall include a stainless-steel combustion analyzer test port.

B. Heat Exchanger: The heat exchanger shall bear the ASME "H" stamp for 160 psig working pressure and shall be National Board listed. The heat exchanger constructed of fully welded 316L stainless steel and be of flexible water tube condensing design. The water tubes shall be individually field replaceable. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Provide each packaged boiler with 316L stainless steel condensate collection basin.

C. Hot Water Boiler Trim: The following items shall be installed on the boiler:
1. Temperature/Pressure Gauge – Min. 3-1/2 inch diameter. Gauge shall have normal operating pressure about 50% of full range.
2. Hi Limit Temperature Control.
3. Pressure Relief Valve – Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed. Size for 50 psi.
4. Supply Water Temperature Sensor.
5. Return Water Temperature Sensor.
6. Flue Temperature Sensor.
7. Outside Air Sensor.
8. Low Water Flow Protection Controls.
9. Freeze Protection Controls.
10. Drain Valves – Min. NPS ¾ or nozzle size with hose-end connection.
11. Condensate Neutralization Kit – Factory supplied condensate trap with condensate trip sensor and high capacity condensate receiver prefilled with appropriate medium.

A. Combustion System

1. Burner operation shall provide infinite modulation with capacity for 20:1 turn down. Tru-O2 Turndown System shall exhibit no more than 1.0% difference in O2 settings between high fire and lowest setting. Tru-O2 Turndown System shall feature an independent ignition position independent of lowest firing rate and nine (9) point curve for adjustment and fine tuning.

2. The burner shall be a metal fiber mesh burner with no moving parts capable of operating low NOx operation without additional components. The burner shall fire in a full 360-degree pattern providing uniform heat transfer. A viewing port shall be provided for visual observation of burner performance.
3. The ignition system shall be supervised pilot with a UV scanner. It shall be independent from the burner turndown operation for reliability.
4. The entire ignition and firing control sequence shall be monitored by a UL approved commercial-type microprocessor based integrated flame safeguard burner control. The burner control shall incorporate both pre-purge and post-purge timing functions
5. The gas train shall be UL/CSD-1 compliant with a supply gas pressure range of 7"wc - 14" wc using Natural Gas. The gas train shall consist of high and low gas pressure switches (each with manual reset), a manual shut off valve upstream of burner and downstream of last gas valve. Two motorized gas valves shall perform the functions of safety shutoff and constant pressure regulation.
6. The boiler electrical control circuit shall include a 120V limit string containing a low water cut off, water flow switch, high limit manual reset, blocked condensate switch, burner fuse, low gas pressure switch, high gas pressure switch, blocked vent switch, combustion air proving switch and proof of closure. CSD-1 compliant.

C. Boiler Control System

1. Scope of Supply

   Boiler Control System shall coordinate the operation of up to eight (8) hot water boilers.

2. Hot Water Temperature Setpoint

   The control system shall control boiler modulation and on/off outputs based on the remote system water supply temperature. The controller shall also be capable of adjusting the modulation rate setpoint automatically based on outdoor air temperature. The boiler controller shall also be able to allow setpoints based on Domestic Hot Water Priority (DHWP), Warm Weather Shut Down (WWSD) or Energy Management System (EMS) input of firing rate demand, remote setpoint or remote start/stop commands.

3. Hot Water Temperature Setpoint

   When the controller is in the local control mode, the control system shall establish the setpoint based on outside air temperature and a reset function curve, or be manually adjusted by the operator.

4. Multiple Boiler Sequence

The controller shall sequence each connected boiler and shall have adaptive technology to automatically match active boilers of various input sizes to the system load and water temperature requirements. The controller shall be connected by using standard RJ45 ethernet cables. The control system shall allow the connected boilers to exchange signals as required to provide coordinated fully modulating lead/lag functions. It shall not be required to wire individual control signals between boilers. Multiple boilers shall be modulated in "Unison" (all at the same firing rate) or "Sequential" (master boiler only to satisfy load with lag boilers operating at peak efficiency "Base Load" rate). To increase operational efficiency, the control system shall utilize both water temperature and firing rate based boiler sequencing algorithms to start and stop the boilers and shall minimize the total number of boilers in operation. The control system shall start and stop boilers when the water temperature is outside the adjustable temperature limit for longer than the adjustable time delay. In order to minimize temperature deviations, the control system shall start and stop the next boiler when the "lead" boiler is at an adjustable firing rate limit for longer than the adjustable time delay. The control system shall monitor both boiler lockout and limit circuits to automatically skip over those boilers that are powered down for maintenance, tripped or otherwise will not start. The boiler shall be run at low fire for warm-up for a preset low fire hold time. When enabled, warm weather shut down control logic shall prevent boiler operation. The controller shall also be capable of auto-rotation of the boilers based on user-selected run time hours.

5. User Interface

A touch screen message display shall be provided to display real time BTU/hr, numeric data, startup and shutdown sequence status, alarm, system diagnostic, first-out messages and boiler historical information. In the event of a fault condition, the display shall provide help screens to determine the cause of the problem and corrective actions. Historical information shall include graphical trends, lockout history, boiler & circulator cycle counts and run time hours.

6. Circulator Control

The controller shall be capable of sequencing the boiler, domestic hot water or system circulators. Simple parameter selections shall allow all three pumps to respond properly to various hydronic piping arrangements including either a boiler or primary piped indirect water heater. The controller shall perform circulator exercise to help prevent pump rotor seizing.

7. EMS Communication

Control and monitor the boiler via communication RS485 Modbus or direct wiring. The control shall allow for simultaneous communication for boiler peer-to-peer communication and EMS communication interfaces. Loss of EMS communication shall automatically transfer the boiler control to local operation. Boiler operation shall not be lost due to corrupt or loss of EMS communication. The boiler control system shall allow individual boiler limits, lockout, boiler and system temperatures and firing rate status to be readable and water setpoint, boiler firing rate, and start/stop command to be readable and writable. The control shall provide easy parameter selection and options for the following: Enable/Disable (contact wired). The control shall allow a real time, live & convenient list of all interface signals to allow for quick interface verification. The boiler control system shall network with a communication gateway to connect with BACnet communication protocol.

8. External Data Transfer
   The control system shall include the ability to transfer parameters from boiler to boiler. Upon completion of commissioning the first boiler, a USB flash drive shall allow settings to be "downloaded" from one boiler and "uploaded" into the next. Additionally, these files shall be able to be sent via email and "uploaded" to a remote technical support system. Additionally, it shall be possible to restore parameters to the "as shipped state" by selecting a "Factory Default" Button.

9. Archive History
   All hard lockouts, soft lockouts (holds), sensor faults, Energy Management System (EMS) signal faults, sequencer faults and limit string faults shall be recorded with a time and date stamp. The time and date log shall store up to 3000 alarm & events even after power cycle." The alarm & event log must be downloadable to a USB thumb drive. The control shall include collect and store supply & return temperature, flame intensity and firing rate for at least 4 months. It shall be a simple matter to page through the boiler's operation using the boiler mounted display or download the historical data to a USB thumb drive for off-site analysis. All data must be stored in standardly compatible CRV files.

10. Quality Assurance
    The boiler control system shall be supplied as part of a factory-assembled and tested burner control cabinet.

2.4 BOILER VENTING & COMBUSTION AIR

A. The boiler shall be designed to accommodate sealed, direct, or other positive pressure venting options. The flue duct shall be UL 1738 listed for condensing flue gases for

positive pressure venting. Single wall vent is acceptable where allowed by local code. Available pressure drop range to be provided for longer runs and upsizing.

B. Exhaust: Provide proper design & materials for complete exhaust venting of furnished Boiler equipment including, but not limited to: stack materials for installation in existing roof/sidewall penetrations, elbows, access ports, drains, sealers, caps, curbs, etc. according to manufacturer's published recommendations.

C. When used for sealed combustion, air intake piping can be PVC or galvanized smoke pipe that is sealed and pressure tight. Pipe must be at least the same size as the inlet air connection on the boiler.

D. Combustion air shall be preheated by passing around the exterior of the boiler furnace section.

E. The combined pressure drop through the vent and combustion air duct shall not exceed 100 equivalent feet.

2.5 ACCESSORIES & SPARE PARTS

A. Provide boilers with the following standard accessories:
   1. Complete/Matched Inline Pumps w/ Integral VFDs/Controls to operate Primary (Boiler) Loop as determined by Hot Water Plant Design.
   2. Complete Flue accessories for noted application, (engineered fittings, curbs, thimbles, lintels, flashings, etc.).
   3. Combustion Air Intake accessories for noted application, (curbs, thimbles, lintels, flashings, etc.).
   4. Acid-neutralization system for noted application.
   5. Open-Protocol Network Serial Communications:
      a. BACnet™ MS/TP.
   6. Main Unit Disconnect Switch.
   7. Natural Gas Pressure Regulator – as applicable for the existing service available.
   8. Motorized Isolation/Flow Control valves to meet design intent & Sequences of Operation.
   9. Spare Parts:
      a. One (1) Ignitor for each provided Boiler Unit.

2.6 SOURCE QUALITY CONTROL

A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code: Section I, for high-pressure boilers and Section IV, for low-pressure boilers.

B. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine roughing-in for required concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

1. Final boiler locations indicated on supporting Drawings are approximate. Determine exact locations before roughing-in for venting, piping and electrical connections. Modify existing supports as required by application.
2. Make provisions to properly remove any existing equipment occupying the new mechanical space(s) and make safe for installation/set of the new equipment. Determine exact locations for venting, piping and electrical connections before demolition scope.

B. Examine mechanical spaces for suitable conditions where boilers will be installed. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Coordinate with Plumbing systems interfaces required for complete installation, including but not limited to:
a. Domestic Water Makeup System (Meter, Backflow, Pressure Relief, Drains, etc.).
b. Floor Drains.

3.2 HIGH-EFFICIENCY BOILER SYSTEMS AND HEATING PLANT INSTALLATION

A. Install boilers level on concrete housekeeping base (as recommended) and make all final connections according to manufacturer’s written instructions. Concrete base, reinforcement, and formwork requirements shall be provided according to local standards and/or usual and customary best practices.

B. Install gas-fired boilers according to NFPA 54.

C. Install separate accessory devices furnished by manufacturer, but not factory-installed, including, but not limited to Protective Panels, Condensate Drains/Accessories, Primary Pumps, Water Flow Measurement/Controls, Flow Switches, Stack Temperature Sensors, Serial Communications devices, etc.

D. Install electrical devices furnished with boiler equipment but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

F. Install appliance Venting (combustion air/flues) for complete working installation per manufacturer's published recommendations and industry usual and customary practices. Coordinate full installation with existing conditions.

G. Coordinate hydronic piping for new devices with Hot Water Heating Plant Circulating Pumps (Boiler Primary-Unitary and Loop Secondary) and operating accessories/components per manufacturer's published recommendations and industry usual and customary practices. Coordinate full installation with existing conditions.

H. Design/Provide/Install Hot Water Heating Plant Chemical Treatment System devices per manufacturer's published recommendations and industry usual and customary practices. Coordinate full install with existing conditions and Owner's current services provider as applicable.

I. Install complete Insulation Systems for Heating Plant System per manufacturer recommendations, industry standards and usual & customary practices.

3.3 CONNECTIONS

A. General: Complete venting, piping, piping accessories and wiring installation requirements per manufacturer's written instructions. Drawings/submittal information indicates general arrangement of equipment, venting, piping, fittings, specialties, controls, etc. All installation materials, clearances, hanging methods, and other noted requirements shall be provided according to local standards and/or usual and customary best practices. Include all design & coordination to address each, but not limited to, the following:
   1. Vessel Shutoff-duty and Flow Control-duty Valves.
   2. Drains.
   3. Unitary Pump Equipment.
   4. Sensor Wells.
   5. Electrical Power Feeds/Means of Safety/Disconnect Switches.

B. Connect gas piping full size to boiler gas-train inlet with valve, union, drip leg and components required by local standards and/or usual and customary best practices.

C. Connect Hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

D. Connect condensate drain piping to boiler tappings with shutoff valve/accessories for neutralization accessory and union or flange at each connection for proper servicing. Route to existing floor drain per local requirements and boiler manufacturer's instructions keeping best access to service equipment.

E. Install piping from applicable safety relief valves to nearest floor drain.

F. Connect combustion intakes and exhaust venting/breeching to full size of boiler inlet/outlet per manufacturer's written instructions. Coordinate combustion intakes and exhaust venting materials, routings, reinforcement, and terminations with equipment vendor(s) and all intake/venting systems shall be provided according to local standards and/or usual and customary best practices.
   1. Provide suitable framing support/curbs/collars and substrate sealing for complete installation in chimneys and/or roofs per manufacturer's published recommendations and industry usual and customary practices. Coordinate full install with existing conditions and Owner's existing roofing vendor/supplier (materials, services, warranty maintenance, etc.).
   2. Coordinate new roof/wall penetrations with existing equipment and service access requirements.

G. Install external venting/piping adjacent to boiler(s) to allow proper service and maintenance.

H. Connect wiring/grounding/controls according to manufacturer's written instructions. Electrical installation work shall be provided according to national/local standards and/or usual and customary best practices.

I. 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 STARTUP & BALANCING SERVICES

A. Provide & Coordinate participation of a factory-authorized service representative to test, inspect, and adjust boiler components and equipment installation and to perform/document complete startup service.

B. Perform complete installation and pre-startup checks according to manufacturer's written instructions. Provide documentation assuring systems are ready for start-up services to factory-authorized service representative prior to scheduling service.

C. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

D. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

E. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Burner Test: Adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen, and carbon monoxide in flue gas and to achieve optimum combustion efficiency/operation.

G. Adjust initial temperature set points, coordinate interfaces with Building Automation Controls system and Owner’s Master Systems Integrator.

H. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

I. Balancing Services: Provide complete hot water heating system balancing services for Boilers, Main and sub-circulating pumps and each terminal connected to the Hot Water Heating Loop/system, Document results and coordinate efforts with Owner’s Commissioning Services provider.

J. Occupancy Adjustments: When requested, within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two (2) visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain High-Efficiency Boiler Systems. Startup sheet shall be completed and submitted to each of the Owners Rep/Engineer and the Manufacturer. Complete a combustion analysis and adjust the gas valves per the Install/Operations manual and noted in startup report.

B. Provide SPECIFIC demonstration for each recommended maintenance action as addressed in the documents addressed in the Operation & Maintenance Manual of this specification.

END OF SECTION 235233